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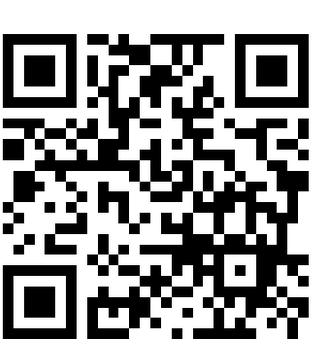

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THE ELECTRICIAN

B

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INDEX TO "THE ELECTRICIAN."

VOL. XC.

SPECIAL INDEXES.

	PAGE
Municipal, Foreign and General Notes	vi
Companies' Meetings, Reports, Dividends, &c.	vii
Companies (New Electrical, &c.) Registered	viii

* *Entries in these Indexes are* not *included in the* GENERAL INDEX.

SUB-HEADINGS IN GENERAL INDEX.

	PAGE
Accounts, Municipal	ii
Domestic Electricity	ii
Educational	ii
Institution Notes	iii
Institution of Electrical Engineers	iii
Legal Intelligence	iii
Obituary	iv
Parliamentary	iv
Personal	iv
Railways, Electric	v
Reviews of Books	v
Telegraphy	v
Telephony	v
Wireless Telegraphy and Telephony	v
Works, Descriptions of	vi

Names of Authors of Articles and Papers are indexed alphabetically in the GENERAL INDEX, *and not under the sub-headings.*

General Alphabetical Index.

Heavy figures **denote that the subject matter is a "Leading Article" or in the "Editorial Notes." When the letter (C) is placed after a title, it signifies that the article in question appeared in the Correspondence column.**

A

ABLETT, C. A.: Economic Principles Governing the Use of Electrical Power in Iron and Steel Works, **529**, 531
Accident at Carlton, 568; Leeds, 633, 665; Oldham, 224; Electrical, 544
Accounts, Collection of, **56**

ACCOUNTS, MUNICIPAL—

Accrington, 655
Bath, 430
Beckenham, 284
Bedford, 71
Birmingham, 284, 655
Blackburn, 655
Blackpool, 430
Bradford, 430
Brighton, 284
Bristol, 103
Burnley, 655
Cardiff, 71, 284
Coventry, 430
Croydon, 430
Darlington, 103, 430
Dover, 284
East Ham, 430
Epsom, 284
Glasgow, 655
Gravesend, 71
Hammersmith, 430
Harrogate, 284
Huddersfield, 430
Keighley, 71, 655
King's Lynn, 103
Leeds, 284, 430, 655
Leicester, 284
Leyton, 284
Lincoln, 655
Manchester, 655
Middlesbrough, 430
Newport (Mon.), 284
Nottingham, 655
Peterborough, 71
Plymouth, 430
Reigate, 284
St. Pancras, 430
Sunderland, 284
Taunton, 430
Thornaby, 430
Weymouth, 103
Whitby, 284
Willesden, 103
York, 71

Advertisements, Street (Strange), 654
Advertising in the Engineering Press, 227; [Reeves] (C) 281, (C) 370; [Goody], 336, 424, 574, 681
Advertising, Value of, 117
Air Cooler, Heenan and Froude, 161
Air Cooling, 683
All-Electric Ship, 462
All-Electric House at Manchester, 570
All-Electric Flats, Glasgow, 627
All-Electric Houses and Control [Lundberg and Sons] (C), 653
Alloys, Resistance to Corrosion, 331
Alternating Current Electrical Engineering S. P. Smith] (C), 719
Aluminium Conductors, Bare, 277
Aluminium Cooking Utensils, 45
Aluminium Facts and Figures, 228
Aluminium Foundries, Electricity in, 98
American Journalists' Christmas Greeting, 11
Antenna Wave Fronts [Press] (C), 40.
ARNOLD, H. D., and G. W. ELMEN: Permalloy, 672

Accounts, Municipal—(*continued*).

Atomic Projectiles and their Properties, 305, 366
Atmospherics, Nature of, **640**
Australia, Electrical Progress in, 75
Australian Electrical Enterprise, 649

B

BAKER, P. M. (C), Modern Boiler House Practice, 456
Band Music Distribution at Olympia, 310
Bann Hydro-Electric Scheme, 375
BARTHOLOMEW, S. C.: Corrosion of Lead-Covered Cables by Electrolytic Action, 69
BASTIAN, C. O.: Electricity and the Domestic Hot Water Problem, 332
Battery Plates, Sulphation of, **215**
Battery, Portable, "Hart," 267
Batteries, Storage, and Continuous Supply, 267
Bavaria, Power Supply in [Menge], 162
Benn (Ernest), Ltd., 274; Latest Enterprises, 573
BENN, SIR ERNEST: Get into Europe Quickly, 119
Henry Ford's Life and Ideas, 347
BENOIT-LEVY, G.: Electric Lighting and Education, 340
BETHENOD, M.: Theory of Three-Brush Dynamo, 309
Bibliography, Books and, **442**
Birmingham Electrical Golfing Society, 517
Boiler House Practice, Modern [Brownlie], **272**, 274, 443; [O'Breen] (C) 368; [Neale] (C) 369; [Casmey] (C) 369; [Rushworth] (C) 369; [Troup] (C) 369; [Vivat Veritas] (C) 370; [Selvey] (C) 395; [McEwen] (C) 396; [Halls] (C) 396; [Erith] (C) 396; [Rushworth] (C) 397; [Brownlie] (C) 397, 538; [Suckan] (C) 427; Mitchell] (C) 427; [Baker] (C) 457; [Foster] (C) 457; [O'Breen] (C) 482; [Gaze] (C), 511, **696**
Boiler House Practice in a Capital Station [Ross], 698
Boilermakers' Dispute, 689
Boilermakers Locked Out, 489
Boiler Plants, Steam, Inefficiency of [Brownlie], **109**, 112
Boilers, Electrically-Heated High Pressure, 93
Books, German, Price of, **56**
Borer, Maugnall-Irving, 176
BOWN, R.: Radio Transmission Measurements, 645
Boys, Employment of, in Supply Stations, 86
BREACH, L., and H. MIDGLEY: Drive of Power Station Auxiliaries, 480, **499**, 573
Bridge Method of Determining the Effective Resistance of an Inductance Coil or Condenser, [Higgitt] 114; [Howe] (C) 142
Brighton Electricity Department, 124
British Thomson-Houston Reference Sheet, 286
British Thomson-Houston Progress, **529**
BROCKBANK, R. A., and L. E. RYALL: The Neon Glow Discharge Lamp on A.C. Circuits, 4
BROWNLIE, D.: (C) Pessimism in Engineering, 40; Inefficiency of Steam Boiler Plants, **109**, 112; Modern Boiler House Practice, **272**, 274, (C) 397, (C) 457, (C) 538; Efficient Steam Generation, 705
Brushes, Nomenclature and [Hunter-Brown] (C) 116
Budget, **384**, **412**, 431
Bulk Supplies, Prices for, **55**, 69
Buyer, Further Confessions of a, 39

C

Cable Testing, Routine, **442**
Cable, Longest Submarine Power, 455
Cable Steamers, New, 543
Cables, Corrosion of Lead-Covered, by Electrolytic Action [Bartholomew], 69
Cables, Steel-Cored Aluminium, for Overhead Lines [Krautt] 677
Cables, Voltage Limits on, **56**
Cables, Water Cooling of, **499**
Calendar, "Met-Vick," 375
Calendars and Diaries, 20
CANADA, W. J.: Power Circuit Interference with Telephone Lines (C) 538
Canadian Tariffs, **497**
Communism, Debate on, 238
Cement Works, Electric Drive in, 278
CHALLIS, F. W.: The B.B.C. Controversy, **411**, 422
Church, The Engineer's [Kilburn Scott] (C) 228
Chester Electricity District, 459
China, Stimulating Electrical Interest in, 603
Circuit Breaker, 1 000 000 kVA, 226
CLINCH, W. N. C.: Electrical Developments at Walsall (C) 14
Coal Mines, Earthing in, 98
Competition, Electrical, Mr. Beauchamp on, 38
Competition, N.A.S.E., 464, 517
Competition, Electric Locomotive, 490
Competitions, "Electrician," **1**, 11, **27**, 51, **57**, 114, 138, **186**, **215**, **244**, **273**, **297**, **357**, 371, **384**, **412**, **441**, 444, 447, 484, **498**, 507 [Peronne] (C) 511, **528**, 534
Competition, E.D.A. Slogan, 513
Commissioners, Electricity (Report), **1**, 10
Commonwealth Edison Co., of Chicago, **412**
Conferences, A Month of, **588**
Consumption of Electricity, Estimate of, **110**, 119
Contractor, An Advocate for the, 597
Contractor, Electrical, **29**
Contractor, Electrical, Position of [Marryat] 331
Contracts, Municipal, Going Abroad, 105, **109** [Wuthrich] (C) 117, 123, **158**, 233
Converters," "Peebles-la Cour," 286
Cookery: B.E.D.A. Booklet, 45
Corporation Profits Tax, **296**
Cranes, 232
Cranes, Truck, 98
CREEDY, F.: Variable Speed A.C. Motors without Commutators, **28**, 35, (*Discussion*) 39.

D

DAHLGREN, F. A.: Three-Phase Auto-Transformer Connections, 616
DAWSON, SIR P.: Financial Prospects of Railway Electrification, 594
Daylight Illumination, **384**
De Forest, Dr., Invention, 477
DELEBECQUE, V.: (C) Broadcasting Difficulties, 203
Depreciation and Assessment (C) 458
Derry Electrical Employees' Wages, 725
Direct Current, Use of, **110**
Dish-Washers, 187
Dublin Hydro-Electric Supply for, **81**, 101
Dumfries, Electrical Engineer for, 105
DU PASQUIER, A. E.: (C) Power Transformer for 66 000 V, 40
Dynamicables, The, 706
Dynamo, Theory of Three-Brush [Bethenod] 309
Dynamos and Motors, Standard, 250

E

Earth, Protective Devices Against, 565
Eastern Telegraph Co. Jubilee Souvenir, 72
ECCLES, W. H.: Studies from a Wireless Laboratory, 502
ECK, JUSTUS: (C) Dangerous Propaganda, 202
ECKERSLEY, P. P.: Problem of Effective Heights of Aerials, 134; (C) [Press], 312 Broadcasting at Glasgow, (C) 482
E.D.A. Electrical Slogan Competition, **412**, 431
Education and Electric Lighting [Benoit-Levy] 340

EDUCATIONAL—

Borough Polyechnic Institute, 146
Coombe Memorial Scholarship, 288
Faraday House Scholarships, 174
Finsbury College, 232
Illuminating Engineering, Training in, **82**
Sir John Cass Technical Institute, 146
Technical Education, **552**
Electric Traction, A Steam Engineer on, **587**, 593
Electricity Controversy in Victoria, **613**
ELECTRICITY DISTRICTS:
East Midlands, 15, 100, 122, 374
East of Scotland, 308
London and Home Counties, 131, **157**, 167, **272**, 285, 315, **412**, 431
Mid-Lancashire, 71, 205, 229
North-East Midlands, 34
South-East Lancashire, 147, 399
Electrical Engineers' Ball, 18
"Electrical Trades Directory and Handbook," 207
Electricity, Selling, **697**
Electricity Supply in Shanghai, **670**
Electricity Supplies in Unoccupied Areas, 254
Electro-Chemistry, Recent Advances in Applied [M. de Kay Thompson], 454
Electrolytic Disinfecting Fluid, 602
Electronic Theory of Valency, 620
ELLIS, A. G.: (C) Power Transformers for 66 000 V., 93, 142, 202
ELWELL, C. F.: Design of Radio Towers and Masts: Wind Pressure Assumptions, 88
Empire Trade, 721
Engineer Stores in the Great War, 682
Engineering Joint Council, **528**
English Electric and Siemens Supplies, Ltd., 51
English Electric Progress, **474**
E.P.E.A. and National Joint Board, **111**, **323**, 347 [Walker] (C) **383**, 395 [Parker] (C) 426 [Jones] (C) 427
ERITH, C.: (C) Modern Boiler House Practice, 396
"European Commercial," 240
Europe, Trade Prospects in [Benn], 119.
EXHIBITIONS:
British Empire, 119, 146, **158**, 402, 627, 660
British Industries Fair, 174, **187**, 203
Brookhirst Switchgear, 692
European, 580
Gothenburg, 679
Grimsby, 433
Ideal Home, 232, 256
Electrical, at Ilford, 603
Leipsic Spring Fair, Electrical Exhibits at, 683
Maidstone, 232
Manchester Wireless, 353
National Trades, Birmingham, 402
Physical and Optical Societies, 37, 64, 87
Scientific Novelties, 19
Scottish Ideal Homes, 147
Useful Electrical, A, at Scarborough, 719
Wimbledon, 317
Woman's, at Olympia, **412**, 430
Eyesight and Electric Light, **186**; [Eck] (C 202

F

Fans as Merchandise to Sell and Profit by [Spectator], 338
Faraday Medal, **527**
"Faraday" Past and Present, 250
"Faradays," The Two, **296**, 298
Farming, Electro-, **272**
Feed Water De-Aeration, 67

Digitized by Google

FLEMING, PROF. J. A.: Problems in Telephony Solved and Unsolved, 642
FOSTER, C. E.: (C) Modern Boiler House Practice, 457
Fire at Liberty's, 105
FRIBBEL, PAUL: The New A.S.E.A. Locomotives for the Riksgrans Railway, 560
Ford, Henry, Life and Ideas [Benn], 347
Fuel Economy in Small Power Stations [Robinson], 704
Fuel, Pulverised, **413**
Fuel, Pulverised, at the New Detroit Station, 718
Fuel, Pulverised, in U.S.A., 603
Fuel Research, New Director of, 682
Furnaces, American, 289
Furnaces, Arc Regulation in, 45
Furnaces for Brass Melting, 98, 123
Furnaces, Electrical Resistance, 168
Furnaces, Electric, 446
Furnaces, Electromagnetic Motions in Electric [Carl Hering], 459
Fuses, Nuisance of, 118

G

GALL, DOUGLAS C.: A New A.C. Potentiometer, 360
GAMBA, E., Renewing Electric Lamps, 569
Gas Deteriorating, Is ? **583**
Gauge, Electric, 73
GAZE, H. P.: (C) Boiler House Economy, 511
Generation, Modern, Applied to Existing Distribution [Purse] (*Discussion*), 714
Generators and Motors, British Standard, 655
Generators, Double Frequency, **2**
General Electric Co., Explosion at Works, 72
German Note and British Trade, **498**
Glasgow Electricity Department Sports Ground, 517
GLAZEBROOK, SIR RICHARD: The Interdependence of Science and Engineering, **497**, 506
GLEICHMANN, B.: Notes on Electric Traction in Bavaria, 6
GOODY, H. M.: Advertising in the Technical Press, 336, 424, 574, 681
Gothenburg Exhibition, Electrical Exhibits at the, 679
GRANT, L. C.: Automatic Sub-Stations, 415, 448
GRIME, T.: Electric Traction, **587**, 593
Group Driving in a Lancashire Mill, 196
Grierson, Ltd., Panel Heating, 660
Green, H., and Co., Annual Social, 517

H

Hackney, Electric Supper Party at, 72
Halifax Corporation and the National Joint Board, 707
Halifax Electricity Works Dispute, 203, 226, 263, **272**, **295**, **323**
HALLS, T.: (C) Modern Boiler House Practice, 396
HALL, T.: Showroom and Sales Department in a Small Town (*Discussion*), 710
HANKEY, H. A.: An Improvement in Speech Amplifiers, 501
HARRIS, T. H.: Operating Experience on the Distribution System of the Rand Power Companies, 675
HAWTAYNE, W. C. C.: A Recent Tendency in Housing, **324**, 326
Heartbreak Villa [Inquirer] (C), 40
Heat Engines, Reducing Losses in, 660
Heating, Electric, of Large Buildings, 337
Henley Pillar Unit and Micanite Insulation [Judge], 596
HERING, CARL: Electromagnetic Motions in Electric Furnaces, 459
HIGGITT, H. V.: Bridge Method of Determining the Effective Resistance of an Inductance Coil, 114
HIGGS, W. F.: Manufacture of Electric Motors in Quantities, 561
High Pressures, Disadvantages of, **28**
HISCOX, W. J.: Handling Work in the Winding Department, 563
HOLLINGWORTH, J.: Measurement of Electric Intensity of Received Radio Signals, 251
Home Counties Industrial Council, 547
HOOPER, F., and J. W. BEAUCHAMP: Co-operation between Architect and Electrical Engineer, **324**, 334, (*Discussion*) 341
Hot Water Problem, Domestic, Electricity and [Bastian] 332
Housing, A Recent Tendency in [Hawtayne], **324**, 326
HOWE, G. W. O.: Notes on Wireless Matters, 30, **123**, 136, 246, 386, 500, 607, 614: (C) Bridge Method of Determining Effective Resistance of an Induction Coil, 142: (C) Radiation of Wireless Waves, 511
HUNTER-BROWN, P.: (C) Nomenclature and Brushes, 116
HYDRO-ELECTRICITY:
Dublin, 399
Tasmania, 45

I

Illuminating Engineering Society, **474**
Imports and Exports, 71, 175, 285, 465, 579, 683
India's Electrical Requirements, 567
Industrial Councils, 682
Industrial Research [Paterson] 554
Insurance by Industries, 15, 176
Insulating Oils, 513

INSTITUTION NOTES—

Association of Officers and Staff Members of Electric (Power and Supply) Companies, 495
Association of Large Users of Brass and Copper, 432
Association of Mining Electrical Engineers, 465
Association of Radio Manufacturers, 46
Association of Consulting Engineers, 659
Batti-Wallah's Society, 661
Birmingham and District Electric Club, 720
British Association, 98, 290, 402, 658
British Electrical and Allied Manufacturers' Association, 319, **324**, 347 [Annual Dinner] 237, 313, 551
British Electrical and Allied Industries Research Association, 41, 86, 261
British Electrical Development Association, 233, 286, 375, 432, 583, 660 (Annual Luncheon) **297**, 313
British Engineers' Association, Annual Meeting, 630
British Science Guild, 232
British Westinghouse Association, 234
Chelmsford Engineering Society, 204, 254
Chemical Society, 353
Conjoint Board of Scientific Societies, 426
County of London Electric Supply Co.'s Social Society, 254
Diesel Engine Users' Association, 18, 495, 660
Dynamicables, The, 706
Electrical Contractors' Association, 72, 125, (Annual Dinner) 462, 485, 597, 630, 721
Electrical Power Engineers' Association, 233, 525
Electrical Society of Glasgow, 14
Electrical Trades Benevolent Institution, 176, 464
Electrical Wholesalers' Federation, 261
Electro-Therapeutic Section of the Royal Society of Medicine, 525
Federation of British Industries, 125, 661, 721
Illuminating Engineering Society, 465
Incorporated Municipal Electrical Association, **384**, 402, 603, **639**, **669**, **695**, 708
Industrial League and Council, 661
Institute of Chemistry, 261
Institute of Cost and Works Accountants, 465
Institute of Industrial Administration, 45
Institute of Metals, 285
Institute of Physics, 661
Institute of Patentees, 347, 525
Institute of Transport, 525, 665, 686
Institution of Civil Engineers, 525
Institution of Heating and Ventilating Engineers, 74, 661, 683
Institution of Industrial Administration, 205
Institution of Mechanical Engineers, 45, 125, 209, 653
Institution of Municipal and County Engineers, 318
Institution of Railway Signal Engineers, 208, 686
Institution of Rubber Industry, 495, 686
Institution of Welding Engineers, 465
Iron and Steel Institute, 125
Junior Institution of Engineers, Sheffield Section, 495
Joint Engineering Council, 517
Liverpool Engineering Society, 495
Manchester Steam Users' Association, 315
National Association of Supervising Electricians, 204, 232, 374
National Electric Light Association, 465
National Engineers' Association, 692
National Federation of Iron and Steel Manufacturers, 378
Newcomen Society, 661
Optical Society, 125
Paisley Association of Electrical Engineers, 318, 353, 432
Röntgen Society, 465, 525, 583
Royal Scottish Society of Arts, 74
Royal Institution, 402, 525, 583
Royal Society, 205, **669**
Scottish Tramways Association, 603
Tramways and Light Railways Association, 465, 720
Whitworth Society, 73
Women's Engineering Society, 430

INSTITUTION OF ELECTRICAL ENGINEERS—

Alternators, High Speed, Some Problems in, and their Solution [Rosen] 198 (*Discussion*) 200, 312
Annual Dinner, 135
Annual General Meeting, 583, **589**, 621
Architect and the Electrical Engineer, Co-operation between [Hooper and Beauchamp] **296**, **324**, 334; (*Discussion*) 341.
Atomic Structure, The Institution and [Sayers] (C) 599, 653
Broadcasting, Mr. Shaughnessy on, 510
Cables, Permissible Current Loading of British Standard Impregnated Paper-Insulated [Melsom and Fawssett], **245**, 253; (*Discussion*) 255
Certificates and Diplomas, 46
Control in Industry (*Discussion*), 280

Institution of Electrical Engineers—(*continued*).

Co-operation between Manufacturer and Retailer, Need for (*Discussion*) 281
Council, Nomination for Election to the, 630
Council, The New, 55, **612**
Electrical Contractors' Association, 154
Electrical Society of Glasgow, 290
Faraday Medal Awarded to Sir Charles Parsons, 200, **527**, 527
Kelvin Lecture, Fourteenth [Fleming], **527**, 642
Liverpool, New Centre at, 161
London Students' Section, 721
Magnetic Drum and Wireless Apparatus [McLachlan] 505
Manufacturer and Retailer, Co-operation between, 367
Meares, J. W., Presentation to, 141
Mersey and North Wales (Liverpool) Centre, 495
National Association of Supervising Electricians, 290
Naval High Power Valves, Development of [Morris-Airey] 394
North-Eastern Centre, 74, 399
North Midlands Centre, 433
North-Western Centre, 68, 225, 233, 495, 525
Power Factor: Its Technical and Commercial Aspects [Yerbury], 423
Power Station Auxiliaries, Drive of [Breach and Midgley], 480, 573
Radio Signals, Received, Measurement of Electric Intensity [Hollingworth] 251
Radio Towers and Masts, Design of: Wind Pressure Assumptions [Elwell] 88
Royal Institution, 154
Scientific Development, The Institution and, **588**
Scottish Centre, 290, 432
Sheffield Students' Section, 208
South Midland Centre, 495, 630
Students' Section, Mr. C. H. Wordingham's address to, **244**
Sub-station, Automatic, Maintenance of Voltage on D.C. Distribution System by [Robinson] **133**, 137; (*Discussion* at Newcastle) 228; (*Discussion* at Manchester) 280
Summer Meeting, 140, 315, **611**, 622, **641**, 648, 650, 661
Telephones, Supply of Steady D.C. for, 166
Telephony, Problems in, Solved and Unsolved [Fleming] 642
Temperature Tests, Equivalent, of the Various Types of Electrical Machinery, 680
Thompson, Silvanus, **611**, 621
Time Switch Development, 41
U.S.A., Facilities for Members visiting, 154
Variable Speed A.C. Motors Without Commutators [Creedy] **28**, 35; (*Discussion*) 39
War Memorial Fund Scholarships, 318
Western Centre, 262, 630
Wireless Section, 525
Wireless Telephony, Transoceanic [Nicholls] **214**, 220
Works Production [Nelson], **83**, 84 (*Discussion*) 90, 371
X-Ray Examination of Materials, 421

Interconnection Alternatives, **296**
Iron and Steel Industry, Electricity and the, **529**

J

Joint Board for Electricity Supply Industry, **271**
JONES, W. ARTHUR: (C) Electrical Power Engineers' Association and the Employers, 427

K

KAHN, DR. M. L.: Equivalent Temperature Tests of the Various Types of Electrical Machinery, 680
KAYSER, J. F.: Magnet Steels, 557
Kerr, W. T., Arrest of, 124, 147, 175
Keys and Keyways [Reavell] (C) 397
KRAUTT, H.: Steel-cored Aluminium Cables for Overhead Lines, 677

L

Lamp, Neon Glow Discharge on A.C. Circuits [Brockbank and Ryall] 4
Lamp Resistances, are they Lighting ? **83**
Lamps, Renewing Electric [Gamba] 569
Lamps, Latest Development in Gasfilled, 719
LAWES, W. H.: (C) Measurement of High-Frequency Potential, 202
L.C.C. and use of Gas, **82**

LEGAL INTELLIGENCE—

Bath Electric Tramways *v.* Home Office, 233, 260
British Thomson-Houston Patent Litigation, 99, 146, 205, 233, 260, 287, 314, 348, 432, 488, 579
Contract for Electrical Goods Disputed, 432
Coombes *v.* Swanton, 205
Electricity, Improper Use of, **83**, 99
Electric Lamp Supplies Co., 205
Fellows Magneto Co. *v.* Armstrong Siddeley Motors, Ltd., 74

Legal Intelligence—(*continued*).

Fellows Magneto Co. *v.* Mica and Micanite Supplies, 177
Ferguson *v.* Electric Components, 177
Goodwin *v.* Stone Electric Supply Co., 374
Handcock and Dykes *v.* Tate and another, 542
Mackenzie *v.* Goldspink, 287
Madras Electric Supply Co. *v.* P. & O. Steam Navigation Co., 579
Marconi Wireless Telegraph Co. *v.* Mullard Radio Valve Co., 123, 146, 349
Mica and Asbestos Insulating Co. *v.* Fellows Magneto Co., 348
Napier and Miller *v.* Lauder, 19
Postmaster-General *v.* Pearce, Pearce and Moon, 314
Postmaster-General *v.* Liverpool Corporation, 542, 720
Russell and Co. *v.* Ingleson, 314
Southport Corporation *v.* Attorney-General, 99, 349
Stanley and Co. *v.* Parr, **463**
Tomlinson-Lee *v.* Mayor of Wimbledon, 260, **272**, 516
Tomlinson-Lee *v* Peel, **528**, 542, 658
Underground Railway's Income Tax, 692
X.G.L. Syndicate, Ltd. *v.* London Electric Supply Corporation, 692
Lead-Boring Beetles, 602
Lee de Forest "Talking Film," **640**
Lifts, Electric, 44, 73
Light Without Heat, 465
Lighting, Industrial, by Electricity, 14
Lighting, Progress in Industrial, **612**
Lighting Scheme at Austin Reed's New Premises, 95
Lighting of Shop Windows, 105
Local Authorities' Contracts, 582
Locomotive "Ni-fe," 151
Locomotive, Modern Swiss Electric, 387
London Electric Wire Co. and Smiths': Duke of York's Visit, 103
London Supply Companies' Accounts, **213**, **244**
Lot's Road Generating Station, 100
Lundberg and Sons, A. P. (C) "All-Electric" Houses and Control, 653
Lyon's New Corner House, **613**

M

MACLEAN, J. B.: Some Considerations of the Make-up Feed Question, 559
Magnet Steels [Kayser], 557
Mazda, Lamp, White, 719
Maidstone Electricity Undertaking, 18
Make-up Feed Question, Some Considerations of the [Maclean] 559
MALLALIEU, V.: Conversion of Spinning and Weaving Mills from Steam to Electric Drive, 189
Manufacturer—Factor—Retailer ["Spectator"] 92, 115, **132**, 139; [X.Y.Z.] (C) 312
MARRYAT, H.: The Position of the Electrical Contractor, 331
MCEWEN, S.: (C) Modern Boiler House Practice, 396
MCLACHLAN, N. W.: Magnetic Drum and Wireless Apparatus, 505
MCMICHAEL L.: (C) The Broadcasting Controversy, 511
Measurement of High-Frequency Potential [Lawes] (C) 202
MELSOM, S. W., and E. FAWSSETT: Permissible Current Loading of British Standard Impregnated Paper-Insulated Electric Cables, **245**, 253; (*Discussion*) 255
MENGE, A.: Power Supply in Bavaria, 162
Mersey and West Lancs Electricity District, 464, 513
Mersey Fiasco, The, **528**

MERCHANDISE TO SELL AND PROFIT BY—

Aeradio, Ltd., 461, 601
Arora Co., 258, 487
Ateliers Constructions Electriques de Charlerol, 515, 601, 685
Austin Walters, 282
Bastian and Allen, 230
Batteries, Ltd., 345, 460
Belling and Co., 656
Benjamin Electric Co., 684
Berry's Electric, 121
Borough Engineering Supplies, 145
Britannia Lathe and Oil Engine Co., 282
British Insulated and Helsby Cables, 429, 461, 577, 657
British Electric Transformer Co., 230, 540
British Thomson-Houston, 16, 43, 96, 121, 144, 173, 231, 259, 345, 400, 458, 461, 512, 515, 541, 600, 629, 685
Brittain's Electric Motor Co., 601
Burnley Components, Ltd., 600
Cable Accessories, 172
Callender's Cable and Construction Co., 601
Cambridge and Paul Instrument Co., 656, 685
Chapman, P. E., 120
Chloride Electrical Storage, 429
Crabtree and Co., 42, 258, 487, 541
Credenda Conduits Co., 70, 96, 120, 144, 344
Crompton and Co., 600
Davis, Kent and Stewart, 657
Ediswan Electric Co., 461
Electric Construction Co., 657
Electric Depot, Ltd., 601, 684
Electric Fires, Ltd., 16, 487, 514
Electrical Apparatus Co., 510, 685

(RECAP)
3230
.329
526045
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Merchandise to Sell and Profit By— (*continued*).
Electrical Components, 685
Electrical Utilities, 344
Elm Works, 230
Elwell, C. F., 576, 629
English Electric Co., 657
Embassy Manufacturing Co., 283
Enterprise Manufacturing Co., 600, 685
Ever-Ready (Great Britain) Co., 515
Fair, W. D., and Co., 601
Falkirk Iron Co., 173
Ferranti, Ltd., 577, 685
Fuller's United Electric Works, 344, 576, 577
Garquarm Specialities, 461, 577
Gath Electrical Engineering Co., 486
General Electric Co., 16, 70, 97, 172, 259, 428, 460, 486, 487, 541, 577, 628
Gent and Co., 173, 577, 601, 656
Guiterman and Co., 17, 685
Hart Manufacturing Co., 541
Hawkins (L.G.), 96, 120
Henley's, W. T., Telegraph Works, 344
Hick, Hargreaves and Co., 577
Higgs Bros., 487
Hodges, Cecil, 400
Holophane Co., 70
Hotpoint Electric Appliance Co., 515
Hunt, A. H., Ltd., 487, 515, 540, 657
Hydraulic Engineering Co., 515
Igranic Electric Co., 96, 144, 400, 512
Imperial Engineering Co., 42, 70
Jackson Electric Stove Co., 16, 121, 282, 541
Jenson and Nicholson, 515
Johnson and Phillips, 601
Keith and Blackman Co., 601
Kelvin, Bottomley and Baird, 576, 629
Leach, S. G., and Co., 600
Lundberg, A. P., 17
McMichael, L., Ltd., 685
Manchester Electricity Supply Department, 685
Marconi's Wireless Telegraph Co., 629
Matthews and Yates, 600
Mavor and Coulson, 577
May and Padmore, 42
Metropolitan-Vickers, 282, 515, 601, 629, 685
Midland Electric Manufacturing Co., 17, 487, 685
Mosses and Mitchell, 601
National Boiler and General Insurance Co., 487, 685
Northern Electric Co., 657
Northern Steel and Hardware Co., 577
Parmiter, Hope and Sugden, 401
Partridge and Cooper, 230
Peirson, C., 43
Peto and Radford, 428
Pratt, Fredk., 460
Radio Instruments, 258, 486, 629
Radiophones, Ltd., 629
Relay Automatic Telephone Co., 629
Reyrolle, A., and Co., 684
Robinson, Lionel, & Co., 515, 577
Rouse and Graseby, 577
Runbaken Co., 283
Richson and Co., 401
Rogers, Foster and Howell, 540, 629
Saunders, W., 145
Sax, Julius, 42
Siemens and English Electric Lamp Co., 685
Simmonds Bros., 70, 120
Société Industrielle pour la Fabrication d'Appareil, 487
Simplex Conduits Co., 145, 231, 428, 656, 684, 685
Smith, J. and W. B., 172
Sterling Telephone and Electric Co., 231, 400, 401, 429, 657
Strode and Co., 576
Sturge and Baker, 16
Sturtevant Engineering Co., 685
Sun Electrical Co., 97, 258, 600, 685
Swedish General Electric Co., 601, 629, 685
Todman, Ryall and Co., 685
Tok Switches, 97, 144
Tucker, J. H., and Co., 283, 345
Underfeed Stoker Co., 685
Underwoods (Manchester), Ltd., 514, 628
Vaughan Crane Co., 577
Venner Time Switches, 345
Vincent Electrical Manufacturing Co., 345
Vincent Switchgear Manufacturing Co., 685
Vislok, Ltd., 515
Waller-Hardway, 428
Walsall Electrical Co., 657
Walsall Hardware Manufacturing Co., 231
Wandsworth Electrical Manufacturing Co., 120
Watson, Duncan, 172
Watson and Sons, 601, 657, 685
Western Electric Co., 514, 577, 628
White, J. C., 43
Wiggin, H., and Co., 629
Wilcox, Edward, 43
Woods, M. W., 144
Zenith Manufacturing Co., 42
Merz, Mr. C. H., on Electricity Supply, 583
Meter, New Single Phase, 510
Meters, German, 44, **186**, 204
Metropolitan-Vickers Long-Service Association, 483
Micanite Insulation, The Henley Pillar Unit and, 596
Miners' Lamps, Electric, **498**
MITCHELL, R. B.: (C) Modern Boiler House Practice, 427
MITCHELL, R. J.: The Electric Vehicle as an Aid to Trade Promotion, 328
MIFTEL, B.: (C) B.B.C. Controversy, 456
MORRIS-AIREY, H.: Development of Naval High-power Valves, 394
Municipal Supply Undertakings' Accounts, **159**
Motor, Cascade, Multi-Speed Automatically Controlled Installation, 425
Motors, Automatic Control of, 94
Motors, Induction, Control of Speed and Power Factor of [Miles Walker], **215**, 216, 247, 302, 391, 418, 451, 478
Motors, Manufacture of Electric, in Quantities [Higgs] 561
MURRAY, DONALD: Telegraph Machinery—A Book Review, 414

N

NASMITH, F.: Electric Operation and Control of Textile Machinery, 188
National Joint Board and Electrical Power Engineers Association, **111**, **323**, 347; [Walker] (C) **383**, 395; [Parker] (C) 426; [Jones] (C) 427
Naval Electrical Reform, **2**
NELSON, G. H.: Works Production, **83**, 84 (*Discussion*) 90, 371
Newcastle-on-Tyne Electric Supply Co. Annual Concert, 291
Newport Electricity Undertaking, 375
New Zealand, Electrical Progress in, 48
NICHOLS, H. W.: (C) Wireless Language, 116; Transoceanic Wireless Telephony **214**, 220
NOBLE, SIR WM.: Broadcasting as an Aid to Trade Promotion, 333; The B.B.C. Controversy 476

O

OBITUARY—
Bryce, J. A., **723**
Bates, Wm., 77
Campbell, Thomas, 348
Chew, William, 433
Cox, Dr. John, 543
Dewar, Sir James, 348
Dobson, James, 316
Farrow, Walter, 206
Frith, Ambrose, 77
Gavey, Sir John, 15, 39, 45
Gedge, S., 403
Haslam, E. P., 206
Hood, W. W., 348
Jervis, J. T., 287
Kipping, P. P., 148
Lambert, P. W., 235
Martin, Arthur, 235
Niven, Emeritus Prof. Chas., 543
North, Gilbert, 348
Osler, J. Taylor, 519
Rigby, G., 235
Roberts, George, 316
Robinson, Mark H., 148
Ross, Alexander, 148
Röntgen, Prof., 174
Rowley, A., 206
Salisbury, J. W., 18
Smith, E. W., 581
Sproule, C. R., 433
Stratford-Andrews, T. W., 206
Taylor, G. C., 77
Thomas, F. S., 206
Trowbridge, H., 235
Ulbrecht, Dr. R., 377
Van Den Waals, Prof. J. D., 287
Walker, Charles, 148
Webster, A. G., 581
Wells, S. H., 377
Wheeler, Dr. S. S., 467
Wilkinson, Herbert T., 543
Willcox, W. H., 348
Williamson, John, 489
O'BREEN, J. E.: (C) Modern Boiler House Practice, 482
"Open" Clause in Contracts, 603
Operating Experience on the Distribution System of the Rand Power Companies [Harris] 675
Outlet Problem, **83**
Overhead Equipment, Unofficial Tests of, 599
Overhead Lines, Electricity, Transmission and Distribution of, by [Storr] (*Discussion*) 711
Overhead Transmission, **695**

P

Panel Heating, Economy of, 660
Pacific Cable Board, 18

PARLIAMENTARY—
Automatic Train Control, 265, 578
Bann Hydro-Electric Scheme, 465
Battersea Electrical Showroom, 374
Birkenhead Corporation, 544
Bradford Corporation (Trolley Vehicles) Provisional Order, 578
British Empire Exhibition, 265, 314, 465
Broadcasting, 350
Broadcasting Committee, 578, 602
Broadcasting in Northern Ireland, 578
Chesterfield Corporation Bill, 720
Coal Consumption in Power Stations, 485
Colonies and the British Empire Exhibition, 484
Electricity Commissioners, 720
Electricity Schemes, 720
Glasgow Tramways Department and Contract Work, 513
Government Trainees in the Electrical Industry, 686
Greenock Electricity Bill, 314
High Power Wireless Stations, 602

Parliamentary— (*continued*).
Imperial Wireless Chain, 433, 627
Indian Cables, 513
Jordan Hydro-Electric Scheme, 433, 465
Local and National Expenditure, 521
London Electric Railway Bills, 265
Lytham St. Anne's Corporation, 544
Maidstone Corporation Bill, 578
Marconi Co., and Public Messages, 314, 350
Metropolitan Railway Bill, 485, 544
Mexborough and Swinton Tramways, 314
National Physical Laboratory Staff, 234
Naval Electric Tubes and Fuses, 720
Oakham Gas and Electricity Bill, 658
Overhead Electric Lines, 686
Pacific Cable, New, 433
Private Bills, 234, 463, 489, 520, 627
Rating of Machinery Bill, 579
Shropshire, Worcestershire and Staffs Bill, 658
Smoke Abatement Bill, 602
Special Orders Approved, 350
Swanage Gas and Electricity Bill, 658
Synchronisation of Purchase Rights, 578
Telegraph Office Extension, 350
Telephones in the Midlands, 513
Telephones, Automatic, 234
Telephones, Rural, 314, 374
Telephone Installation, Speed of, 578
Telephone Wires, Underground, 265, 314
Torquay Corporation Bill, 686
Tramway Proposals in Belfast Bill, 578
Tube Trains, Overcrowded, 578
Warships, Turbo-Electric Drive for, 374
Wimbledon and Sutton Railway Bill, 578
Wireless Communication with the Dominions, 544
Wireless Experimental Licences, 578
PARKER, J. H.: (C) The Electrical Power Engineers' Association and the Employers, 426
Parsons Turbo-Alternator for U.S.A., 72
Passport Visas in Europe, 150
Press and Industry, 579
Patent, British Empire, 525
Patent Office in 1922, 602
Patents Expiring in 1923, **27**, 44
Patents in the Irish Free State, 525
PATERSON, C. C.: Industrial Research, 554
Permalloy, **669**; [Arnold and Elmen], 672
PERONNE, P. E.: (C) The "All-Electric" House, 511

PERSONAL AND BUSINESS ITEMS—
Adams, H. B., 287
Addyman, P. J., 177
Alexandra, A. C., and Co., 725
Aspinall, H. S., 433
Baker, H. W., 148
Baker, P. J., 403
Baker, Sir T., 206
Bain, Colonel A., 124
Barclay, R. L., 543
Barker, R. C., 631
Bartley, R. H., 433
Barnes Bros., 725
Barton, T., 287
Blackall, A. T., 605
Blake, A. W., 235
Blagden, A. H., 263
Boot, Horace, 235
Bragg, Sir Wm., 631
Brammer, A., 148
Bridger, T. W., 124
Bristow, F. G., 124
Brocklehurst, H. J., 723
Bromley, J. A., 21
Brook, J. R., 148
Brooksbank, N., 519
Brown, C. L., 48
Brown, Wm., 664
Bryant, H. S., 124
Buckell, Sir Robert, 316
Burnett, H. R., 543, 605
Butters, J. H., 631
Carey, Prof. F. S., 581
Chalmers, A. D., 177
Chattock, R. A., 519
Chilcott, F., 177
Clarke, T. W., 606
Clarkson, Hood and Co., 664
Climie, T., 235
Clothier, T. D., 287, 403
Conway, John, 177
Cooper, R. G., 177
Cox-Walker, E., 348
Cramb, A. C., 377
Crofts, W. S., 348
Crook, G. H., 605
Cross, T., 99
Crowther, J. P., 377, 723
Curtis, H. H., 48
Dalrymple, J., 177, 605, 723
Darker, A. H., 74
Davenport, F. R., 263
Davis, L. H., 206
Dawson, Sir Phillip, 403
Devonshire, Sir James, 687
Dewar, Sir James, 581
Dix, H. S., 124, 148
Dixon, J., and Co., 664
Dodd, Wm. G., 606
Dunkerley, R., 723
Dunn, Gano, 148
Edgecumbe, J. E., 124
Edmonds, J. F., 124
Elliott, W. R., 605
Ellis, H. S., 403
Electrical Pioneer, **474**
Elwood, A., 316
Evans, F. J., 605
Evershed, S., 663

Personal and Business Items— (*continued*)
Ewer, Major G. G., **348**
Fairchild, J., 723
Ferguson, A. W., 725
Ferguson, R. F., 263
Fleming, G. H., 581
Forde, J. A., 287
Forrest, William, 605
Frank, T. P., 723
Froebel, G. H., 581
Furness, C., 177, 403, **489**
Garcke, E., 687
Gavey, Sir J., 467
Gedge, Sydney, 631
Glazebrook, Sir Richard, 433
Gilbert, T. C., and Co., 725
Green, J., 403
Greene, Lieut.-Colonel R. A., 631
Gresham, C. B., 206
Grice, Wm., and Sons, 635
Grieff, C. S., 723
Guest, Captain F. E., 433
Hadfield, J. W., 377
Hall, H., 581
Hardy, W. E., 235
Hayward, F. R., 433
Harrison, H. T., 48
Harriss, G. M., 348
Harwood, E., 316
Hawes, G. W. Spencer, 316
Herbert, A., 663
Higham, T. E., 403
Hitchens, Lieut.-Colonel C. F., **66**
Holford, G. W., 433, 467
Hooper, C. H., 287
Howard, F. G., 21
Hoyle, T. B., 287, 605
Hyde, Dr. E. P., 467
Jeken, H. G., 687
Jenkins, F., 581
Johnston, W. S., 235
Johnstone, W., 48
Jones, C. H., 287
Jones, H., 687
Jones, S. P., 605
Joynson-Hicks, Sir W., 287
Kahn, H., 377
Kelly, Bertram, 605
Kibbey, R. N., 377
Kirkham, Wm., 467, 543
Kirkland, J. W., 99
Knibbs, G. H., 631
Kristiansen, M. L., 148
Lambert, A. T., 631
Lamme, B. G., 148
Land, Norman, 21
Lann, A. L., 177
Larmor, Sir J., 48
Leadbeater, J., 263
Leeming, W. J., 235
Lincoln, H. E., 74, 235
Llewellyn, W. J., 348
Lorentz, Prof. H. A., 489, **663**
Luck, W. C., 21
Lunn, A. L., 206
Mackaulay, W. R., 725
McClelland, Wm., 631
Mackay, H. R. Forbes, 631
McKenzie, A. E., 519
Maclean, Prof. Magnus, 263, **467**
Madgen, W. L., 687
Manville, Sir E., 21, 48, 263
Martlew, S. G., 519, 543
Miller, H. W., 263
Millikan, R. A., 177
Milton, C. O., 177, 348, 403, 631
M.K. Electric, Ltd., 635
Mond, Sir Alfred, 48
Mordell, L. J., 543
Morley, C. G., 543
Morse, A. H., 48
Munro, E. M., 663
Napier, W. H. U., 124
New, C. Morley, 235
Newton, C. A., 348
Noble, Sir Wm., 99
Northern Aluminium Co., 606
Ogden, F. L., 48
Page, E. P., 74
Parsons, Sir Charles, 124, 206
Parsons, H., 467
Pedley, F., 723
Peet, R. H., 663
Pilcher, R. Stewart, 631, 663
Pink, M. C., 124
Potts, J. T., 48
Preston, G. F., 48, 148
Pryor, H. A., 543
Raphael, F. C., 403
Raven, Sir Vincent, 21, 99
Rawkins, R. G., 74
Richards, H., 687
Ritchie, T. M., 124, 206
Robertson, J. A., 124, 287
Robins, W. H., 543
Robinson, Mark, 124
Roles, T., 48, 519
Ryall, R. J. H., 433
Rynd, F. J., 263
Sanders, W., and Co., 725
Scotson, R. H., 687
Shea, J. F., 631
Sidley, H. W., 287
Soames, E. R., 687
Simpson, J. F., 74
Simpson, S., 605
Sinclair, D., 687
Sinclair, V., 99
Smith, Archer, 99
Smith, Frank E., 21
Smith, James, 206, 403
Smith, S. Parker, 432
Somerville, G., 377
Spence, John, 287

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Personal and Business Items—(*continued*)
Stafford, C. H., 287
Staley, Captain R., 263
Staniland, N., 605
Stephens, J., 74
Stewart, W. D., 124
Stokes, H. P., 287
Stuart, K. R., 723
Stubbs, O., 124
Sturdee, A. H., 263
Sun Electrical Co., 725
Sutton, Sir George, 99, 263
Swarbrick, F., 263
Sycamore, W. A., 48
Tasker, A. A., 377
Taylor, G. C., 287
Thomas, D., 403
Thomson, Sir Joseph, 433
Thorpe, Frank, 99
Trotter, H. A., 687
Tulloch, H., 631
Tonge, J. H., 21, 99
Turner, W. G., 467
United Water Softeners, Ltd., 635
Upton, W. T., 489
Utting, Major S., 489
Valentine, W. A., 99
Wadmore, W. H., 74
Walker, Alderman W., 631
Watson, S. J., 74, 148
Watson, W. G., 148
Watson, W. G., and Co., 664
Western Wireless and Electrical Co., 606
Weston, G. C., 148
Wilshaw, Edward, 631
Wilson, Andrew, 433
Winter, Alderman D. L., 663
Windle, S. R., 177
Wion, G. H., 605
Wood, E. Seymour, 519
Wood, James, 687
Wordingham, C. H., 723
Yeaman, C. H., 235
Yerbury, H. E., 605
Pessimism in Engineering [Brownlie] (C) 40
Phase-Advancer, New Type for Induction Motors, 118
Photo-Electric Effects, 358
Post Office Estimates, 399
Power Station at Detroit, 174
Power Station Economy, 385, 402
Power Station Politics, 111
Power Station Auxiliaries, Drive of, 480, 499
Power Supply in Bavaria [Menge] 162
Potentiometer, A New A.C. [Gall] 360
Power Circuit Interference with Telephone Lines [Canada] (C) 538
Power Engineers' Salaries, 285
Power Supply Progress, 552
PRESS, A.: (C) Antenna Wave Fronts, 40; (C) Problem of Effective Heights of Aerials, 312
Projection of Light, 243
Propaganda, Harmful, 111
Propaganda by Outdoor Staff, 110
Protective Apparatus, 696
Public Address System, Western Electric, 310
PURSE, F. W.: Modern Generation Applied to Existing Distribution, 714

R

Radio Transmission Measurements [Bown, Englund and Friis], 645
Railless Traction at Birmingham, 158, 169
Railless Trolley Traction, 68
Railway A.S.E.A. Locomotives for the Riksgrans [Friebel], 560
Railway Rates and Trade, 359
Railway Electrification in South America, 532, 567, 618

RAILWAYS, ELECTRIFICATION—
Bavaria, Some Notes on Electric Traction in [Gleichmann] 6
Brighton Railway, Twelve Years of Electric Traction on, 31
Germany, Main-Line Electrification in, 60
Grouping System, Effect of, 19
Locomotive, Experimental Steam-Electric, 110
Mersey Railway, 151, 261
Midland Railway, Unofficial Tests of Overhead Equipment, 599
Points, Electrical Operation of, 261
Railway Electrification, The Financial Prospects of [Dawson], 594
South America, Railway Electrification in, 532, 567, 618
Stockholm-Goteberg Line, 358
Swiss Electric Locomotive, Modern, 387
U.S.A., Service Records in, 98
Rating of Machinery, 579
Reactances for Electricity Supply, 718
REAVELL, W.: (C) Keys and Keyways, 397
Relays, D.C. Electric Track Circuit, Maintenance and Test of [Woods], 160
Research and Selling, 553
Research in America, 683
Research Laboratory for Sheffield, New, 556

REVIEWS—
Alternating Current Electrical Engineering [Kemp] 617
Applied Calculus [Bisacre] 93
Bibliographical History of Electricity and Magnetism Chronologically Arranged [Mottelay] 273
Dictionary of Applied Physics, Vol. II [Glazebrook] 171
Electric Ship Propulsion [Robinson] 598
Electrical Engineers' Year Book, 51

Reviews—(*continued*).
Electrical Handling of Materials [Broughton] 602
"Electrician," Annual Tables of Electricity Supply Undertakings, 484
Electricity in Agriculture [Allen] 93
Induction Motor and other Alternating Current Motors [Behrend], 63
Factory Accounts in Principle and Practice [Garcke and Fells] 598
Industrial Electric Heating [Beauchamp] 453
Magnetism and Electricity [Yorke] 171
Maintenance and Repair of Electric Measuring Instruments [Yargill] 617
Mechanical Handling and Storing of Materials [Zimmer] 598
Practical Engineer Electrical Pocket Book, 46
Printing Telegraph Systems and Mechanisms [Harrison] 414
Radio Year Book [Pitman's] 102
South African Mining Year Book, 175
Stock Exchange Year Book, 432
Telephony [Herbert] 678
Yarrow, Alfred: His Life and Work [Lady Yarrow] 678
Year Book of Wireless Telegraphy and Telephony (1923 Edition), 491
REEVES, E. H.: (C) Advertising in the Engineering Press, 281
Reflectors, The Use of, 552
Registration of Electrical Contractors, 100
Rheostats, High Frequency, Notes on [Vincent] 276
ROBINSON, L. L.: Fuel Economy in Small Power Stations, 704
ROBINSON, P. J.: Voltage Maintenance on D.C. Systems, 133, 137; (*Discussion* at Newcastle) 228; (*Discussion* at Manchester) 280
RODGER, J. W.: The Design and Construction of Static Transformers, 702
Ross, W.: Boiler House Practice in a Capital Station, 698
ROSEN, J.: Some Problems in High Speed Alternators and their Solution, 198; (*Discussion*) 200; (*Discussion* at Cardiff) 312
Rotherham Corporation Electricity Undertaking, 483, 587
Rotor Forging for Nechells Power Station, 124
Royal Society Conversazione, Exhibits at the, 571
Royal Warrant Holders, 46
Rubber and Gutta Percha in Telegraph Cable Manufacture, 276
Rubber Industry, Electricity in, 214
RUSHWORTH, D.: (C) Modern Boiler House Practice, 396

S

Salaries of Power Engineers, 285
Salesmanship Conferences in London, 38, 91, 143, 201, 244, 257, 296, 311
Salesmanship Conferences in Newcastle, 281
Salesmen, Dearth of, 72
SAYERS, H. M.: (C) Wireless Language, 116
SAYERS, J.: (C) The Institution and Atomic Structure, 599, 653
Science Abstract, 186
Science and Engineering, Interdependence of [Glazebrook], 497, 506
SCOTT, E. KILBURN: (C) The Engineer's Church, 228
Seasonal Tendencies in Electric Merchandising ["Spectator"] 339
Separators, Magnetic, 45
SELVEY, W. M.: (C) Modern Boiler House Practice, 395
Sheffield, New Research Laboratory, 556
Ship Propulsion, Electric [Emmet] 359, 362
Ships, Electric Propulsion of, 214, 430
Showroom and Sales Department in a Small Town [Hall] (*Discussion*) 710
Showrooms, Metropolitan-Vickers at Manchester, 177
Showrooms, Sun Electric Co., 346
Siemens, Dr. C. W., 475
Silvanus Thompson Memorial Lecture, 132, 142
SMITH, S. PARKER: (C) Alternating Current Electrical Engineering, 719
Smoke Abatement, L.C.C. Report on, 528
Socialist Debate, 317
South-East Lancs Electrical Advisory Board, 612, 633
Southend-on-Sea and Diesel Engines, 82, 122
Speech Amplifiers, Improvement in [*Hankey*] 501
Spinning and Weaving Mills, Conversion of, from Steam to Electric Drive [Mallalieu] 189
Spirella Process of Renewing Electric Lamps [Gamba] 569
Spring Cleaning and Electricity, 324, 342
Stage Lighting, 238, 279
Standard Dynamos and Motors, 250
Standard Switches and Circuit Breakers, 227
Standardisation of Plugs, 158, 204
Static Transformers, The Design and Construction of [Rodger] 702
Steam, Electrically Produced, 110
Steam, Generation, Efficient [Brownlie] 705
Steam Pressures, Economics of, 132
Steel, Stainless, 101
STIGANT, S. A.: (C) Power Transformer for 66 000 V, 41; another Transformer Problem (C) 202
STORR, J. EDWIN: Transmission and Distribution of Electricity by Overhead Lines (*Discussion*) 711
Stoker, Underfeed Type "F" Multiple Retort, 307
Storage Equipment, Modern, 602
STRANGE, LIEUT.-COLONEL E. F.: Street Advertisements, 654
Street Lighting and Taxes, 365
Strikes, City and South London Tube Railway, 627, 689
Substation Advertising, 571
Substations, Automatic [Grant] 415, 448
SUCKAN, C. A.: (C) Modern Boiler House Practice, 427
Super Power Stations, Limiting Public Supply to, 131, 140
Supply Companies' Reports, London, 324
Supply Companies' Reports, Municipal, 159
Supply Undertakings and Service Charges, 57
Switch, Air-Break Outdoor, 398
Switchgear, Ironclad, Ferguson Pailin, 539, 640
Switchgear Manufacture, Ten Years of, 652

T

"Talking Film," Dr. Lee de Forest's, 640
Tasmania, Hydro-electric schemes in, 45
Taxation, 358, 375
Trade, Future of, 105
Tramcar Disaster, Leeds, 547, 583
Turbine, Sulphuric Acid, 573
TAYLOR, W. T.: (C) Power Transformer for 66 000 V, 14, 63, 117, 171, 186, 228

TELEGRAPHY—
Empire Telegraph and Trade, 315
Germany, 14
Notes, 20 379
Pacific Cable Board, 18
Power Circuit Interference with Telephone and Telegraph Lines, 225
Rubber and Gutta Percha in Telegraph Cable Manufacture, 276

TELEPHONY—
Automatic Telephony, 73
Electric Houses and Water Supply, 551
Electrical Engineers' Ball, 18
Electrical Engineers on Railways, 28
Electrical Power in Iron and Steel Works, Economic Principles Governing the Use of, [Ablett] 530
Germany, 14
Hull, Municipal Service at, 72
International Telephony, 72, 272, 323, 357
Italian Telephone and Telegraph Rights, 583
Long Distance Telephony, 402
Notes, 20, 379, 543
Postmaster-General on Telephone Developments, 175
Power Circuit Interference with Telephone and Telegraph Lines, 225
Telephone Problems and Research, 639
Telephone System, Government, 552
Telephones, Profitable Hull, 633
Telephones, Rural, 462
Temperature, Effect of on Engineering Materials, 215
Textile Drives and Motor Design, 197
Textile Industry and Electricity, 194
Textile Machinery, Electrical Operation of, [Nasmith] 488
Textile Mill, All-Electric at Bolton, 192
Textile Mill Output, 467
THOMPSON, J. LINDLEY: (C) High Voltage Transformers, 202
THOMPSON, M. DE KAY: Recent Advances in Applied Electro-Chemistry, 454
Tidal Power, 15
TILNEY, M. J. E.: (C) Broadcasting—The Amateur Problem, 203
Traction, Two Views on Electric, 587 [Grime] 593
Trade Prospects, British, 538
Trade Promotion, 325
Trade Union Subscriptions, 498
Trading Policy, 475
Tramcar, The Future of the, 686
Tramway Standards, Machine for Removing, 176
Tramways Obsolescent, Are? 442
Transformer Connections, Three-Phase Auto [Dahlgren], 616
Transformers for 110 000 V, [Taylor] (C) 14 [Du Pasquier] (C) 40; [Stigant] (C) 41; [Taylor] (C) 63; [Ellis] (C) 93; [Taylor] (C) 117; [Ellis] (C) 141; [Taylor] (C) 171; 186; [Thompson] (C) 202; [Ellis] (C) 202 [Taylor] 228
Transformer Problem, [Wireman] (C) 171; [Stigant] (C) 202
Turbo-Alternator Design, 187
Turbo-Alternator Short Circuit, Test on a 40 000 kVA, 483
TURNER, L. B.: (C) Radiation of Wireless Waves, 456

U

Underground Railway, New Cars for, 146
Unemployment [Organiser] (C) 14
Units Sold or Units Generated, 2, 14

V

Vacuum Arc for Visible and Soft X-Rays, 597
Vehicle, Electric, as an Aid to Trade Promotion, [Mitchell] 328
Vehicles, Electric, 110
Vickers and the Spearing Boiler Co., 603
Vignoles, Colonel W. A., Presidential Address at I.M.E.A. Convention, 708
VINCENT, J. H., and A. L. BEAK: Notes on High Frequency Rheostats, 276

W

Wages Reductions, 23, 122, 347
Wages Reductions, Staff, 22
Wages of Scottish Electricians, 46
Wages in the West Midlands Area, 725
West Midlands Industrial Council, 517
WALKER, PROF. MILES: Control of Speed and Power Factor of Induction Motors, 215, 216, 247, 302, 391, 418, 451, 478
WALKER, W.: (C) Electrical Power Engineers' Association and the Employers, 383, 395
Wall Plugs, Standardisation of, 81
Walsall, Electrical Developments at, [Clinch] (C) 14
WARRILOW, W. E.: (C) The Little Window, 14
Water, Electric Hot, 588
Water Power Problems, 2
Watford, German Meters at, 44, 186, 204
Welding, Electric, in Cast Iron, 450
WILSON, D. M.: Selling Wireless, 572
Winders, Electric, at Hilton Collieries, 170
Winding Department, Handling Work in the [Hiscox] 563
Window, The Little, [Warrilow] (C) 14

WIRELESS TELEGRAPHY AND TELEPHONY—
Aerials, Problem of Effective Heights of, [Eckersley] 134 [Press] (C) 312
Association of Radio Manufacturers, 46
Broadcasting Co., 272
B.B.C. Controversy [Challis] 411, 422, 442; [Hinderlich] (C) 456; [Mittel] (C) 457, 473; Sir Wm. Noble, 476; [McMichael] (C) 511
Broadcasting:
Copyright and, 392
Difficulties [Delebecque] (C) 203
At Glasgow, 384, 393; [Eckersley] (C) 482
Politics, 442
As an Aid to Trade Promotion, [Noble] 333
Legality of, 405
Programmes, 56, 384
Public Houses and, 110, 127
Amateurs' Non-licensed sets, 132; [Tilney] (C) 203, 383
Broadcasting Items, 547
Cardiff Broadcasting Station, 181
Empire Wireless Telegraphy, 27, 74, 243, 265, 291
Long-Distance Joint Meeting, 147
Notes, 22, 49, 74, 102, 127, 148, 181, 209, 237, 265, 291, 319, 353, 379, 405, 437, 469, 491, 521, 547, 583, 633, 665, 689, 725
Notes on Wireless Matters [Howe], 30, 133, 136, 246, 386, 500, 607, 614
Patents, 28
Publications Index, 50, 152, 268, 408, 522, 636
Radio Society's Manifesto, 405
Selling Wireless [Wilson], 572
Transatlantic Wireless Telegraphy, 20, 220
Transatlantic Wireless Telephony, 57, 58
Underground Wireless Reception, 89
Wireless Chain, Imperial, 531
Wireless Laboratory, Studies from a, [Eccles] 502
Wireless Language [Sayers] (C) 116; [Nichols] (C) 116
Wireless Publicity, Portable, 630
Wireless Waves, Radiation of, [Turner] (C) 456
Wireless, Public House, 475
Wireless Waves, Radiation of, [Howe] (C) 511
Wiring Rules, 473
WOODS, R. C.: Maintenance and Test of D.C. Electric Track Circuit Relays, 160

WORKS, DESCRIPTIONS OF—
Bolton Eagle Spinning Co., 196
Crowborough Gas and Electricity Co., 564
Egyptian Mill at Bolton, 192
Ferguson, Pailin, The Works of, 652
General Electric Co.'s New Buildings at Wembley, 214, 222
General Electric Co.'s Witton Works, 659
Metropolitan-Vickers Electrical Co., 661
Nechells Power Station, 659
Parsons, C. A., Heaton Works, 9
Reyrolle and Co., Hebburn Works, 32
Rotherham Corporation Electricity Works, 483, 590
Stoke-on-Trent, Electric Developments at, 66
Workshop Heating and Ventilation, 204
WUTHRICH, G.: (C) Municipal Contracts Going Abroad, 117

X

X-Ray Department, 446

Y

YERBURY, H. E.: Power Factor: Its Technical and Commercial Aspects, 423

Digitized by Google

Municipal, Foreign and General Notes.

ELEC. SUPPLY

Aberdeen, 75, 403
Abergele, 21, 207, 467
Abertillery, 149
Accrington, 581
Addlington, 687
Aldershot, 179, 207
Andover, 75, 489
Ardwick-le-Street, 289
Armagh, 263
Ashby-de-la-Zouch, 289
Ashford, 179, 283
Atherstone, 544
Axminster, 351, 723
Ayr, 207

Bagenalstoun, 605
Ballinagh, 377
Ballybay, 149
Bangor, 289
Bann (River), 125, 375, 581
Banstead, 377
Bardsey, 519
Barford, 605
Barnsley, 235
Barrow-in-Furness, 47, 75, 179, 377
Basingstoke, 101
Batley, 687
Bath, 149, 207, 403
Battersea, 125, 631, 687
Bebbington, 545
Bedford, 605
Bedfordshire, 101
Beer, 47
Belfast, 47, 149, 351, 489
Bethesda, 687
Billingham, 489, 631
Birkenhead, 75, 289, 663
Birmingham, 663
Blackburn, 47, 125, 519, 663
Blackpool, 21, 149, 179, 403
Blackrock (co. Dublin), 663
Blairgowrie, 581
Bocking, 101
Bootle, 663
Boston Spa, 519
Bradford, 21, 351, 403
Bradford-on-Avon, 101
Brentford District Electric Co., 75
Brighton, 489
Bristol, 435, 545, 687
Bromley, 179
Builth Wells, 723
Burnley, 467, 631
Burton-on-Trent, 207, 545
Bury St. Edmunds, 75
Buxton, 317

Caeran, 235
Caerphilly, 545
Calne, 351, 435, 723
Cannock, 47
Canterbury, 519
Canvey Island, 125
Cardiff, 21, 75, 125, 179, 435, 489, 631
Carlisle, 75, 317, 687
Carnarvon, 545, 631
Chadderton, 351
Charges, Alterations in, 21, 47, 75, 101, 125, 149, 179, 207, 234, 263, 289, 317, 351, 377, 403, 435, 467, 489, 519, 545, 605, 631, 663, 687, 723
Cheadle, 317, 605, 723
Chester, 149, 377
Chesterfield, 179
Chichester, 47, 581
Chippenham, 489
Chorley, 21, 125, 377
Clitheroe, 235
Clogher, 631
Clowne, 47, 687
Clyde Valley Electric Power Co., 101
Collingham, 519, 581
Colne, 21, 149
Cookham, 489
Corwen, 207, 581
Coventry, 467, 631
Cranbrook, 519, 545
Crediton, 377
Crewe, 545
Crowborough, 125, 565
Croydon, 75
Cuckfield, 489

Dalkeith, 351, 435
Dalton-in-Furness, 545
Darfield, 435, 723
Darlington, 207
Darwen, 21
Derby, 21
Derry, 207
Desborough, 149
Devizes, 207, 377, 519, 663
Dewsbury, 75
Doncaster, 403, 581
Dorchester, 207
Douglas (I.O.M.), 21, 581
Dover, 47, 149, 179, 317, 519, 581
Droitwich, 435
Dronfield, 207
Dundee, 489

Ealing, 75
East Keswick, 519
Easthampstead, 435
Eastleigh and Bishopstoke, 21
East Saltney, 489
Ebbw Vale, 21
Eccles, 435
Edinburgh, 235, 351, 435, 467
Elgin, 467
Ellesmere Port, 149
Enniskillen (Fermanagh), 687
Epsom, 101
Evesham, 263
Exeter, 101, 289, 723
Exmouth, 489

Falkirk, 351
Fareham, 289
Faversham, 101
Featherstone, 605
Felixstowe, 179
Ferryside, 581
Fivemiletown (co. Tyrone), 519
Folkestone, 377, 631
Formby, 289
Fulham, 435, 723

Gillingham, 179
Glasgow, 47, 75, 149, 723
Godalming, 75
Godstone, 631
Gorseinon, 179, 289
Gourock, 467
Grampians, 179
Grays (Essex), 317
Greenock, 289, 467, 489
Grimsby, 101, 179, 545
Guernsey, 101
Guildford, 21, 149, 377

Hackney, 317, 403, 467, 663
Hammersmith, 75, 149
Hampstead, 263, 377
Harpenden, 581
Harrogate, 21
Harrow Weald, 545
Harwich, 467
Haslingden, 263, 489
Hastings, 101, 687
Haywards Heath, 101
Headington, 351
Heckmondwike, 21
Helston, 403
Henley-on-Thames, 289, 317, 519, 631, 687, 723
Hereford, 377
Hetton, 545
Heywood, 75
Hightown (Lancs), 101
High Wycombe, 21
Holywood, 351, 663, 723
Hoole, 125
Horley, 179
Horwich, 75, 435, 467
Hornsey, 605, 663
Hove, 519, 545, 605
Hoylake, 21
Huddersfield, 351, 605, 663
Hull, 21, 125
Hurst, 179

Ilford, 149, 489, 631

Jersey, 75

Keighley, 351, 467
Kettering, 723
Kingsbridge, 47
King's Lynn, 545, 723
Kingston-on-Thames, 21, 125, 489
Kirkcaldy, 207

Lanark, 289
Lancashire (S.E.) 75
Lancaster, 101, 631
Leeds, 467
Lees, 351
Leicester, 351, 403
Leicestershire, 289
Lerwick, 47
Lewes, 47
Leyton, 489
Lichfield, 545, 687
Limerick, 317
Lincoln, 179
Linton, 519
Liverpool, 47, 125, 149, 235, 519
Llandrindod Wells, 207, 581
Llanelly, 351
Lockerbie, 101
London, 179, 235, 435
Long Ashton, 631
Lothians, 207
Loughborough, 21
Lowestoft, 75, 435
Luton, 289, 519
Lydney, 235
Lyme Regis, 149, 289
Lytham St. Annes, 545

Maesteg, 235, 545
Maidenhead, 489, 663
Maidstone, 21, 47, 149, 489
Malling, 663
Malmesbury, 263, 317, 403
Malvern, 179, 631, 687
Manchester, 47, 75
Mansfield, 435, 545
Marazion, 21
Margate, 545
Market Harborough, 403
Marton, 377
Marylebone, 149, 435
March, 47
Market Harborough, 47, 263
Marlborough, 581
Marylebone, 101, 581
Matlock, 75, 235
Melksham, 489
Mersey Power Co., 75
Mersey and West Lancs, 575
Mid-Lancashire, 575
Midland Electric Light and Power Co., 317
Milnthorpe, 519
Minffordd, 545
Mold, 403
Monmouth, 723
Morecambe, 351, 489
Moreton-in-Marsh, 235
Musselburgh, 125

Nailsworth, 317
Nelson, 545
Newark, 263, 631
Newcastle-on-Tyne, 101, 125 358
Newmill, 631
Newport, 289, 375, 663
Newton Abbot, 351, 377, 687
Newtownstewart, 581
North East Midlands, 527, 575
North Metropolitan Electric Power Supply Co., 207
North Wales, 75
North Walsham, 289
Northampton, 545
Norwich, 581, 605, 687
Nottingham, 149, 663, 687
Nuneaton, 519

Oakham, 179
Oban, 263
Ogmore and Garw, 47
Okehampton, 467
Oldbury, 289
Oldham, 149, 351, 435

Paisley, 581, 605, 687
Penybont, 47
Penzance, 545, 581

Peterborough, 631
Peterhead, 179
Pickering (Yorks), 289, 489
Plymouth, 75, 125, 207, 687
Pontypridd, 467
Portobello, 47, 723
Portsmouth, 75, 101, 545, 687
Portrush, 377
Port Talbot, 75
Preston, 351, 377, 467, 723
Private Bills, 207

Radcliffe, 467
Redcar, 179
Redditch, 179, 605
Reigate, 149, 377, 519, 545
Retford, 489
Ripon, 149
Rochford, 125
Romsey, 377, 723
Rotherham, 21, 581
Rothesay, 317
Ripon, 21
Rugby, 235
Rugeley, 21
Rushden, 687
Rye, 207

St. Pancras, 125
Saffron Walden, 351, 489, 545
Salford, 47, 545
Saltburn, 723
Sandwich, 179
Sanquhar, 179
Scarcroft, 519
Seaford, 317
Seahouses (Durham), 467
Seaton, 519
Selby, 21, 377
Selkirk, 435
Sheffield, 581
Sherborne, 47, 101, 149, 403
Sheringham, 605
Shoeburyness, 631
Shrewsbury, 605, 631
Sidmouth, 289, 403
Sileby, 179
Skipton, 663, 723
Smallthorne, 377
South Molton, 545
Southampton, 101, 435
Southend, 377, 467
Southport, 149, 519
Southwick, 289
South Wales and Monmouthshire, 263
Spalding, 149
Special Orders, Applications for, 289, 317, 403, 435
Stafford, 545, 581
Stevenage, 125
Stirling, 21, 435, 467
Stoke Newington, 101
Stockport, 179, 519
Stockton, 207
Stourport, 47, 519, 545
Stranorlar, 289
Stratford-on-Avon, 467
Strathclyde, 723
Stroud, 149, 235, 351
Sunderland, 207, 545, 581
Swansea, 47, 125, 403, 435

Taunton, 435
Teignmouth, 289
Tenby, 125, 435
Thetford, 377, 687
Thorner, 519
Thorpatch, 519
Ticehurst, 101
Tideswell, 377
Tilehurst, 207
Titchfield, 403
Tiverton, 289, 317, 581
Torrington, 75
Torquay, 235, 467, 519, 663
Tredegar, 403, 435
Trowbridge, 489
Truro, 101, 687
Twyford, 351
Tunbridge Wells, 403, 519, 687

Ulverston, 47, 317, 435, 663
Upton, 125

Wallasey, 179, 263, 435
Wallingford, 207, 235
Walsall, 289, 351
Walthamstow, 435
Walton-le-Dale, 179, 467
Walton-on-the-Hill, 351
Wantage, 605
Wareham, 435
Warminster, 207
Warrington, 435
Watford, 75, 435
Wells, 467
Wellingborough, 687
Welwyn Garden City, 179, 289
West Bromwich, 289
West Gloucestershire, 149, 235, 289
West Ham, 21
West Hartlepool, 75
West Riding, 47
West of Scotland, 21, 687
Westgate and Birchington, 125
Wetherby, 519, 581
Weymouth, 179, 545
Whitehaven, 687
Whitstable, 21
Wicklow, 377, 581
Wigan, 351, 519
Willesden, 101, 605
Winchester, 263
Windsor, 235
Wirral, 125, 351
Withernsea, 75
Woking, 545
Wokingham, 47, 605
Wolsingham, 75
Wolverhampton, 47, 75
Woolwich, 403
Worcester, 605
Workington, 47, 289, 519
Worthing, 403, 519
Wrexham, 21, 351

Yeovil, 545
York, 377, 467, 631

TRACTION

Aberdare, 23, 406, 689
Aberdeen, 265, 291, 437, 633
Accrington, 23, 49, 103, 209, 379
Ashton-under-Lyne, 151, 181

Bangor, 181
Barnoldswick, 406
Barrow, 237
Belfast, 103, 181, 237, 319, 406, 521, 547, 607
Birkenhead, 353
Birmingham, 181, 237, 469, 632
Blackburn, 265, 379, 406, 607
Blackpool, 49, 151, 379, 406, 491
Bolton, 49, 291, 547, 633, 689
Bournemouth, 49, 127, 406, 521
Bradford, 23, 151, 353, 491, 607, 689
Brighton, 181, 237
Bristol, 181, 665
Burnley, 23, 49, 103, 151, 209, 265, 379, 521, 547, 607

Cardiff, 103, 209, 265, 379, 406, 469, 583
Carlisle, 127, 521
Croydon, 406
Chatham, 725
Cumberland, 379

Darwen, 547
Dearne Valley, 583
Doncaster, 49, 406, 689
Dublin, 379, 469
Dudley, 379
Dundee, 583, 689

Edinburgh, 23, 49, 77, 127, 181, 209, 237, 319, 353, 379, 491, 605, 689, 725
Epsom, 103
Exeter, 127, 291, 665

Gateshead, 151
Glasgow, 23, 77, 181, 209, 319, 379, 406, 437, 607
Golders Green, 127

Haslingden, 607
Hastings, 77
Holme Cultram, 491
Huddersfield, 103, 237, 291
Hull, 23, 77, 103, 151, 379, 469, 607, 725

Isle of Wight, 23
Italy, 386

Jarrow, 103

Keighley, 583
Kidderminster, 49

Leeds, 23, 49, 103, 181, 265, 291, 491, 521, 607, 633, 665
Leicester, 237, 469
Lincoln, 291
Liverpool, 49, 127, 265, 319, 353, 379, 406, 469, 491, 521, 633, 689
Llandudno, 469
London, 23, 49, 77, 103, 127, 151, 181, 209, 319, 353, 379, 437, 469, 491, 547, 583, 607, 633, 665, 689, 725
London, Midland and Scottish Railway, 127
Lytham, 49, 406, 665

Manchester, 49, 77, 265, 491, 607, 725
Mersey Railway, 49, 237, 353, 379, 437, 491, 665
Metropolitan Railway, 209, 437
Mexborough, 151
Middleton, 521
Middlesex, 127

Nelson, 181
Newcastle, 23, 49, 127, 237, 437, 491
Newport, 23
Newsham, 491
New York, 725
Northumberland, 547
Nottingham, 48, 127, 151

Paisley, 237
Plymouth, 77, 437, 469, 689
Portsmouth, 689
Preston, 23

Reading, 49, 181, 291, 437, 521, 665
Register of Charging Stations, 77
Rochdale, 632
Rotherham, 291
Rothesay, 437

Salford, 127, 237
Scottish Tramways Associations, 181
Sheffield, 209, 469, 547
South-Eastern and Chatham Railway, 209, 237, 547
Southend, 353
Southport, 406, 437
South Shields, 291, 491
Southern Railway, 127, 265, 353
Stockport, 406
Sunderland, 23, 77, 151, 491, 521, 607
Swansea, 77, 437

Tooting Junction, 353
Torquay, 181
Tramways and Light Railways Undertakings in Great Britain, 521

Underground Co., 23, 265, 406, 437

Wallasey, 23, 151, 291, 406, 521
Walsall, 635, 689
West Hartlepool, 181, 291, 406, 491
Westhoughton, 665
Wigan, 127
Wirral Railway, 406
Wolverhampton, 237, 379, 406
Worcester, 265, 406, 469, 607

York, 23, 665

IMPERIAL

Africa, 150, 178, 288, 580 722
Australia, 48, 76, 100, 126, 150, 178, 206, 234, 262, 288, 350, 434, 466, 490, 518, 580, 604, 632, 662, 688, 722

British Columbia, 76
British West Indies, 126

Canada, 48, 76, 100, 126, 150, 178, 206, 262, 288, 350, 376, 404, 490, 434, 518, 580, 604, 632
Ceylon, 48, 178, 466

India, 76, 178, 206, 234, 262, 288, 316, 404, 434, 466, 491, 518, 580, 604, 632, 662, 688, 722

Jamaica, 126

New South Wales, 48, 100, 206, 350, 376, 404, 434, 580, 632, 662
New Zealand, 22, 48, 234, 376, 466, 632

Queensland, 150, 288

South Africa, 22, 48, 126, 178, 262, 288, 376, 404, 519, 688
Straits Settlements, 100

Tasmania, 100

Victoria, 22, 48, 100, 126, 150, 178, 234, 262, 350, 376

FOREIGN

Africa, 404, 434
Albania, 316
Argentina, 100, 126, 150, 206, 434, 490, 662, 722
Austria, 48, 150

Belgium, 234, 404, 434, 466, 544

Bohemia, 206
Brazil, 126, 150
Bulgaria, 206

Celebes, 580
Chile, 178, 632
China, 76, 100, 178, 234, 376, 632, 655, 671
Cuba, 48, 76
Czecho-Slovakia, 76, 376

Denmark, 76, 466

Esthonia, 22

France, 22, 48, 126, 150, 350, 466, 490, 518, 688

Germany, 22, 76, 150, 178, 350, 466, 604, 662

Holland, 404

Indo-China, 22
International Electrotechnical Commission, 22
Italy, 376, 518, 722

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Municipal, Foreign and General Notes—(*continued*).

Japan, 76, 150, 178, 376, 490, 688
Java, 22, 126, 288, 580

Luxembourg, 316

Manchuria, 404
Mexico, 150, 262, 518

Netherlands, 662
Norway, 376, 434, 722

Palestine, 126, 632
Para, 316
Peru, 48
Philippines, 632
Portugal, 688

Roumania, 434
Russia, 518, 632

Siam, 126, 178
South America, 288, 350, 466, 604
Spain, 22, 100, 262, 404
Sumatra, 580
Sweden, 76, 126, 434, 580, 662
Switzerland, 76, 234, 376, 404, 544, 722

Uruguay, 632, 662, 688
U.S.A., 22, 48, 76, 126, 234, 262, 288, 316, 376, 404, 434, 464, 518, 604, 632, 663, 688

Companies' Meetings, Reports, Dividends, &c.

Aberdeen Suburban Tramways, 239, 320
Accumulator Trust, 523
Adelaide Electric Supply, 585
Agricultural and General Engineers, 24
Allen, Edgar, 726
Allen-Liversidge, 24, 78, 691
Alley and MacLellan, 407
Altrincham Electric Supply, 666
American Telephone and Telegraph, 380
Anchor Cable Co., 548
Anglo-American Telegraph, 52, 438, 523
Anglo-Argentine Tramways, 52
Anglo-Portugnese Telephone, 608
Arbroath Electric Light and Power, 380
Armstrong Whitworth, Sir W. G., 320, 668
Auckland Electric Tramways, 128
Automatic Telephone Manufacturing, 24, 634

Babcock and Wilcox, 470
Banbury and District Electric Supply, 634
Bath Electric Tramways, 407
Bell Telephone of Canada, 24
Bell's United Asbestos Co., 470
Benn Bros., 24
Birkdale District Electric Supply, 634
Birmingham Electric Supply, 239
Birmingham District Power and Traction, 470
Boardman Electric Patents, 154
Bournemouth and Poole Electric Supply, 267, 320
Brazilian Traction, Light and Power, 78, 438
British Aluminium, 320
British Automobile Traction, 407
British Broadcasting, 78
British Columbia Electric Railway, 78
British Electric Traction, 585, 634, 692
British Electric Transformer Co., 470, 493
British Electrical Winders, 523
British Engine, Boiler and Electric Insurance, 354
British Insulated and Helsby Cables, 24, 292, 320, 354
British L.M. Ericsson Manufacturing, 438
British Mannesmann Tube, 78
British Thomson-Houston Co., 470
Broit, 354
Bromley (Kent) Electric Light and Power, 380
Brompton and Kensington Electric Supply, 239, 320, 358
Browett, Lindley, 320
Bruce Peebles, 239, 292
Brush Electric Engineering, 354, 380
Buenos Aires Tramways, 154

Calcutta Electric Supply, 210
Callender's Cable and Construction Co., 548, 585
Cambridge Electric Supply, 267
Cammell Laird, 380
Carlisle Electric Tramways, 128
Cawnpore Electric Supply Corporation, 585
Central Electric Supply, 180
Charing Cross West End and City Electric Supply, 180, 608
Chatham and District Light Railways, 78
Chelsea Electric Supply, 128, 292
Chiswick Electric Supply Corporation, 407
Chloride Electric Storage, 523, 585
City of London Electric Lighting, 267, 292
Clarke Chapman, 267
Claud Hamilton, 24
Clyde Valley Electric Power, 239, 354

Colombo Electric Tramways and Lighting, 585
Commonwealth Edison, 128
Consolidated Signal, 407
Cork Electric Tramways and Lighting, 492
County of Durham Electric Power Distribution, 354
County of London Electric Supply, 210, 292
Craigpark Electric Cable, 492
Crompton, 24
Cuba Submarine Telegraph, 438

Davis and Timmins, 239
Dickson and Mann, 438
Direct United States Cable Co., 492
Direct Spanish Telegraph, 292
Direct West India Cable, 239
Drake and Gorham, 52
Dublin Corporation, 661
Dublin United Tramways, 106
Dublin and Lucan Electric Railway, 492
Dumbarton Burgh and County Tramways, 267
Dureico, 24

East London Railway, 106
Eastern Extension Australasia and China Telegraph, 78, 292, 726
Eastern Telegraph, 407, 726
Electric Construction, 608
Electrical Distribution of Yorkshire, 239, 320
Electric Supply Corporation, 492, 634
Electro-Bleach and By-Products, 320
Enfield Ediswan Cable Works, 691
English Electric 438, 691
English Electric Co. of Canada, 106, 128
Ever-Ready Co. (Great Britain), 492, 585

Ferguson, Pailin, 267
Ferranti, 52, 78, 691
Fife Tramway, Light and Power, 239
Folkestone Electric Supply, 380
Frederick Braby, 154
Fuller's United Electric Works, 210

Gateshead and District Tramways, 267, 523
General Electric (U.S.A.), 24
General Electric (New York), 585
Globe Telegraph and Trust, 267, 666, 691
Great Northern Telegraph Co. of Denmark, 470
Greenwood and Batley, 128
Gwynne's Engineering, 78

Hadfields, 407, 438
Halifax and Bermudas Cable, 239
Hart Accumulator, 634
Head, Wrightson, 52, 691
Henley's, W. T., Telegraph Works, 180, 239, 266
Herbert Morris, 128
Hong Kong Tramway, 154
Hurst, Nelson, 523

Imperial Tramways, 726
Immisch Electric Launch, 154
International Automatic Telephone, 634
India-Rubber, Gutta Percha and Telegraph Works, 691
Indo-European Telegraph, 438

Johnson, R., Clapham and Morris, 691
Johnson and Phillips, 548, 585

Keith and Blackman James, 726
Kensington and Knightsbridge Electric Lighting, 154, 210

Lanarkshire Tramways, 106
Lancashire Dynamo and Motor, 380
Lancashire Electric Light and Power, 52, 154, 523, 585
Lancashire United Tramways, 210
Lewes and District Electric Supply, 634
Liverpool District Lighting, 24
Liverpool Overhead Railway, 210, 239
Llandudno and Colwyn Bay Electric Railway, 267
Llanelly and District Electric Lighting and Traction, 52, 320
London Electric Supply Corporation, 180, 210
London Electric Wire Co., and Smiths, 380
London and Suburban Traction, 180, 267
Low Temperature Carbonisation, 24

Mackay Companies, 52
Mansfield Engineering, 470
Marconi's Wireless Telegraph, 106
Mansfield and District Tramways, 239
Mather and Platt, 210, 239
Merthyr Electric Traction, 634
Mersey Railway, 210
Metropolitan Electric Supply, 210
Metropolitan Electric Tramways, 180
Metropolitan Railway, 154, 523
Metropolitan Vickers Electric, 292, 354
Midland Counties Electric Supply, 239, 320
Midland Electric Corporation for Power Distribution, 292, 354
Mirrlees Watson, 210, 354
Mirrlees, Bickerton and Day, 608

Newcastle and District Electric Lighting, 292
Newcastle-on-Tyne Electric Supply, 267, 358
Northampton Electric Light and Power, 180
North Metropolitan Electric Power Supply, 52, 180, 470
Notting Hill Electric Lighting, 292, 691

Oriental Telephone and Electric, 726
Oxford Electric, 267

Penarth Electric Lighting, 634
Paisley District Tramways, 239
Pernambuco Tramways and Power, 608
Peterborough Electric Traction, 470
Pinchin, Johnson, 320
Potteries Electric Traction, 585
Pritchett and Gold and E.P.S., 407
Provincial Tramways, 52

Rangoon Electric Tramway and Supply, 585
Ransomes, Sims and Jefferies, 691
Reading Electric Supply, 470
Register of Joint Stock Companies, 180, 320, 407
Rees Roturbo Manufacturing, 691
Reyrolle, A., 354
Rhondda Tramways, 407
Robey, 320
Rotherham Electric Engineering, 523
Royce, 726
Rushden and District Electric Supply, 180

St James' and Pall Mall Electric Light, 154
St Maurice Power, 180, 210
Scarborough Electric Supply, 407

Scottish Power, 239
Shanghai Electric Construction, 78, 585
Shropshire, Worcestershire, and Staffordshire Electric Power, 523, 548
Siemens Bros., 52, 523, 548
Siemens and Halske, 234, 585
Slough and Datchett Electric Supply, 320
Smithfield Markets Electric Supply, 239
South London Electric Supply, 210
South Wales Electric Power Distribution, 666
Stewarts and Lloyds, 292
Stock Exchange Committee, 239, 267, 380, 407, 492
South Metropolitan Electric Light and Power, 210
South Metropolitan Electric Tramways and Lighting, 180
Steel's Electric and Engineering, 523
Stock Exchange Committee, 634, 726
Submarine Cables Trust, 548
Sunderland District Electric Tramways, 106
Swansea Improvements and Tramways, 380

Telegraph Construction and Maintenance, 210, 267
Tilling-Stevens Motors, 438
Tisbury Electric Supply, 210
Tokyo Electric Light, 726
Tottenham District Heat, Light and Power, 634, 726
Tottenham Light, Heat and Power, 128
Traction and Power Securities, 180
Tynemouth and District Electric Traction, 407
Tyneside Electric Development, 267
Tyneside Tramways and Tramroads, 239

Underground Railways, 180, 210
United Provinces Electric Supply, 106
United River Plate Telephone, 78, 634
Urban Electric Supply, 523, 585, 634
Uxbridge and District Electric Supply, 210

Vandervell, C. A., 24
Vera Cruz Electric Light, Power and Traction, 585
Vickers, 239, 493, 585
Vulcanite, 106

Waste Heat and Gas Electric Generating Stations, 267
Waygood-Otis, 691
West African Telegraph, 691
Western Electric Distributing Corporation, 78, 180
West India and Panama Telegraph, 608
Weston-super-Mare and District Electric Supply, 634
Western Telegraph, 267, 634
Western Union Telegraph, 354, 438
Westminster Electric Supply, 154, 210
White, J. G., 691
Whitehall Electric Investments, 608
Windsor Electric Installation, 320
Wycombe (Borough) Electric Light and Power, 438

Yorkshire Electric Power, 154, 210, 438
Yorkshire (West Riding) Electric Tramways, 239, 634
Yorktown and Blackwater Gas and Electric Lighting, 407

Companies (New Electrical, &c.) Registered.

Aberdeen Radio, 154
Adam, Small, 267
Advance Wireless, 380
A.E.G. Machinery and Apparatus, 523
Albion Rotary Engines, 523
Amalgamated Wireless (Australia), 691
Anglo-Polish Electric Development Corporation, 634
Armature and Engineering, 691
Armstrong Construction, 492
Armstrong, John (Manchester), 492
Auckland's Wireless, 726
Automatic Burglar Alarm, 239
Automatic Coil Winder and Electric Equipment, 666
Auto-Welding and Engineering, 106

Bamford Works, 52
Barnard, J. W., and Haynes, 24
Barrow, 320
Bates, E. M., 470

Bay-Brooke, 634
Bayliss, March and Newey, 240
"B.D.S." Wireless, 438
Beaver Electric Supply, 407
Bellamy, Roland C., 691
Bell Battery and Accessory, 666
Bell's Radio and Electrical, 106
Bennett, Walter, 128
Bennett and Weaver, A. J., Ltd., 608
Birmingham Wireless, 470
Bloom's (Wireless) 210
Borough Engineering Works, 523
Bosden Rubber, 154
Boston and District Electric Supply, 666
Braham, R. W. E., 128
British Arca Regulators, 106
British General Radio, 380
British Homo Wireless, 180
British Ozone Appliances, 106
British Wireless (1923) 106
Broadcasting Installations, 128

Brown (Electricity), F. C., 634
Bruce Campbell, 523
Buss, Webb and Son, 634
Bussanel Engineers, 523

Carpax, 666
Cary, Hallowell, 128
Central Electrical Engineers' Accessories Supply, 239
Centrifugal Clutches, 128
Chalumo, 726
Cheltenham Wireless Supplies, 523
Cobb, Webb, 666
Coliseum Engine, 407
Comptophone, 407
Condor Lamps (Great Britain), 239
Crystal Engineering, 292

Defiance Electrical, 608
De Laval, 128
Dickson and Gow, 78

Dispatch Engineering, 523
Dolywern and District Electric Supply, 210
Dorco Engineering, 24
Drycel, 106

Eagle Wireless Supply, 438
Eastern Wireless, 267
E.E.E. Carbon, 608
Electric Auto Supplies, 24
Electric, H.E.C., 726
Electrical Ohms, 666
Electrical Power Equipment, 52
Electric Welders (Leeds), 154
Electric Winding and Doubling, 154
Electricity Finance and Distribution Corporation, 523
Electro Chemical Manufacturing, 240
Electron, 634
Eletactors, 666
Elkay Electric Manufacturing, 106
Ellesmere Port Electrical, 666

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Companies (New Electrical, &c.) Registered—(*continued*).

Elliott and McCarthy, 292
Ellison, F., 666
Embleton and Barker, 470
Empson Electrical Engineering, 267
Ether, Ltd., 407
Ewing Inventions, 726
Expert Electrical, 470

Fallon Condenser Manufacturing, 407
Ferguson, James, and Munro, 154
Ferguson, C. J., and Sons, 666
Fitch, A., and Son, 380
Fitter and Poulton, 320
Fivemiletown Electric Supply, 438
Flactem Wireless, 267
Fleet Bros., 320
Forum, 210
Friend Wintle, 267

Gilbert, T. C., 292
Glevum Motor and Radio, 380

Hall and Brenard, 608
Hambling Clapp, 608
Hardware and Electrical, 407
Harrison's, 267
Hargreaves, Hamilton, 470
Headphones (Manchester), 608
Horace Green, 470
H. P. Electrical, 239
Hudson, G. H., Harnell Manufacturing, 470
Hulburd Patents, 470
Hunter's Vale Accessories, 726

Insulating Supplies, 180
International Exaphone, 240
International Radio Manufacturers, 240
Iron and Nickel Battery, 407

Jacobs, L. (London), 320
Jeffery, W., 380
Johnson and Turner, 666

Kelly and Tarshis, 380
Kent Bros. Electric Wire, 470
Knight, A. W., 407

Lacland Electric Manufacturing, 240
Lacy Patents Holding, 666
Lamp, F. W., 691
Lead Hydrate Battery, 407
Light-O-Day Electric Lamp, 608
Liverpool Electric Engineering (1923), 666
London Universal Advertising Service, 292
London Wireless, 523

Mackerron and Scott, 634
Magnus Volk, 666
Maisner, E. H., 239
Mansfield Engineering, 523
Marchand and Chabloz, 634
Marchaphone, 608
Marrec, 380
Mathieson, T. B., and J. A., 666
Mechanical Utilities, 320
Metropolitan Electric Wire, 128
Midland Radiotelephone Manufacturers, 492
"M. K." Electric, 470
Morkley, G. E., Sprague, 407
Mulliner, S., 666
Multi Electrode Radio Valve, 320

National Electric Lamp, 726
National Radio Corporation, 523
Neon Lights (1923), 691
Newport Electrical, 608
Newtownbutler Electric Supply, 470
N.E.S. (Bradford) 128
North-East Coast Wireless, 78
Northern Light and Power, 666
Northern Radio, 492
Nox Electric Lamp, 492

Ormiston, P., 608

Phillips and Sons (Chiswick) 608
Phillips Valves, 726
Phonex Manufacturing, 320
Pickering Hart Lift, 239
Pickford, Johnson, 634
Pomeroy Foundry, 608
Premier Electric Supplies, 154
Prince's Electric Clocks, 239
Prior's Television (Parent Co.) 240

Radiax, 239
Radio Ebonite Supplies, 128
Radio Gramophones, 24
Radiolion Manufacturing, 128
Radio, Phonopore and Electricals, 78
Radio Products, 407
Radio Reception, 691
Radio Slot Machines, 608
Radio Stocks, 292
Radio Transformer, 691
Re-Echo Wireless Manufacturing, 78
Refty Electrical Appliances, 292
Residential Wireless, 78
Rhayader Electric Light and Power, 354
Rheostatic, 210
Ripaults, 267
Rissik, Fraser, Spinks, 608
Robson Paling, 240
Royle, Frank, 106
Rubon, 407

Samoiloff's Lighting Scheme, 292
Saunders, J. B., 492
Saunders Patents, 634
Savoy Elec. Construction, 24
Scammell and Abbott, 470
Scott, A. S., 726
Scottish Radio Centre, 634
Seaton and District Electric Light, 608
Shafteabury Wireless and Engineering, 292
Shaw Electric Transmission, 240
Sheffield Wireless Depot, 691
Sherborne Electricity Supply, 239
Shipton, E., 608
Shorrock, H. N. (Morecambe), 666
Smith, W. A. C., 292
Smith (South Shields), 666
Southern Repairs, 239
Southwark Electric., 380
South Yorkshire Electric Welding, 666
Speedwell Press, 470
S.S. Wireless, 492
Stafford Radio, 523
Star Lamp, 180
Stevenage Electric Light and Power, 239
Stevenston and District Electric Supplies, 407
Sutherlands (Electrical Engineers) 666
Swansea Welders, 128
Swift Manufacturing, 407
Technical Instrument Case Manufacturing, 492
Thames Electric Wireless, 407
Thamesmouth Radio Manufacturing, 320
Thomas Inventions Development, 470
Townlea Electrical, 470
Thompson Manufacturing, 292
Thorne, F. H. (1923) 691
Thornton and Vowles, 691
Tomlin Booker, 267
Townend, Fred, 78
Turner, E. (Manchester) 666

United Engineering and Manufacturing, 666

Valverust, 154
Vauxhall Electric Manufacturing, 354
Venner Grills, 407
Ventimotors, 691
Victor Radio, 128
Visso Lighting Corporation, 726

Walker Vehicles, 154
Ward, W., and Son, 380
Waterloo Electric, 666
Webber Engines, 470
Wellington Electric and Radio Engineering Works, 354
Westminster Tool and Electric, 691
Wholesale Equipment, 492
Wild, Windsor, 380
Wilmer Contracts, 608
Wilmore's Wireless, 666
Wireless Accessories Stores, 438
Wireless Agencies, 52
Wireless Developments Syndicate, 407
Wireless and Electric, 634
Wireless Manufacturers, 634
Wireless Enterprises, 320
Wireless Supplies, 354
Wireless Lights Syndicate, 239
Wireless Apparatus, 523
Wireless Club, 523
W. and M. Wireless, 154
Woodward Bros., 380

Yera Electrical, 106

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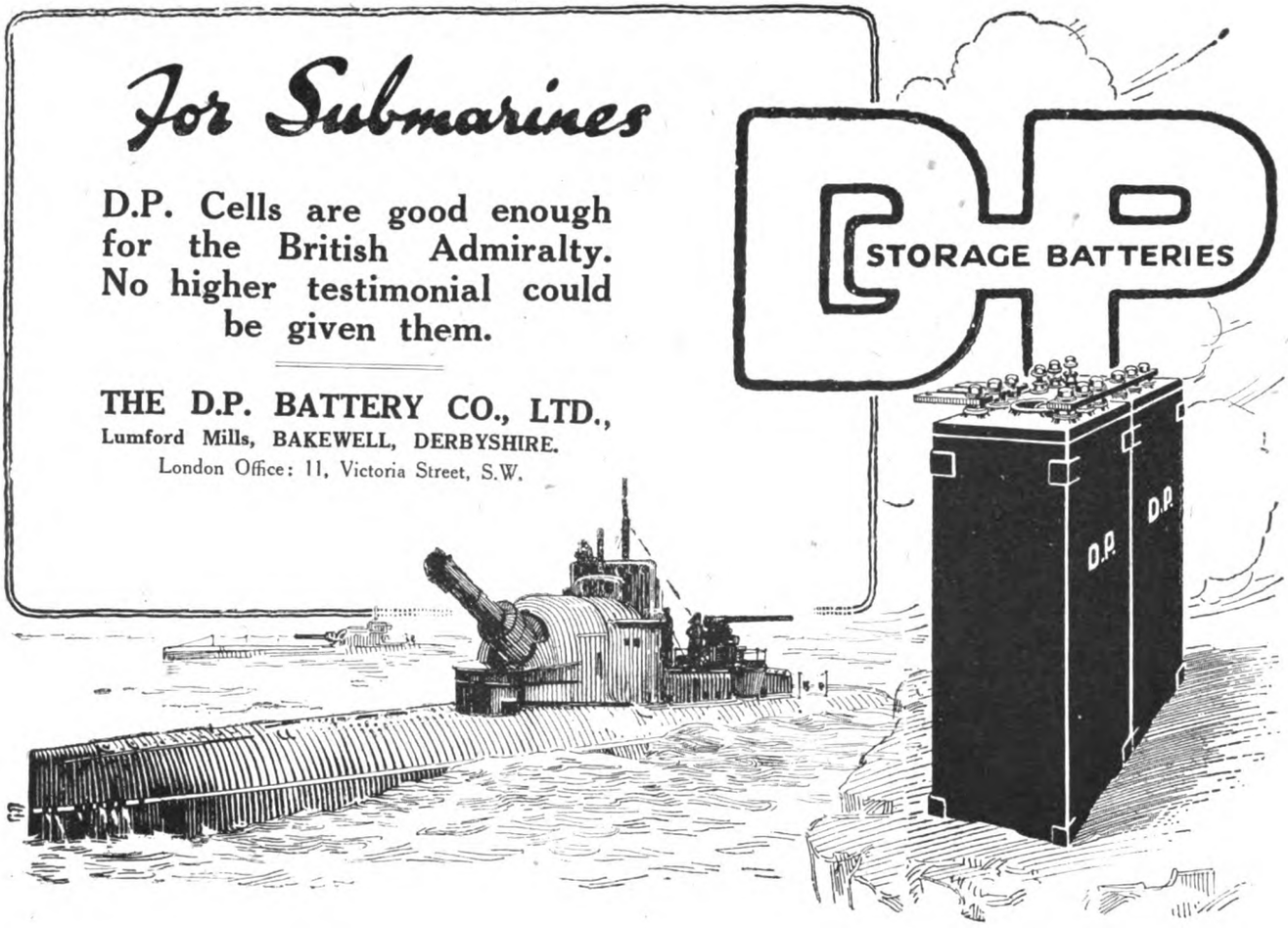

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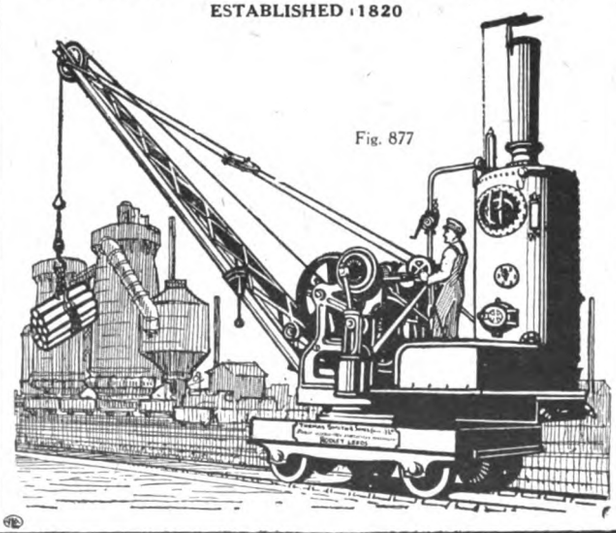

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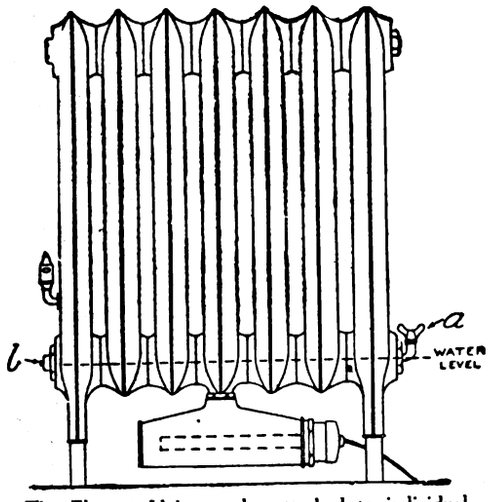

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The Stainless Steel Pin was placed into service with a number of new pins made from other steels, and after a period of six months an examination was made.

Apart from its resistance to rust and corrosion, the Stainless Steel Pin was found to have worn only 1/32" on the diameter, whereas the others had been reduced to the extent of 3/16".

In consequence of this satisfactory trial, a large order from this Colliery was received for pin forgings in FIRTH'S STAINLESS STEEL.

There are no Industries in which Firth's Stainless Steel cannot be adopted with advantage.

Our experience is *always* freely at your services.

THOS. FIRTH & SONS, LTD.,

SHEFFIELD.

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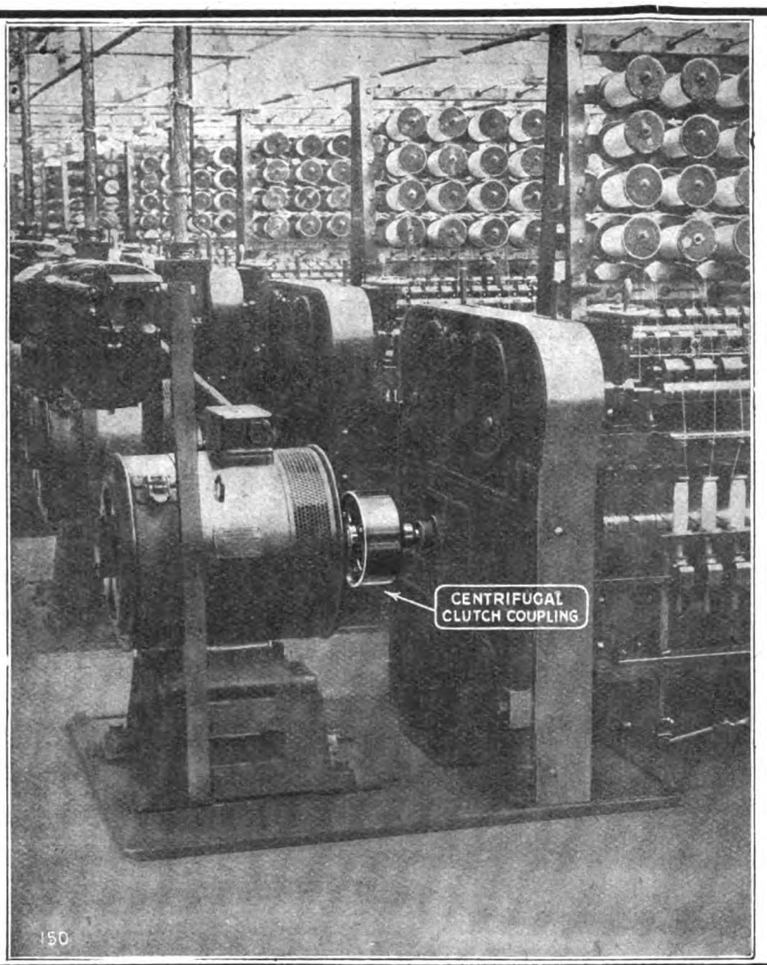

CENTRIFUGAL CLUTCHES

APPRECIATION

A Firm of Wire Rope Makers has recently reported to us that since fitting a 14 H.P. Clutch to one of their machines, the current consumption has been Reduced by 28·72%, the output Increased by 11·3%, and great economy effected in belt maintenance costs.

Write for New Catalogue—Post Free

THOMAS BROADBENT & SONS, LIMITED

HUDDERSFIELD

"Laundry Queen" Electric Washers

The most perfect electric washing machine yet produced

The "Laundry Queen" is truly wonderful in the almost human way in which it handles the clothes. It washes, rinses, blues and wrings them. It is the only electric washer which will do two operations at the same time, it will wring one batch of clothes whilst a second batch is being washed.

It is simple, it is efficient, it is reliable.

You cannot buy a better

THE NORTHERN STEEL AND HARDWARE Co. Ltd.

9 SOUTH PARADE MANCHESTER

Write also for particulars of the famous "Northern" electric vacuum cleaner "Laundry Queen" electric irons

Phone: 3768 Central. 'Grams: "Assiduous." No 4

The "BRIARTON" Electric Washing, BOILING, Rinsing and Wringing Machine

ALL BRITISH

Simple to Operate. Safe. Low Current Consumption

A sound, robustly constructed machine on the correct washing principle. Thoroughly tested in everyday service by many users. Simple to operate. Safe. Low current consumption. Competitive prices.

The "BRIARTON" totally enclosed high ratio speed reduction gear for powers up to ½ h.p. Highest ratio 175 to 1. With auto clutch for A.C. motors if required. A reliable gear at a reasonable price.

Get in personal touch with the actual makers

ARTON & WALTON, Ltd., Thomas St., Cheetham Hill, Manchester

(JOHN H. ARTON, 14 years Works Manager and Designer with Thos. Bradford & Co., Manchester)

PEEBLES

Bruce Peebles & Co., Ltd.

Engineers Edinburgh.

Electrical Machinery

"ANTI-SULPHURIC" ENAMEL

Should be used in all ACCUMULATOR ROOMS.

SOLE MAKERS: for Protection from Acid Fumes.

GRIFFITHS BROS. & CO., LONDON, Ltd. Meek's Rd., Bermondsey LONDON, S.E.

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"POLAR" Radiophones

are a distinctive line in

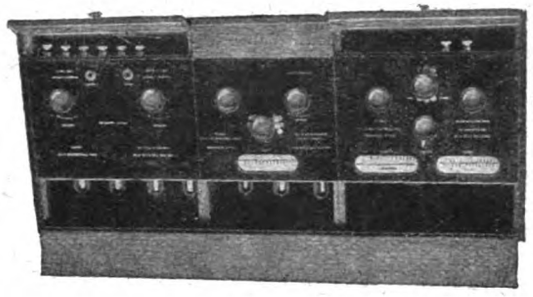
Design, Appearance, Manufacture and Performance

Their superiority stands out ahead of all other Broadcasting Receivers.

DESIGN :—

Note these special features :

1. **Wave length scales on all tuned circuits.**
2. **Three stage H.F. can be switched in or out of circuit.**
3. **Three stage L.F. with power valve connections for loud speaker.**



APPEARANCE :—

Against the handsome polished teak case, the sloping panel of rich ebonite, with its polished knobs, has a most sales-inviting effect.

MANUFACTURE :—

"POLAR" Radiophones are made throughout at our own works, which have for years been engaged in the manufacture of commercial wireless sets for the leading ship owners, P.O., Colonial Governments, &c.

PERFORMANCE :—

Copy of Report on set installed at Glasgow, 11/12/22, for Messrs. ..... :—

"I am pleased to say that the R.A. 33, 34 and 35 combination supplied through Messrs. ..... to Mr. ..... has been installed and was tested by myself personally last night. Signals through 2-L.O. which were too strong for the Head Telephones were readable over a large-sized room through the medium of a Gramophone Adaptor and a Hornless H.M.V. Machine. Manchester was particularly clear, and Mr. ..... has expressed his surprise and appreciation of the excellent results achieved, which were far beyond his expectations.

"I, myself, am particularly pleased with the results, as this is the first set which has been actually tested in this district, and considerable doubt has been expressed locally as to its capability of receiving London through this heavily screened area."

For those in remote districts, for those who wish to listen to distant broadcasting stations, and equally for those who cannot provide an efficient out-door aerial, the "POLAR" Radiophone, 3 stage H.F. combination is the ideal set.

We invite applications from the Trade for further particulars of these and other "POLAR" broadcasting specialities.

The RADIO COMMUNICATION CO., LTD.

(Suppliers of the G.P.O. installations at North Foreland (G.N.F.) and Seaforth (G.L.V.), of Coastal Stations for various Colonial Governments, and of Ship's Radio for most of the Great Shipping Companies.)

OSBALDESTON HOUSE, NORFOLK STREET, STRAND, W.C.2

BRANCHES :—NEWCASTLE—17, Sandhill. CLASGOW—116, Hope Street. LIVERPOOL—67, Dale Street.
CARDIFF—Atlas Chambers, James Street. SOUTHAMPTON—19, Queen's Terrace.

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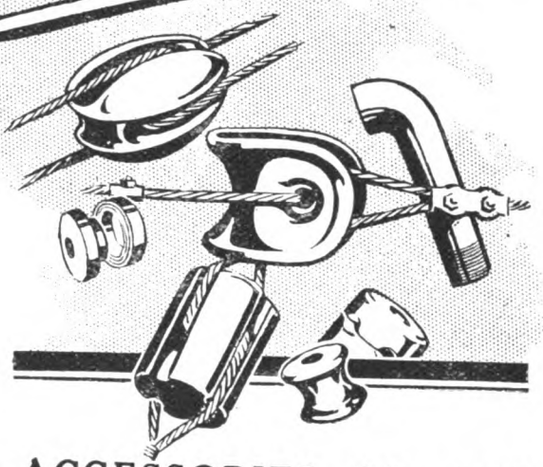
Porcelain Insulators for Wireless Sets



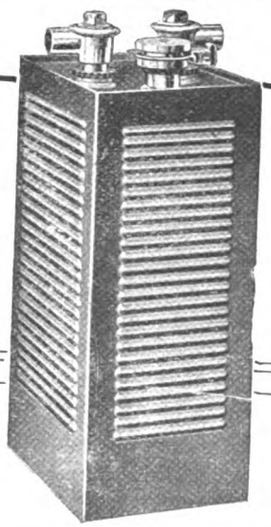
We specialise in the manufacture of EGG, SHELL and BARREL TYPE PORCELAINS for WIRELESS TELEPHONY. Also REEL and BOBBIN INSULATORS, CLEATS, LEADING-IN TUBES, etc.

Any of the above Porcelains can be supplied immediately from Stock.

THE ELECTRIC & ORDNANCE ACCESSORIES CO., LTD.

(Proprietors: Messrs. Vickers Limited.)
Offices & Works: Havelock & Shelton Potteries, Hanley, Stoke-on-Trent.
London Office: - - Vickers House, Broadway, London, S.W.1.
(Please address all enquiries to Hanley.)

EDISON ACCUMULATORS



FOR ALL TYPES OF COMMERCIAL VEHICLES, SHIP AND YACHT LIGHTING, HOUSE LIGHTING, &c.

FOR Commercial Vehicles, for House Lighting, Marine Lighting, wherever accumulators are used—the name Edison stands for quality, reliability and service.

Edison batteries reduce running costs because they cost very little to maintain, and have the longest life of any battery—a life of over eight years.

Constructed in steel, they stand the severest strain of heavy work and are simple to operate.

DEFERRED PAYMENTS ARRANGED

See what present users say. Facts, Figures, and Fullest particulars from:—

SALES DEPT, "E."

EDISON ACCUMULATORS, LTD.

Head Office: 15 UPPER GEORGE ST., W.1

Telephone—Paddington 5120 (Private Branch Exchange)
Telegrams - - - "Edisbatt, Edge, London"

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To wish you a bright and profitable New Year
MAZDA
ELECTRIC LAMPS
British made in Rugby.
B T-H
The British Thomson-Houston Co., Ltd.
Mazda House, 77 Upper Thames Street, London, E.C.4
Works: Rugby, Willesden, Coventry, and Birmingham Branches: Manchester, Liverpool, Birmingham, Sheffield, Leeds, Newcastle, Middlesboro, Cardiff, Swansea, Glasgow, and Dublin

Westinghouse

ELECTRICAL APPARATUS FOR EVERY PURPOSE

This trade mark is the guarantee of dependable electrical equipment.

An International Institution

Westinghouse Electric engineering ability, invention and research, Westinghouse thorough workmanship are greater factors in the electrical world today than ever before.

For Westinghouse Electric has succeeded in building into its products something of the ideals and principles of the institution, which are:

To keep always in advance of electrical development.

To devise every kind of apparatus that will reduce the cost of generating and distributing electric current.

To build machines that will most economically use electric current to meet every human need.

To surround these products with every safeguard of good quality and durability; to follow them in use with expert service.

These principles have built up a world-wide business which designs, manufactures and distributes over 300,000 separate articles. Westinghouse Electric makes everything from gigantic locomotives, generators, and motors to the electric ware that makes home life less laborious, and the myriad small supplies used by the practical electrician.

Westinghouse Electric International Co.

165 Broadway
New York, U.S.A.

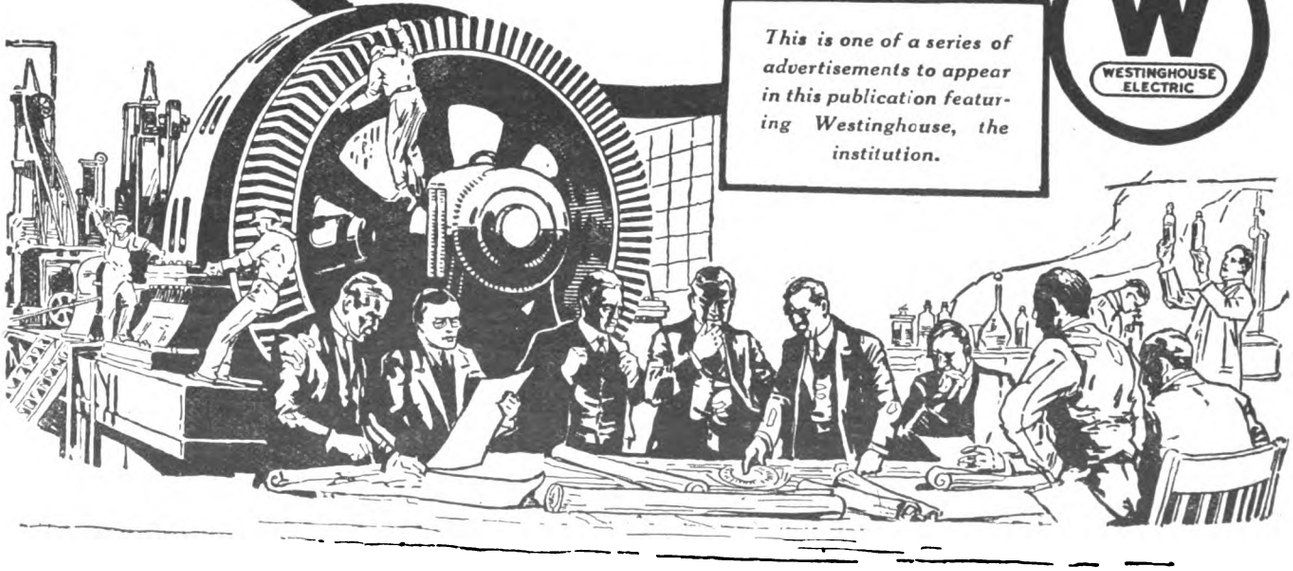
2 Norfolk Street, Strand
London, England

Cable: Wemcoexpo, New York or London

3

This is one of a series of advertisements to appear in this publication featuring Westinghouse, the institution.

W
WESTINGHOUSE ELECTRIC



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Electric Lighting

THE Mark of Efficiency.

Cosmos Lamps

Gasfilled and Vacuum

involve

NO PATENT RISKS

You are perfectly safe from legal action if you stock, sell and use "COSMOS" LAMPS. They are fully licensed and made under British Patents Nos. 23499 of 1909, 23775 of 1912, 10918 of 1913, and others.

"Cosmos" Lamps are made in a variety of types for a wide range of Voltages and capacities to suit all conditions of application.

ILLUMINATING ENGINEERING SERVICE.

WE have at the disposal of our customers, an Illuminating Engineering Section which has been formed to draw up complete specification for industrial, domestic and street lighting, and to advise in connection with all illumination problems. You are invited to make full use of these facilities.

Write for particulars of trade discounts, new literature and overprinted leaflets to :—

BELFAST
BIRMINGHAM
BRISTOL
CARDIFF
DUNDEE
EDINBURGH
GLASGOW

METROPOLITAN Vickers

ELECTRICAL CO., LTD.
TRAFFORD PARK WORKS - - MANCHESTER

LEEDS
LONDON
MANCHESTER
NEWCASTLE-ON-TYNE
SHEFFIELD
SOUTHAMPTON
SWANSEA

S
BOI.

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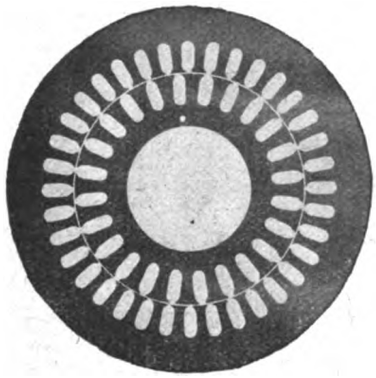
JOSEPH SANKEY & SONS, LTD.

ALBERT ST. WORKS
BILSTON, STAFFS

Telegrams: "SANKEY, BILSTON." Code: LIEBER'S. Telephone: 115 BILSTON.



Manufacturers of SHEETS and STAMPINGS of all descriptions for Dynamos, Motors, Transformers, &c., and for Electrical Work generally

MAKERS OF

STALLOY

(PATENT)

LOW HYSTERESIS LOW EDDIES HIGH RESISTANCE

Telephone & Radiophone Receiver Diaphragms, Wireless Transformer Stampings

IN STALLOY

Registered Trade Marks

"LOHYS"
"SPECIAL LOHYS"
"MEDIUM RESISTANCE"
"STALLOY"
"INSULINE"

Representative—ROBERT JENKINS, 168 REGENT STREET, LONDON, W.1

Telegrams: "PERMEABLE, PHONE, LONDON." Telephone: REGENT 5508.

W. P. THOMPSON, F.C.S., M.I.Mech.E., F.I.C.P.A.
G. C. DYMOND, M.I.Mech.E., F.I.C.P.A.

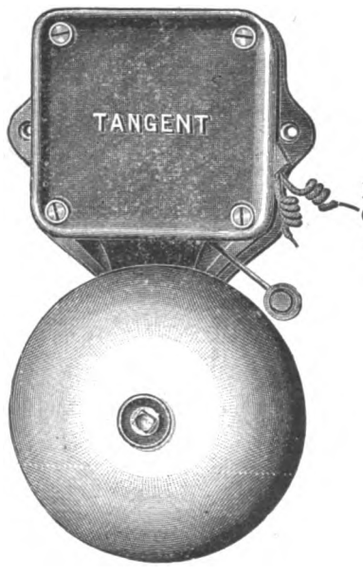
W. P. THOMPSON & CO.,
CHARTERED PATENT AGENTS,
12 CHURCH STREET, LIVERPOOL,
and 50 LINCOLN'S INN FIELDS, LONDON.

H. E. POTTS, M.Sc., Hon. Chem., F.I.C.P.A.
J. V. ARMSTRONG M.T.I., F.I.C.P.A.

MEWBURN, ELLIS & CO.,
CHARTERED PATENT AGENTS AND TRADE MARK AGENTS,
70, Chancery Lane, London.
Telegrams: "Patent London." Phone: Holborn 437 (2 lines).
And at
Newcastle-on-Tyne: 3, St. Nicholas Buildings.
Stockton-on-Tees: 6, Finkle Street.
Sheffield: 18, York Street; and
Bristol: 55, Corn Street.

REMEMBER—

GENTS' MANUFACTURE
"TANGENT"
POWER BELLS



IN CAST IRON CASES.

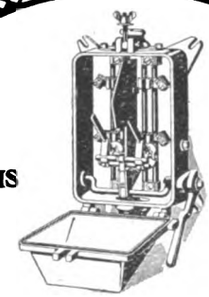
PUT THEM DIRECT ON THE MAINS AND SAVE BATTERIES.

SEND FOR REDUCED PRICES.

GENT & Co. LTD. "FARADAY WORKS" LEICESTER

LONDON:—25 Victoria St., S.W.1
NEWCASTLE-ON-TYNE:—"Tangent House," Blackett St.

THE FAMOUS



GLASGOW-PREMIER SWITCH

The Switch which raised the standard

If you are interested in raising the standard of electrical installation use [the] "Glasgow-Premier" switch, the QUICK-MAKE and QUICK-BREAK action of which ensures perfect and complete contact irrespective of the ignorance or folly of the operator. It costs no more than the others.

SEND FOR PARTICULARS, IT WILL SAVE YOU MONEY

Stocks are carried by over 200 electrical wholesalers.

THE MARK OF M·E·M EXCELLENCE

THE MIDLAND ELECTRIC MANUFACTURING Co LTD
BARFORD STREET—BIRMINGHAM

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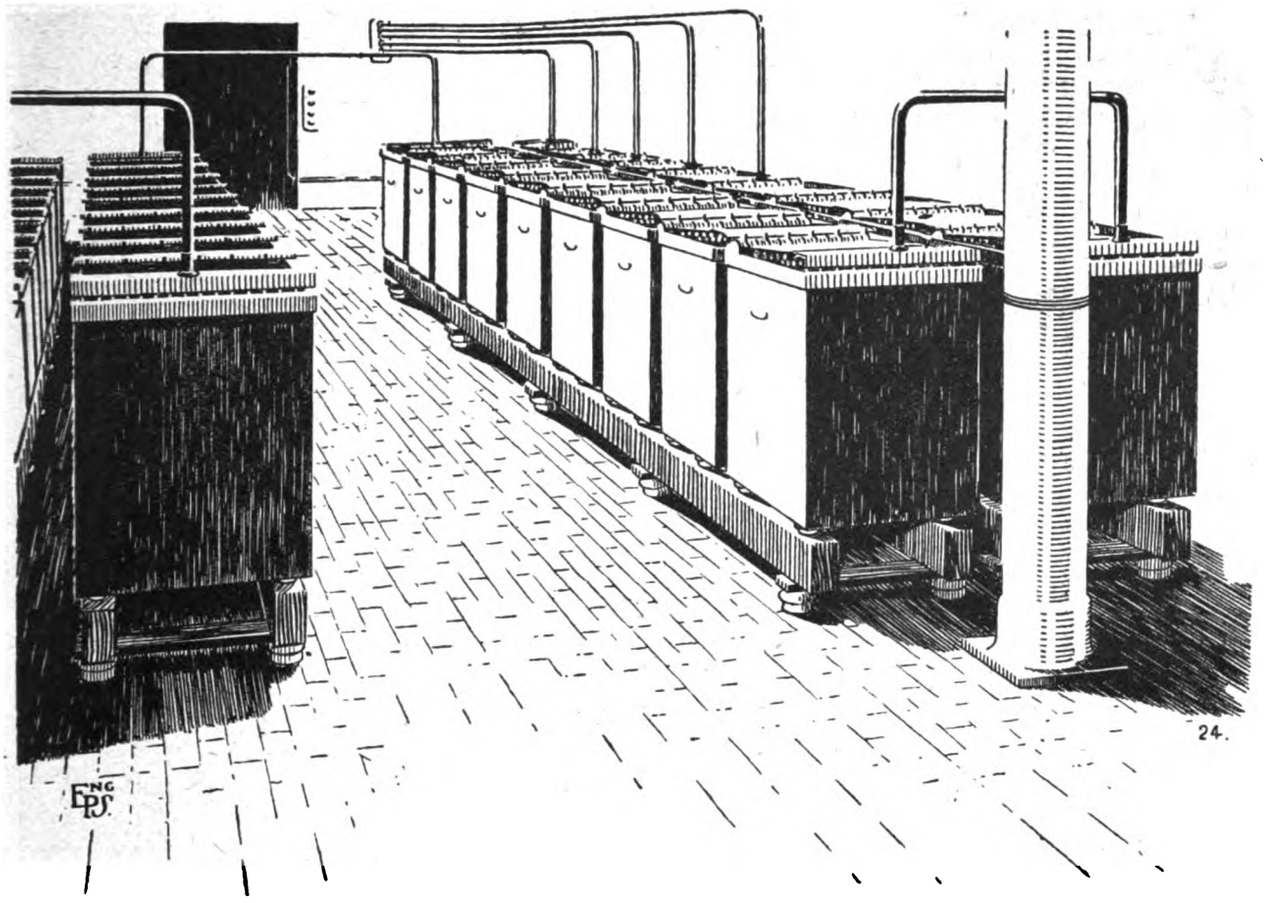

TUDOR

The Better Battery

for the large power job.

In any of the following cases it pays to think of TUDOR :—

1. New battery installations.
2. Renewals to existing batteries.
3. Battery information.

Whenever it is a matter of batteries, consult TUDOR.

The
TUDOR ACCUMULATOR
Co., Ltd.
2 Norfolk St., Strand, London, W.C.2

Telephone - - - - - - - Central 3308
Telegrams - - - - Subconical, Estrand, London
Works - - - - Dukinfield, near Manchester

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WIRELESS SUPPLIES

Order at once if you require prompt delivery.

Q. 61. HEADPHONES

4000 ohms

21/- Per Pair

Offered subject to being in stock on receipt of order.

THE JEARY ELECTRICAL CO., LTD.
8 Lambeth Hill, & 97 Queen Victoria St., LONDON, E.C.
Union Chambers, Temple Row, BIRMINGHAM : 95 Waterloo Street, GLASGOW
Telephones { LONDON : Bank 5075 (Private Exchange to all Departments) GLASGOW : Central 5239. BIRMINGHAM : Central 2379

Join the E.C.A.

Electrical Contractors Association

Because it will strengthen your position in meeting unfair competition and help all those members whose aims are identical with your own. You will find membership of your local branch of the greatest help in more ways than one. Please write for full information to

The Secretary,
The Electrical Contractors' Association
(Incorporated)
The Institution of Electrical Engineers' Building
Savoy Street, Victoria Embankment, W.C.2.

"With your Receivers, signals could be heard distinctly over long and short distances when other makes indicated no sound whatever."
—UNSOLICITED TESTIMONIAL

RECEIVERS for BROADCASTING

ERICSSON Receivers for Wireless Telegraphy and Telephony were adopted as standard by the British Admiralty as far back as 1909 and by the Air Board for Wireless Telephony in Aeroplanes in 1917. Latest type consists of Receiver with all electrical parts insulated from case and headband and terminals enclosed.

Write for Lists and Addresses of Local Agents.

THE BRITISH L.M. ERICSSON M'FG. CO., LTD.
Head Office: 67/73 International Buildings, Kingsway, London, W.C.2.

Ericsson Telephones

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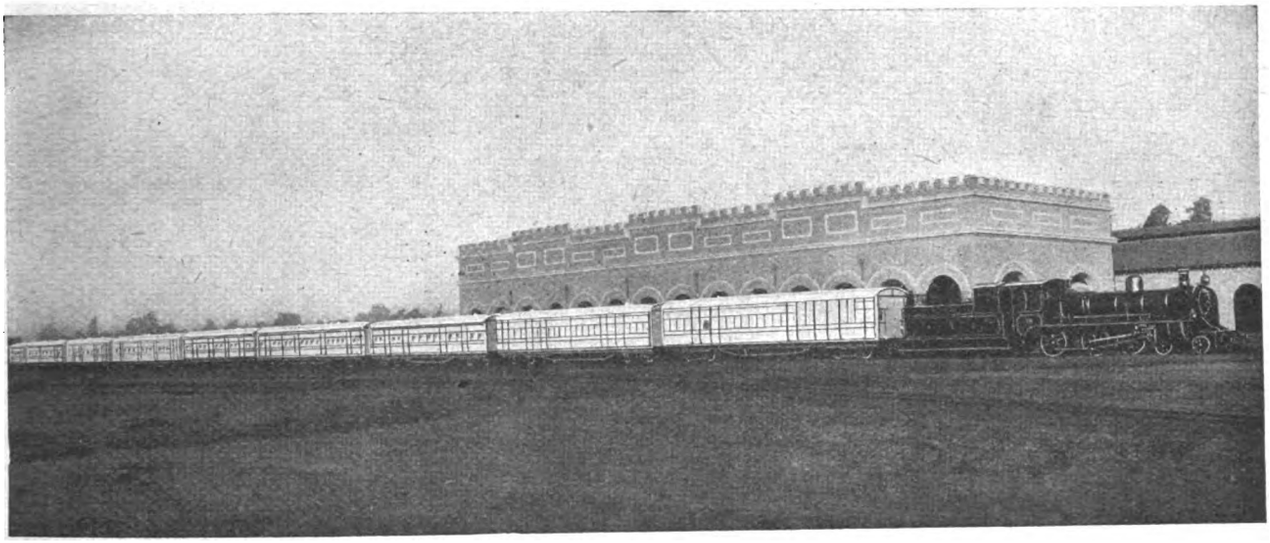
LUX
CELLS
for
TRAIN LIGHTING.



The Royal Train on the Mysore Railway—used by H.R.H. The Prince of Wales during his visit to India—lighted and ventilated by LUX Cells.

Lux Cells are used by the leading railway companies of the world. A new and improved type for Indian and Home railways, where headroom is limited, is available.

ASK FOR PARTICULARS.

THE Chloride ELECTRICAL STORAGE COMPANY LIMITED.

CLIFTON JUNCTION, Nr. MANCHESTER.

57, VICTORIA STREET, LONDON, S.W.1

And at Bombay, Calcutta, Sydney, Johannesburg, etc.

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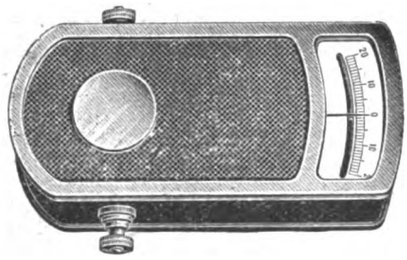

Have you seen our latest type of

POINTER GALVANOMETER?

SUITABLE FOR WHEATSTONE BRIDGES, POTENTIOMETERS, &c.

Apply for price and particulars.

WHITE ELECTRICAL INSTRUMENT CO., LTD.,

2, 4, and 6, Gloucester Street, Clerkenwell, E.C.1.

Wire: Voltograph, London. *'Phone: City 8660.*

ACKROYD & BEST, LTD.

MORLEY, near LEEDS (*Works cover 4½ acres*)

ACTUAL MAKERS OF—

GLASSWARE for all lighting purposes (Clear, Opal or Coloured)

STAMPINGS and PRESSINGS in all metals

LAMPS (Oil, Spirit and Acetylene) for Mines and Quarries

Once a Parkinson-Motor is installed its position is never usurped. It becomes the pioneer of a long line of sales—for it satisfies. It is simple, reliable, and thorough throughout.

F & A. PARKINSON LTD

GUISELEY LEEDS

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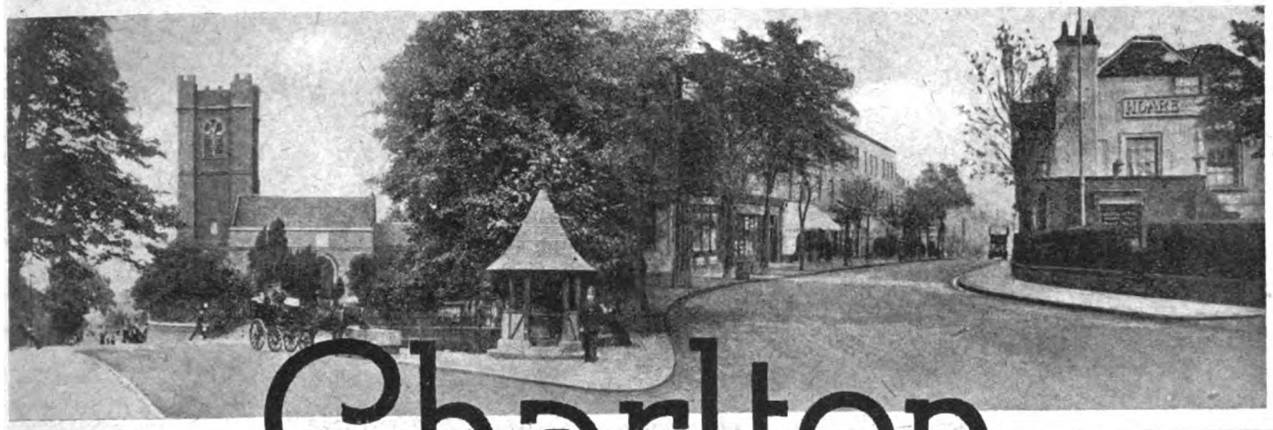
One of the "J & P" pages



Charlton

FORTY years back Charlton was still an old-fashioned Kentish village, perched on the rim of the river valley, about half-way between Greenwich and Woolwich.

"Old Charlton," shown in our top picture, still retains its winding village street, its ancient church and tavern, all clustered round the entrance to the "Big House" in Charlton Park.

Wooded combes and grassy slopes fell from the village-crowned heights towards the marshlands bordering the river. The railway to Woolwich already followed the lower ground and "desirable villa residences" had just begun to appear among the trees and park-land.

To-day Charlton forms part of one of England's great industrial cities, riverside London. Huge factories almost cover the reclaimed marshland and line the river bank—the grassy combes and woods have, alas! largely replaced their one-time verdure by bricks and mortar.

To readers of this journal Charlton will be familiar by name as one of the centres of the electrical industry—the home of "J. & P.," whose

Cables, Switchgear, Transformers, etc.

have made the name of their birthplace known to engineers all over this country and the world.

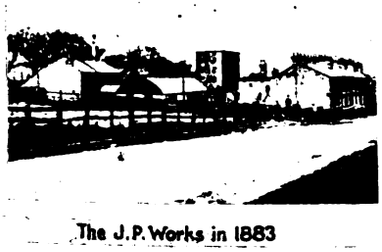
The view on left at foot shows the J. & P. Factory in its rural surroundings of the eighties, and that on the right the Works as they exist to-day.

Johnson & Phillips, Ltd.

Cable makers and Electrical Engineers since '75.

Charlton London, S.E.7

City Office & Stores: 12 Union Court, Old Broad Street, E.C.2.



The J.P. Works in 1883

The J.P. Works to-day

A hall mark of quality

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MORISON'S

EVAPORATORS MAINTAIN HIGHEST BOILER EFFICIENCY IN POWER STATIONS

RICHARDSONS, WESTGARTH & CO., LD.

HARTLEPOOL. MIDDLESBROUGH. SUNDERLAND.

LOST! 29,000,000

Tons of Steel through Corrosion in 1920

The above startling statement was made by Sir Robert Hadfield in a paper read before the Institute of Civil Engineers last April.

This irreparable loss could have been very largely PREVENTED by the use of

"BITUMASTIC" (REGD)

The "World's Record" Anti-Corrosive

"BITUMASTIC" Coloured Solutions

Are supplied ready for application in the same way as ordinary paints, in Black, Red, Brown, Green or Grey.

The solutions render corrosion impossible by keeping the causes of rust from reaching the surface of the metal. They form an impervious coating of great durability, which is totally unaffected by gaseous fumes.

A postcard will bring full details.

Wailes Dove Bitumastic Ltd.

NEWCASTLE-ON-TYNE, London, Liverpool, Glasgow, Leeds, Manchester, Birmingham, Cardiff, Hull, Dublin, Belfast, etc.

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MISCELLANEOUS ADVERTISEMENTS.

1s. 3d. per line, single column. (minimum, 3s.)
CONTRACTS OPEN.
LEGAL NOTICES.
PARTNERSHIPS.
AGENCIES.

1s. per line, single column.
APPOINTMENTS VACANT AND WANTED.
SALES BY AUCTION. PATENTS.
PLANT AND MACHINERY FOR SALE AND WANTED.
PREMISES FOR SALE, TO LET AND WANTED.
SITUATIONS VACANT MISCELLANEOUS.

12s. per inch, single column.
EDUCATIONAL ANNOUNCEMENTS.

8d. per line, single column. (minimum, 2s. 3d.)
SITUATIONS WANTED.

All announcements of this description average 10 words to a line, *and must be prepaid*. Replies to Advertisements can be addressed to the Offices to be called for, but where these replies are to be sent on to Advertiser by post, 6d. must be added for postage.

'PHONE: City 9852 (5 lines). **THE "ELECTRICIAN" ADVERTISEMENT DEPARTMENT** 8 Bouverie Street, Fleet Street, London, E.C.4. WIRE "Benbrotric Fleet London."

APPOINTMENTS VACANT.

TRANSFORMER DRAUGHTSMAN.—Applications are requested for the appointment of Transformer Draughtsman with well-known British firm of electrical engineers.

Applicants must have had first-class experience in the design and manufacture of LARGE HIGH TENSION TRANSFORMERS.

The position would be a permanency, and offers ample scope to a suitable man. Applications will be treated with strict confidence. Apply, Box No. J.Z.P., ELECTRICIAN Offices, 8, Bouverie Street, London, E.C.4, giving full particulars of experience.

TENDERS INVITED.

CITY AND ROYAL BURGH OF DUNDEE.

ELECTRICITY DEPARTMENT.

THE Town Council invites Tenders for the supply and delivery of ELECTRICITY METERS for public supply service work.

Specifications, Guarantee Forms, Schedules and Forms of Tender may be had on application to the undersigned, and must be returned whole and complete with the Tender.

Tenders (sealed in envelopes provided) to be lodged with the Town Clerk, City Chambers, Dundee, not later than by 10 a.m. on Friday, 19th January, 1923.

The Town Council does not bind itself to accept the lowest or any Tender.

D. H. BISHOP, B.Sc., M.I.E.E., General Manager and Engineer.

Electricity Supply Department, Dudhope Crescent Road, Dundee, December 30th, 1922.

STATE ELECTRICITY COMMISSION OF VICTORIA.

TENDERS FOR PLANT.

TENDERS are hereby invited for the supply, delivery, etc., of the following for Morwell Power Scheme.

Copies of Tender Form and Specification may be obtained or inspected upon application to

AGENT-GENERAL FOR VICTORIA,
MELBOURNE PLACE,
STRAND,
LONDON, W.C.2.

SPECIFICATION No. 23 8—TRANSFORMERS.

Charge, 5s. for first two copies of Tender Form, Conditions of Contract, and Specification complete. This charge will be returned on receipt of a *bona fide* Tender.

A third or any further copies may be obtained on payment of 2s. 6d. per copy, not returnable.

PRELIMINARY DEPOSIT.

A preliminary deposit of 1 per cent. of total Tender Price is required to be lodged with tender.

The Commission does not bind itself to accept the lowest tender.

Tenders on prescribed form, properly endorsed, and addressed, must be delivered to the undersigned in Melbourne not later than 12 noon on the 31st March, 1923.

R. LIDDELOW, Secretary.

COUNTY BOROUGH OF NEWPORT.

ELECTRICITY DEPARTMENT.

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The Corporation do not bind themselves to accept the lowest or any Tender.

(Signed) O. TREHARNE MORGAN, Town Clerk.

Town Hall, Newport, Mon., January 1st, 1923.

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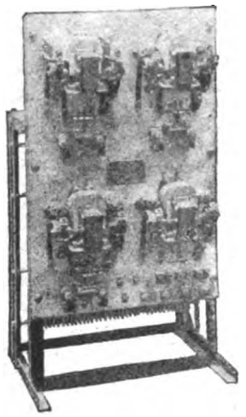

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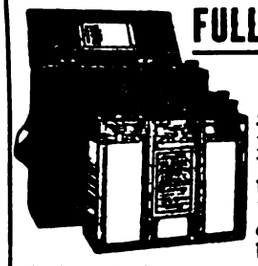

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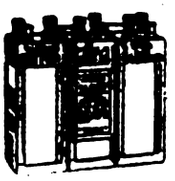

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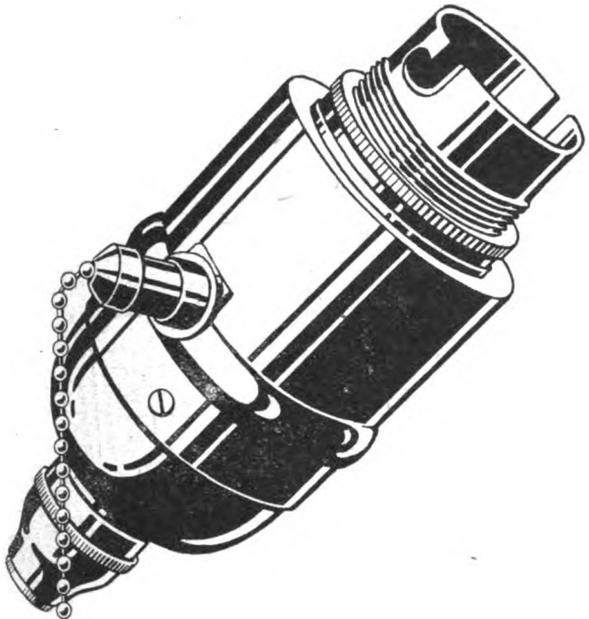

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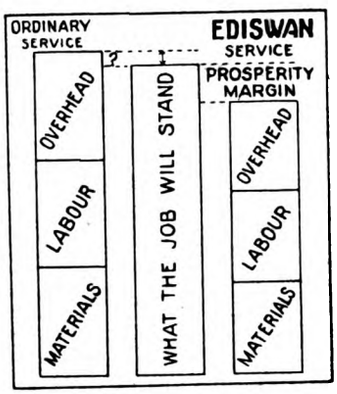

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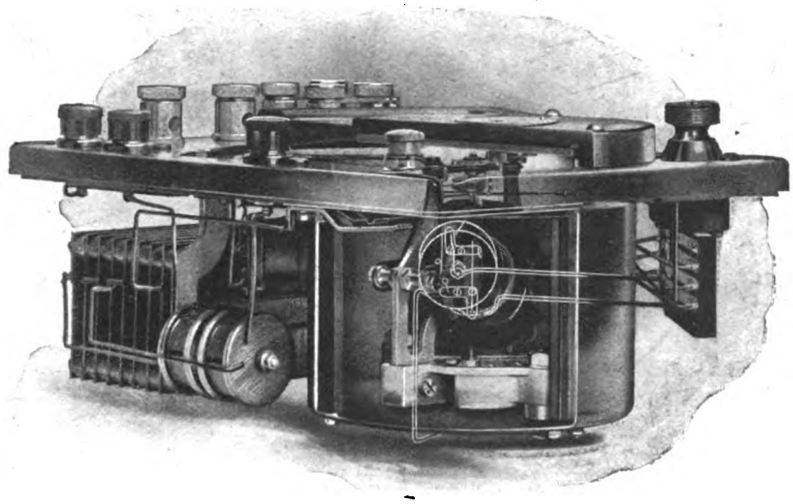

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CONTENTS.

Notes of the Week	1	"Scientific Novelties" Exhibition	19
1922	3	Railway Grouping	19
The Neon Glow Discharge Lamp on A.C. Circuits. By R. A. Brockbank and L. E. Ryall. Illustrated.	4	Transatlantic Wireless Telegraphy	20
		Calendars and Diaries	20
Some Notes on Electric Traction in Bavaria. By Prof. B. Gleichmann. Illustrated	6	Telegraph and Telephone News	20
		Electricity Supply	21
Heaton Revisited. Illustrated	9	Personal Items	21
The Electricity Commissioners' Report	10	New Managing Director of B.T.H. Co.	21
The Electrician "All-Electric" House. Conditions of the Competition	11	Foreign Notes	22
		Wireless News	22
Correspondence	14	Imperial Notes	22
Industrial Lighting by Electricity	14	Electric Traction	23
East Midlands Electricity District	15	Electricians' Wages	23
French Tidal Power Scheme	15	Companies' Meetings, Reports, etc.	24
The late Sir John Gavey	15	New Companies	24
Insurance by Industries	15	Tenders Invited and Accepted	24
Merchandise to Sell and Profit By. Illustrated	16	Business Items	24
Price Lists, Catalogues, etc.	17	Commercial Intelligence	25
Pacific Cable Board	18	Forty Years Ago	25
Electrical Engineers' Board	18	Prices of Metals, Chemicals, etc.	25
Diesel Engine Users' Association	18	Patent Record	26
Maidstone Electricity Undertaking	18	Arrangements for the Week	26
Contravention of Electricity Regulations	19		

Notes of the Week.

The Electrician Competitions.

On pp. 12 and 13 of this issue we publish complete plans of The Electrician "All-Electric" House, while on p. 11 we publish the conditions with which competitors desiring to submit schemes for wiring this house are requested to comply. These plans and conditions are being reprinted in pamphlet form and competitors are advised to obtain copies from us. The first condition states that the designs are to be re-drawn. This applies only to the plans and sectional elevations and not to the outside views which have only been published to make the house complete. It will be noticed that the house is assumed to be in Hackney. There is more in this than meets the eye. May we also remind competitors that their pseudonym should be written on every plan, schedule or description they send in? Failure to do this will cause anxiety to the judges and disappointment to the competitors. And lastly we draw the attention of those entering to the desirability of protecting any patentable suggestions they put forward. There will be plenty of time to do this. From opinions we have received we are assured the competition will be a success, we shall look forward to the result with interest.

The Electricity Commissioners' Report.

The second annual report of the Electricity Commissioners, recording the progress of their work between April 1st, 1921, and March 31st, 1922, falls naturally, for the purpose of comment, under two headings. Under the first come such routine duties as used in the old days to be performed by the Board of Trade. These duties include sanctions to borrowing, fringe orders, accounts, returns and statistics, consents to subscriptions to Associations, remuneration for the hire of meters, appointment of electric inspectors, charges for electricity, wayleaves, overhead lines and so on. All very necessary items of procedure, but not very interesting to do or to read about! Under the second heading comes an account of what has so far been done to reorganise the electricity supply of the country and the Commissioners' views on such matters as areas without supplies, private and non-statutory undertakings, joint electricity authorities, the preparation of schemes and local inquiries. Subtly interwoven into this account may be sensed a something which is not quite an apology and yet is a little more than an explanation for the delay which has occurred in bringing about a better and brighter electrical industry.

An Explanation or An Apology?

It is a little difficult to analyse this attitude but we feel that the Commissioners wish to imply, though they are too polite to say so, that the fault is as much with the industry as with themselves. For instance, they point out, speaking of the delay that has occurred in giving effect to schemes, that a reorganisation can only succeed with the co-operation of all concerned, and that the acceptance of a unified system of control of the generating stations in a district will constitute the "acid test" of the sincerity of co-operation. Again, they complain of the undue delay of some undertakings in returning a *questionaire* necessary for the preparation of statistics and point to the lack of appreciation of the importance of the compilation of such figures. Some of the returns that were sent in revealed omissions and arithmetical errors and their editing and correction delayed the publication of what will be a useful mass of information. During the past few months many hard words have been said about the Commissioners and their doings. They have succeeded, thanks to some of their critics, in making a very telling reply.

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The Pros and Cons of Non-Statutory Undertakings.

A NUMBER of the routine matters dealt with in the report lose their news value from having been reviewed in the Annual Report of the Minister of Transport and therefore require no further comment. But mention may be made of the discussion of the relative advantages of statutory and non-statutory undertakings. The Commissioners point out that in small towns a good argument can be advanced for proceeding on non-statutory lines principally because expense is saved. Against this, however, must be placed the lack of authority to exercise many rights, such as breaking up streets, and the absence of any protection of the consumer in the way of price or voltage of supply. And, finally, hidden away in the discussion of the future of Joint Authorities is the statement that such bodies would have the power to supply in the areas served by non-statutory undertakings and in competition with them. On the balance, therefore, it seems, if the cost of obtaining a Special Order can be kept as low as the £300 mentioned by the Commissioners, that the day of the non-statutory undertaking is past.

The Cost of Reorganisation.

THERE has been much complaint of the expense of preparing schemes of reorganisation and of holding enquiries. The Commissioners point out that the enquiries are essential preliminaries to any reorganisation and that having in view the importance and complexities of the problems at issue the expenses necessarily incurred are relatively small when compared with the economies that will be obtained. The important word in the sentence is: necessarily. The squadrons of counsel, the piles of papers, the arrays of statistics, the army of clerks and the bevy of consulting engineers, all cost money and are not all really necessary to effect reorganisation. In many districts the true work towards this end has been done by unofficial committees of engineers working without extra remuneration. The remainder, which has cost the money, has been either *camouflage* or due to a desire to score some debating point or dialectical advantage over a rival town or body. It is not really worth while, but those who do it should not blame the Commissioners because it costs money.

Water Power Problems.

ALTHOUGH the use of water as a source of power is much older than that of coal, it suffered almost a complete eclipse during the past century. This was due to several causes, the most important of which was the development of steam-power which enabled coal to be transported cheaply and easily stored. The steady rise in the price of coal, the increased difficulty of winning it, and the liability to interruption of supplies have recently given an impetus to the study of water power, and a paper read by Dr. HALTON THOMSON before the Liverpool Engineering Society contains an instructive survey of the present position. One important point emphasised is that whereas the storage of coal presents little difficulty, so that in a steam installation the greater proportion of the capital may be allotted to the plant, in the case of water power much of the expenditure is eaten up by constructional works. Such works may, in fact, absorb as much as 78 to 93 per cent. of the initial outlay, and this naturally goes far towards counterbalancing the apparent advantage of getting the power for nothing.

What Is Needed.

ON the other hand, the principles of hydro-electric power production are fairly well understood. What is needed is a thorough survey of available water power, particularly the degree of variation in dry and wet seasons. The need for systematic collection of hydrometric data has long been urged, but gaugings are seldom undertaken until a scheme is seriously mooted. Hence much time is expended in obtaining fundamental data, before the actual planning of the installation can be even considered. The author presents some instructive records of streams in various localities. The extent of the variation is illustrated by the fact that the dryweather flow per unit area, even in watersheds of about the same size situated in mountainous districts with high rainfall may differ in the ratio of 36 to 1. Impounding essentially involves a compromise. Flowing water must be preserved or used when it appears, otherwise it is lost; on the other hand, a reservoir that seldom or never overflows in wet years would imply a waste of capital expenditure. It is commonly assumed that in combined plants steam power will be used as a supplement to water power. This would naturally be the case where water power is abundant, and is the cheaper source of supply. But in parts of this country, where coal is cheap and readily available, and where steam plant is already in operation, the converse might apply—i.e., water power might conceivably be used only in emergencies or to deal with the peak load. This is a new way of looking at old problems, and we hope both the optimists and the pessimists will study Dr. THOMSON'S results. They are well worth while.

A Naval Electrical Reform.

To the landsman the arrangements for the control of electrical installations on H.M. ships have appeared, to say the least of it, weird. Electricity first came into use in connection with the torpedoes and therefore to the sailor it logically followed that all electrical equipment was the "pidgeon" of the torpedo lieutenant. This has applied until the present time when generators, motors, and switchgear of a size once unimagined are the rule rather than the exception. But the machinery which drove the generators and the machinery which the motors drove were the "pidgeon" of the engineering branch, an arrangement which all the well-known suavity of our naval personnel could not prevent from at times causing difficulties. We are therefore glad to learn that a Fleet Order has been issued, placing the electrical installation under the engineering branch. This ought to have been done before, but vested interests have stood in the way. Now that it has been done not only should greater efficiency be the rule, but a more complete training of naval engineers should be possible.

Double Frequency Generators.

THE Italian Brown, Boveri Company of Milan, are building two double frequency generators to the order of the Italian State Railways Department for the Bardonecchia power station. They can supply three-phase energy either at 16⅔ periods per second for traction or at 50 periods for general industrial purposes. The generators are intended for direct coupling to water turbines. This is said to be the first occasion on which large double frequency machines have been employed. The 16⅔ cycle generator has four poles and its output will be 7 000 kVA at 4 000 V; the 50 period machine has 12 poles, and it will give 6 000 kVA at 7 000 V, the speed in both cases being 500 revs. per minute. There are certain areas in this country where the use of machines of this kind might well be economically advantageous and the results obtained will be watched with interest.

Units Sold or Units Generated.

IN a letter which we publish in our Correspondence columns this week Mr. W. N. CLINCH raises an important question: The desirability of some agreement to use either units sold or units generated in determining not only station costs, but thermal efficiencies. The latter factor is likely to receive the closest consideration during the coming year and, as Mr. CLINCH rightly points out, it should be based on units sold, not only that the comparison may be just as between stations but that thermal efficiency may mean what it obviously should mean. It may be noted that the contributions which electricity supply undertakings will make to the expenses of the Commissioners will be based on "units sold," and that the useful figures of costs published each month by the "Electrical Times" are worked out on the same basis. Nothing is to be gained by departing from this standard, and we hope, for every reason, it will in future be rigidly adhered to.

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1922.

It is, or was, the habit of historians to open a new chapter in their narratives with the death of every king. The division at best was an artificial one, for even in history the progress of events is hardly checked by the recurrence of lives or deaths, by the changing of the seasons, by the clash of wars or by peace treaties. There are times when progress is slow. Equally there are times when progress is rapid. And again there are times when a certain task seems to have been satisfactorily fulfilled. But these alternating periods of motion, rest and completion, have a way of coming about without regard to the calendar, or indeed to any other axis of origin.

If, therefore, we in the electrical industry use the period from the beginning of one year to the beginning of the next as an excuse for historical stocktaking we are more often than not doomed to disappointment. For there are years when nothing seems to have happened of which we can take stock, when everything appears to be in a state of flux and when, though much is being done, very little seems to have been done. That disappointment is the most natural result of a review of the year 1922. It is the most natural result also of using artificial boundaries for dividing up the march of natural phenomena.

Vast Happenings—Little Doings.

We can prove our premises in no better way than by reviewing events in the electricity supply world during the past twelve months. A vast deal has happened but nothing much has been done. True, after a great deal of discussion and ill-advised opposition, the Electricity Supply (No. 2) Bill became law, and so the way of the Commissioners and the electricity supply industry was smoothed to some extent. But that was not, after all, a very great achievement; and it is still too early to count what harvest is likely to be gathered as the result.

The harvest which many expected as the result of the Electricity Supply Act of 1919 also tarries. Many inquiries have been held, many schemes have been propounded, but no electricity district or Joint Authority is yet fully in being. It is difficult to decide whether anyone is to blame for this; and, if so, who. The Commissioners have worked hard, but so far largely fruitlessly. The engineers concerned have put forward agreed schemes in more than one case. But there have been displays of parochialism and circumlocution which might well make the most optimistic despair. And in the event nothing has been done.

International Wireless Delays.

At the other end of the scale the story is the same. The one achievement in the wireless world has been the inauguration of broadcasting. This in itself took a great deal of time for reasons which need not be repeated and the event itself was rather an extension of something that was being done already than the beginning of anything new. As regards the Imperial Wireless Chain, nothing! The whole matter has been explored and reported on and reported on and explored. Technically there seems no difficulty. Private enterprise has offered to undertake the whole problem and to solve it. But hidden away in some Government office lurks some obstacle which so far has prevented the attainment of anything that can be called a result.

Railway Electrification Delays.

With railway electrification the state of things is the same. A number of plans but little or no achievement! The South-Eastern and Chatham Railway, the London, Brighton and South Coast Railway, the London Underground Railways, the North-Eastern Railway, to give them their 1922 names, have all large schemes of extension in hand which are being undertaken, the cynical will note, without regard to the findings of the Ministry of Transport Advisory Committee. But no new line has been opened and the greatest progress has been in the use of longer trains and other similar palliatives for dealing with the problem of traffic congestion.

No Cause for Pessimism.

This sombre review is intended neither to be derogatory nor to cause pessimism. Though little has been achieved much is going on under the surface. The pessimism of the early year lightened as the months went on and with the confidently expected revival of trade may well bloom into optimism during 1923. That this will be so is supported by one significant fact. The war years were distinguished by widespread additions to the country's generating plant, so much so that the demand for connections in many places outran the possibilities of supply. The subsequent years of slump left much of this plant not fully loaded, though the falling away was nothing like so great as might have been expected from the condition of the country's trade. During 1922 the upward movement was resumed, and that upward movement has been reflected in the numerous extensions to generating plant which have taken place. We need only instance Liverpool, Hastings, Walsall, Nelson, Stoke-on-Trent and Derby as cases in point, while the new stations which have been opened at Birmingham and Leicester reflect another phase of the same development.

The Progress of Engineering Thought.

History should not be solely a chronicle of facts; it should also deal with the progress of thought. From a study of what men are thinking can be predicted what they will soon be doing. In the supply world the two most important tendencies in thought during 1922 were a recognition of the pre-eminent position of the boiler house in the economics of the electricity undertaking and of the need for a sales organisation which would allow the commodity provided to be profitably marketed. In these two fields there is still much to be done and many problems to be solved, and upon their proper solution depends the future of the entire electrical industry. The enterprise, hard work and vision of certain engineers have opened up to the general view the possibilities of domestic electricity. To explore and develop those possibilities as they should be explored will require optimism, unremitting labour and courage. These should be accorded. How fine a material we have to work in is not yet realised as it should be and herein lies the need for self-education and a grasp of all the potentialities of the electric idea. In this work all can play a part and in the reward all can share.

The Important Quality of Vision.

Electrical engineers are not unprovided with that important quality of vision. If proof were needed we should refer to Mr. FRANK GILL'S Presidential Address to the Institution of Electrical Engineers wherein he pointed out the need for an International Telephone Authority for Europe to enable us in the Old World to possess facilities for communication which are already in the possession of the inhabitants of the New World. That Authority will not be established without the overcoming of difficulties. But when it is established everyone will wonder why it was not done before. And that in itself is a sure proof of the greatness of the idea. We are glad to say that Mr. GILL'S suggestion has caught on and we hope it will not be long before we can record that something concrete has been done.

Interest in the Future.

That is, very briefly, the history of 1922. There are many other events, such as the Jubilee celebration of the Institution of Electrical Engineers and the Eastern Telegraph Co., to which we might have referred, but these belong rather to the past than to the future. It is the future we are interested in and it is only that interest that makes us look backward to past events. For though these events can tell us little exactly of what will happen they do indicate the line of progress, and by comparing events in the near past with what happened at a more distant date we are enabled to learn lessons which can be of the very greatest use. We part from 1922 without regret, but we look forward to 1923 with expectation.

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The Neon Glow Discharge Lamp on A.C. Circuits.

By R. A. BROCKBANK and L. E. RYALL.

Description.

The neon glow discharge lamps of the "Beehive" type consist of a glass bulb enclosing two metal electrodes; one in the shape of a conical spiral of 6·5 turns, and the other a circular plate of about 0·6 in. diameter. The minimum clearance between the nearest coil and the plate is 0·15 in. In the "Beehive" lamp a silk-covered, fine wire

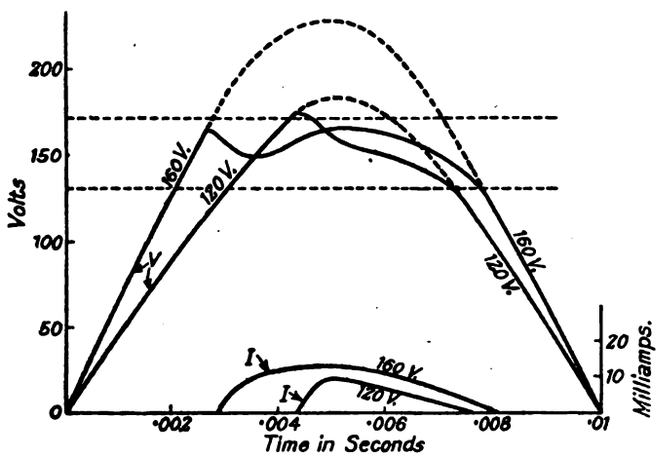

FIG. 1.

resistance of 2 900 Ω is wound round the stem of the bulb inside the cap and is connected in series with the plate electrode. In the "Osglim" lamp the wire resistance (3 430 Ω) is wound on a small former inside the neck of the lamp

Oscillograms.

Oscillograms were obtained when the "Beehive" lamp was run under the following conditions:—

Overall voltage (R.M.S.) (*a*) 120 V. (*b*) 160 V
(*c*) 200 V. (*d*) 240 V

having a crest factor of 1·54 and a frequency of 50.

The actual instantaneous voltage across the electrodes was obtained by subtracting the "IR" drop in the resistance for each value of the current from the corresponding applied voltage.

The following characteristics of the lamp are observed from the oscillograms (Figs. 1 and 2):—

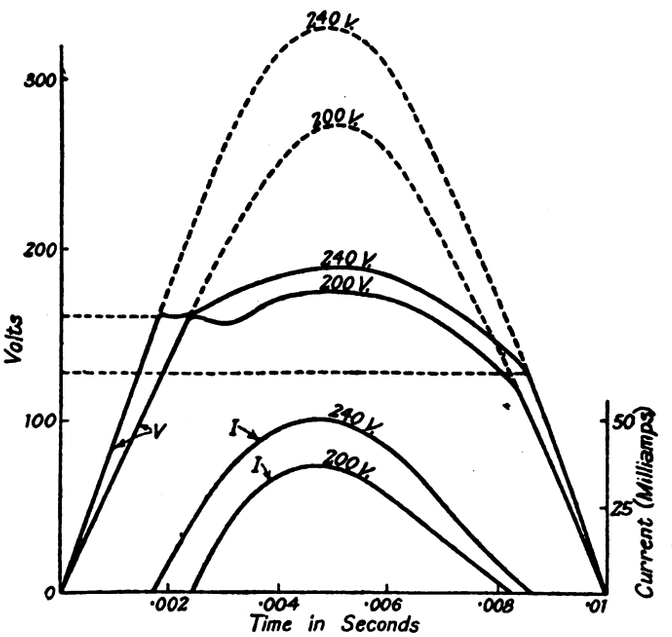

FIG. 2.

1. On 120 V (R.M.S.) the lamp lights for a short period of the cycle only; the minimum value of the voltage at which the discharge strikes being 115 V (R.M.S.).

2. Discharge commences when the P.D. across the electrodes equals 165 to 170 V.

3. The sudden rush of current when the discharge commences and the consequent "IR" voltage drop in the stabilising resistance causes the actual P.D. across the electrodes to drop below the "striking" value.

4. The discharge then shows a slightly positive characteristic;

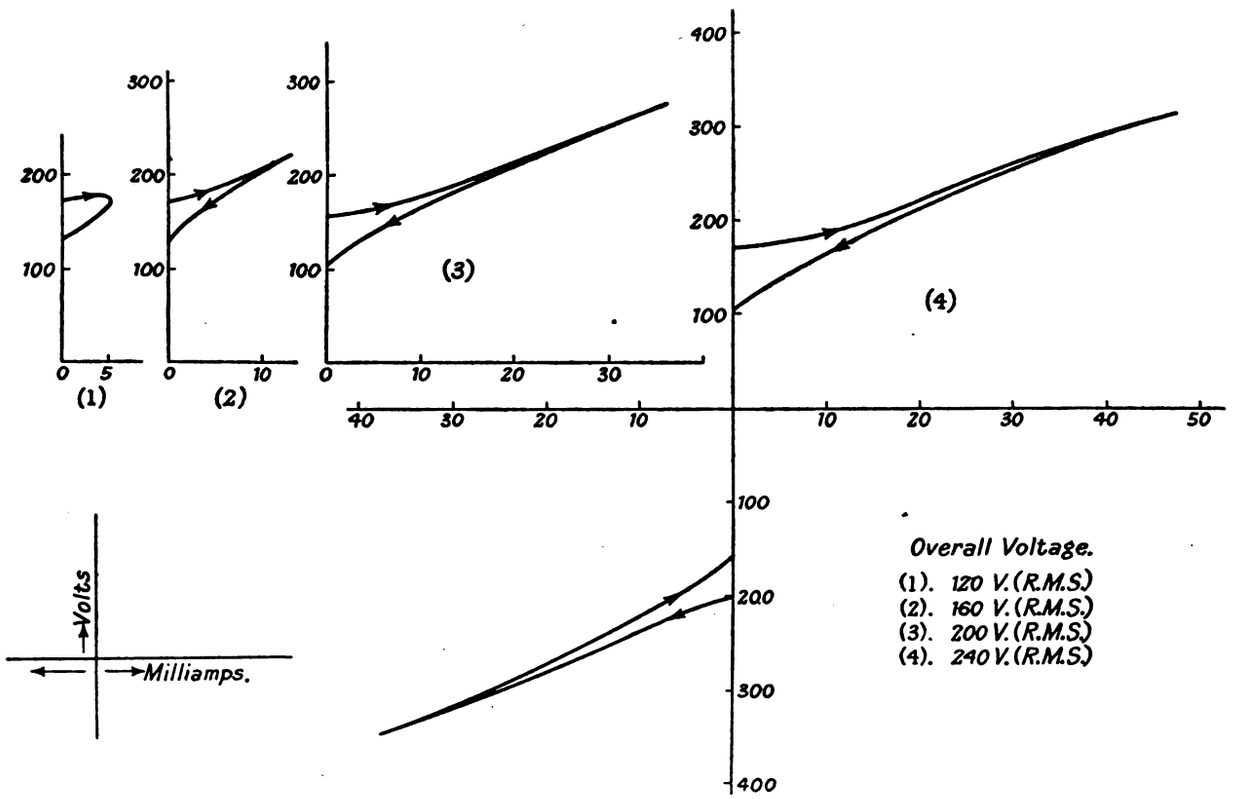

FIG. 3.

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i.e., a small increase in voltage effects a small increase in the discharge current.

5. The discharge finishes at a lower voltage than the striking voltage (i.e., about 130 V), and the current wave is less steep at the end than at the beginning of the discharge. This characteristic is more marked on the small current waves than on the larger ones.

Fig. 3 shows the dynamic characteristics at 50 ~ obtained from the oscillograms, and exhibits clearly the characteristic stated above. The percentage of the total cyclic time during which current flows increases as the voltage is increased, from about 27 per cent. at 120 V (R.M.S.) to about 70 per cent. at 240 V (R.M.S.). The " flicker " is

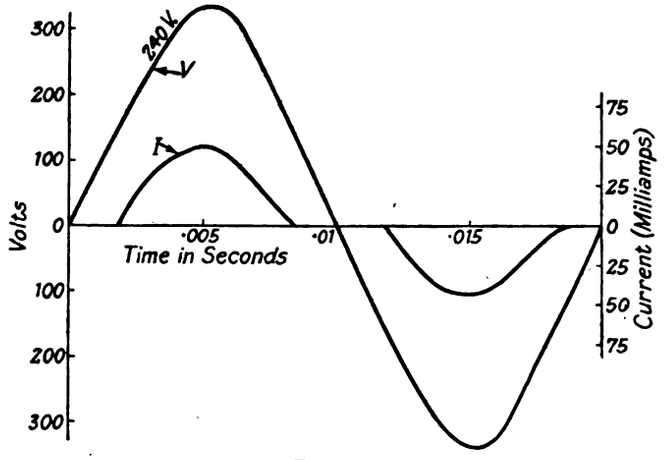

FIG. 4.

therefore very clearly marked on low voltages, making it highly suitable for stroboscopic work, especially as the glow does not apparently persist after the current has ended.

Effect of Electrodes.

It is interesting to note that the two halves of the current wave are not identical (Fig. 4) ; the maximum value of the current for the larger half-wave being about 25 per cent. greater than the maximum value for the smaller half-wave. This lack of symmetry in the wave forms is due to the difference in size and construction of the two electrodes. In each case, however, for the various voltages on which the lamp was tested, the corresponding values of the currents during the cycle bear the same ratio to each other. It has, therefore been considered necessary to show only one

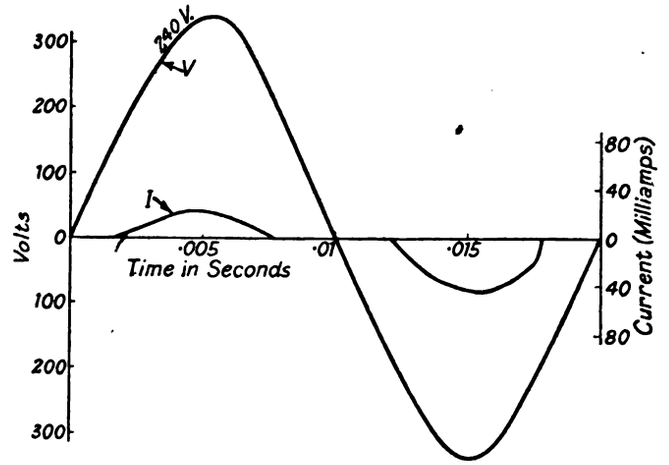

FIG. 5.

complete wave for the lamp (Fig. 4), diagrams 1 and 2 showing the larger current half-wave in each case.

The " Osglim " lamp, which has a large difference in the size and shape of its electrodes exhibits far wider variations in the shape and size of the current half-wave (Fig. 5). The maximum value of the current during one half-wave is twice the maximum value of the other half-wave, whilst the forms of the two waves are different.

Cyclic Changes of Resistance and Conductance.

Figs. 6 and 7 show the variation of effective resistance and conductance during one half-cycle (0·01 seconds). The instantaneous values of the effective resistance and conductance were obtained from the ratios of instantaneous voltage and current in the oscillograms (Figs. 1 and 2).

The use of the stabilising resistance is seen from these curves (Figs. 6 and 7) ; for without it, the maximum

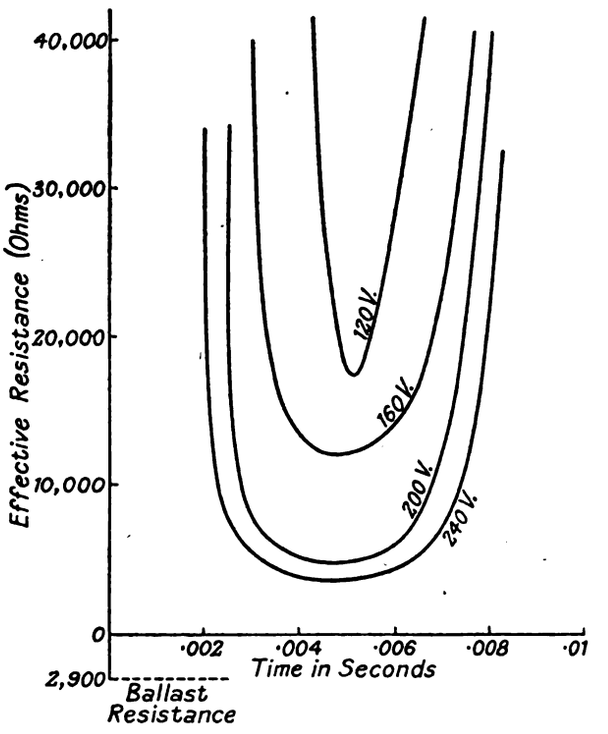

FIG. 6.

conductance increases rapidly as the terminal voltage is increased, giving rise to excessive currents through the lamp.

Energy and Power Factor Measurements.

Fig. 8 shows various curves relating to the electrical properties of the lamp plotted against terminal voltage. The curves were obtained from the following tables in which

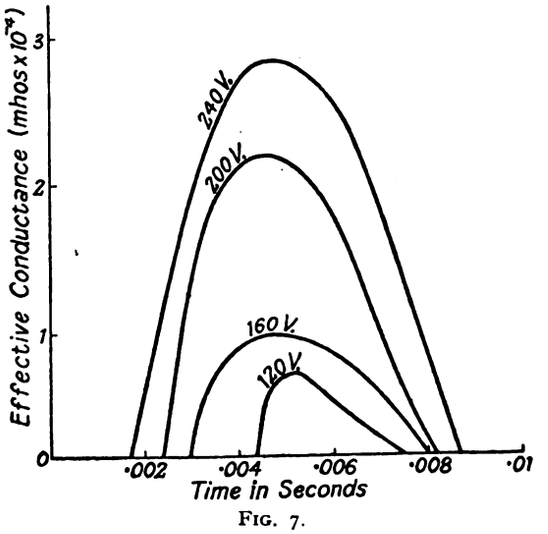

FIG. 7.

the current (R.M.S.) was obtained by means of a Duddell thermo-milliammeter. The power absorbed by the lamp was measured by a Duddell-Mather wattmeter, whilst the power lost in the stabilising resistance was calculated from the values of the resistance and the current measured. The actual voltage (R.M.S.) applied to the electrodes was determined from the voltage wave form in the oscillograms (Figs. 1 and 2), and hence the volt-amperes absorbed by the glow discharge and the power factor of the discharge were calculated.

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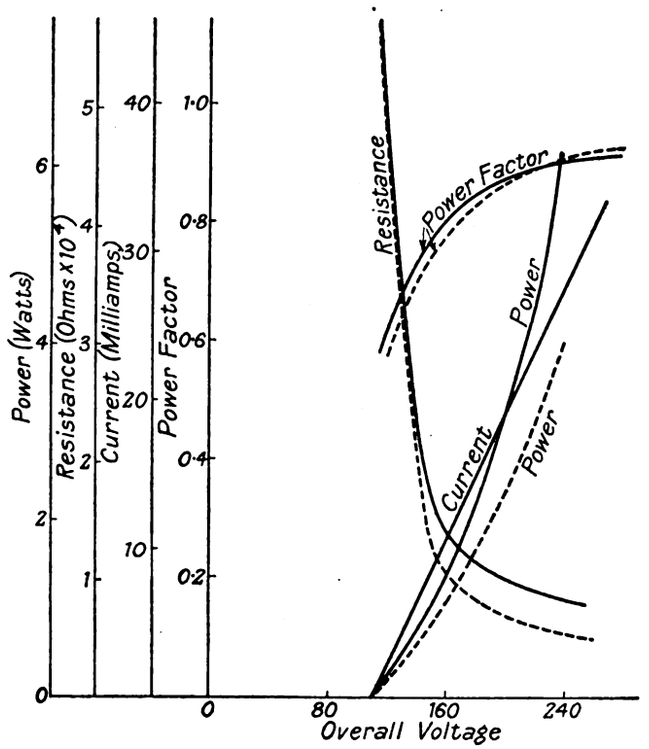

FIG. 8.

TABLE 1.

OVERALL CHARACTERISTICS (*Full Lines*).

Terminal Voltage (R.M.S.)	120	160	200	240
Current (Milliamps, R.M.S.)	2·4	10·65	18·7	27·8
Resistance (Ohms)	50 000	13 700	10 700	8 600
Power absorbed (Watts) ..	0·183	1·41	3·30	6·21
Volt-amperes	0·288	1·71	3·74	6·66
Overall power factor ..	0·625	0·826	0·885	0·93

TABLE 2.

CHARACTERISTICS OF GLOW DISCHARGE (*Dotted Lines*).

Terminal Voltage (R.M.S.)	120	160	200	240
Voltage across Electrodes (R.M.S.)..	117	128	138	152
Current (Milliamps, R.M.S.)	2·4	10·65	18·7	27·8
Effective resistance (Ohms)	49 000	11 000	7 400	5 400
Power absorbed (Watts) ..	0·166	1·08	2·28	3·97
Volt-amperes	0·281	1·37	2·58	4·22
Power factor of discharge	0·592	0·786	0·885	0·94

The power factor curves are interesting. The low power factor at small voltages is due to a large portion of the voltage wave not being used (*i.e.*, when no current flows), and this idle voltage merely increases the volt-amperes compared with the actual watts absorbed.

Further Experiments.

Further suggested experiments on this lamp would be :—

(1) A detailed study of the lamp for stroboscopic purposes at all frequencies, especially with regard to the question as to how long—if at all—the glow persists after the current has ended.

(2) A study of the photometric properties of the lamp i.e., the relation between candle-power and current at various applied voltages.

(3) Experiments to determine the possibility of its use for photographic purposes.

In conclusion we wish to thank the authorities of East London College for the use of the Electrical Engineering Laboratories, and especially Prof. J. T. MacGregor-Morris for the valuable suggestions he has given, and under whose supervision this work has been carried out.

Some Notes on Electric Traction in Bavaria.*

By Prof. B. GLEICHMANN.

Experimental Lines.

The electrified lines in Bavaria are shown in Fig. 1. Electric working began in 1912 on the Mittenwald Railway, Innsbrück-Garmisch-Reutte, power being supplied at 50 kV from the Reutz works near Innsbrück. At the end of 1913, the State power station at Saalach was ready to supply power for operating the Salzburg-Reichenhall-Berchtesgaden line. The Saalach works have two 2 000 kVA railway generators and a 1 700 and a 2 000 kVA three-phase generator for general supply in the south-east corner of Upper Bavaria. The system for the railways adopted was single phase at 16⅔ cycle with an overhead conductor pressure of 15 kV, in conformity with the other German States which adopted electrification. The above lines were regarded as experimental and were intended to provide technical and economical experience in comparison with steam operation before further extensions were made. As coal reached such an unheard-of price at the end of the war, and made the Walchensee and other hydro-electric schemes in Bavaria urgent for general power purposes, the railway administration had to decide definitely whether it would participate from the outset in developing these works which were so well suited for traction needs. The knowledge that national interests demanded the conservation and economical utilisation of coal led to the decision to extend electric traction.

Comparisons Between Available Forms of Energy.

By means of data taken from the pocket-book "Hütte," the author has constructed a diagram to show the amount of energy required with different prime movers to produce one unit of work, and therefrom deduced the comparative efficiencies. Table I. has been drawn up from this diagram. In the case of the locomotives, the unit of work (kWh) is done at the wheel rim ; in the other types of machines at the bus bars of the generating station. The examples in Tables II. and III. show how the figures in Table I. are arrived at. It is seen that the different types of internal combustion engine offer promising fields for development.

TABLE I.

Comparative Efficiencies of Various Prime Movers, etc.

Prime Mover, etc.	Fuel, etc.	Units required per available kWh.	Efficiency in per cent.
Steam locomotive ..	Coal	16·7	6·0
Electric locomotive..	Steam turbine and lignite	15·9	6·3
	Water	3·02	33·1
Water turbine ..	Water	1·81	55·3
Diesel engine ..	Oil	3·48	28·7
Gas turbine	Gas	8·13	12·3
Gas engines	Furnace gas	4·76	21·0
	Coal gas	3·91	25·6
Producer gas engines	Coal	6·66	15·0
	Lignite	7·14	14·0
Steam turbine ..	Peat	9·62	10·4
	Lignite	9·46	10·55
	Coal	9·1	11·0
Steam reciprocating engine	Peat	11·35	8·85
	Lignite	11·1	9·05
	Coal	10·7	9·4

* Based on an article in the festal number of "Elektrotechnische Zeitschrift" issued to commemorate annual meeting of V.D.E. in Munich, 1922.

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TABLE II.
Efficiency of 4-cylinder Compound Steam Locomotive with superheater and feed-water heater.

Loss.	Efficiency in per cent.	Total units required.	Loss in units.
Mechanical and auxiliaries	85·0	$\frac{1}{0.85}=1.18$	1·18−1 =0·18
Thermodynamic ..	64·5	$\frac{1.18}{0.645}=1.83$	1·83−1·18=0·65
Thermal	16·5	$\frac{1.83}{0.165}=11.1$	11·1−1·83=9·27
Fire and boiler ..	66·5	$\frac{11.1}{0.665}=16.7$	16·7−11·1=5·6
Total	6·0	$\frac{1}{6.0}=16.7$	16·7−1 =15·7

TABLE III.
Efficiency of Electric Locomotive supplied from Hydro-electric Generating Station.

Loss.	Efficiency in per cent.	Total units required.	Loss in units.
Driving mechanism..	90·0	$\frac{1}{0.9}=1.1$	1·1 −1·0 =0·1
Locomotive motor and transformer ..	86·4	$\frac{1.1}{0.864}=1.28$	1·28−1·1 =0·18
Overhead conductor	90·0	$\frac{1.28}{0.9}=1.42$	1·42−1·28=0·14
Transformer and transmission line ..	85·5	$\frac{1.42}{0.855}=1.66$	1·66−1·42=0·24
Station transformer, alternator, etc. ..	83·0	$\frac{1.66}{0.83}=2.0$	2·0 −1·66=0·34
Turbine— Mechanical and auxiliaries ..	96·0	$\frac{2.0}{0.96}=2.1$	2·1 −2·0 =0·1
Clearance	97·0	$\frac{2.1}{0.97}=2.17$	2·17−2·1 =0·07
Hydraulic.. ..	85·0	$\frac{2.17}{0.85}=2.55$	2·55−2·17=0·38
Intake, gate, pipe-line, outlet, etc. ..	84·5	$\frac{2.55}{0.845}=3.02$	3·02−2·55=0·47
Total	33·1	$\frac{1}{0.331}=3.02$	3·02−1 =2·02

Working Costs.

Working costs are made up of (1) the amounts for interest, redemption, renewal and maintenance in respect of capital outlay; and (2) the costs for fuel, oil, packing and wages. The curve of costs per kWh for a hydro-electric scheme is a rectangular hyperbola, since the working costs are independent of the output. With a steam station, a considerable expenditure is needed for fuel. As objection might be raised against present-day figures because of the high price of erecting hydro-electric stations and the probability that coal will get cheaper and steam stations will work more efficiently in the future, comparative figures which take these items into account are given. In each case the power produced in hydro-electric stations is shown to be much cheaper than that produced in steam stations.

Sources of Supply.

The first power stations will be at the Walchen Lake (Walchensee) and at Aufkirchen, Eitting, and later Pfrombach on the Middle Isar (Fig. 1). The Walchensee station is well suited for a fluctuating traction load, and also, on account of its storage capacity, for equalising the load with linked stations having no storage—*e.g.*, river stations (Fig. 2). The storage capacity can be reckoned as follows, which shows the units obtainable from the m³ of accumulated water in the Walchen Lake under a head of 195 m :—

$$\text{kWh.}=\frac{1000\times \text{m}^3\times \text{m}\times \eta_{\text{turb.}}\times \eta_{\text{el.}}\times 0.736}{75\times 3600}=\frac{\text{m}^3\times \text{m}}{500}$$

where $\eta_{\text{turb.}}=0.8$ and $\eta_{\text{el.}}=0.92$.

Daily accumulation of 10 m³ per sec. for 16 hours
$=10\times 16\times 3\,600=576\,000$ m³.

Daily variation in water level

$$=\frac{576\,000\ \text{m}^3}{16\,000\,000\text{m}^2}=0.036\ \text{m}=3.6\ \text{cm}.$$

576 000 m³ yield $576\,000\times 195\times 0.002=224\,600$ kWh daily.

224 600 kWh.=74 000 kW for 3 hours' peak load.

Continuous load=16 000 kW; total load=90 000 kW.

1 m³ per sec. of water tapped from the Isar supplies 31 536 000 m³ per annum to the Walchensee and produces $31\,536\,000\times 195\times 0.002=12\,299\,000$ kWh.

In the Walchensee station there will be four 12 000 kW traction generators running at 250 revs. per min.

The stations on the Middle Isar, linked up with the Walchensee station, are also well suited for a railway load. The heads are relatively large (Fig. 3) the inlet canals of good capacity, thus rendering them useful for peak loads. A storage lake of 25 000 000 m³ capacity also makes it possible to increase the day load, and compensates for the reduced flow in winter. On both the Aufkirchen and Eitting stations there will be two 9 000 kW railway generators running at 167 revs. per min., while the Pfrombach station will have two 7 400 kW generators.

The stations will be linked by a 110 kV line, and each transformer station will receive power from two directions.

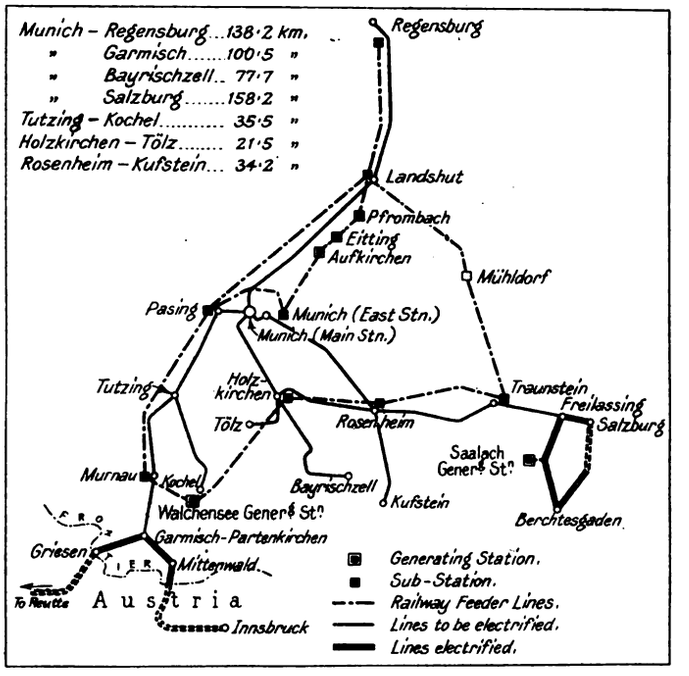

FIG. 1.—ELECTRIFIED RAILWAYS IN BAVARIA.

Though the railways will not have their own exclusive stations, their single phase generators will be separate from those for general supply. This combination brings down the cost of the hydraulic works for the railway electrification. Similar economy is obtained by having common boilers and auxiliaries in steam stations for mixed supply.

Details of System Employed.

The choice of system was settled from the following considerations. As work was commenced in Bavaria on the Bavarian power scheme of Dr. Oscar von Miller, the question was examined anew whether the supply of power for traction should be handed over to these authorities. Three-phase current is less suited to railway work because two overhead conductors are needed, and consequently a rather low pressure is required on account of insulation and structural difficulties. The resulting large number of transformer stations would be an undesirable feature in a 100 kV system. A better solution would be to have an additional 60 kV line traction system supplied from the 100 kV line, but it was desired to avoid a second network.

The alternative suggestion repeatedly put forward to utilise the general three-phase network by using different phases for different sections of a single phase traction system was unacceptable owing to its complexity, etc., quite apart from the harmful effects on the three-phase system of the unbalanced traction load, and that there was no 50-cycle single phase motor for main line work.

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Arguments Against Direct Current.

Apart from other complicated and untried systems, there remained only the system of converting into direct

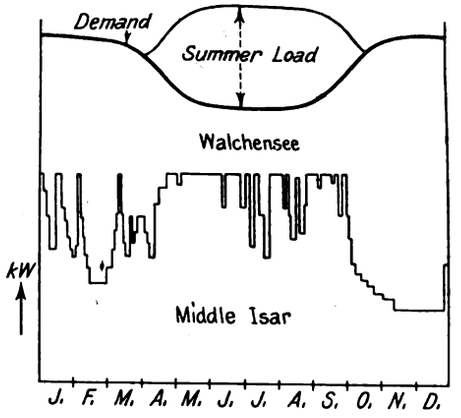

FIG. 2.

current if the railways were to receive their supply from the general 50 cycle network. In competition with this was single phase current at 16⅔ cycles, which also required only one overhead conductor and was suitable for large, variable-speed motors. Furthermore, the single phase current could be generated in the power stations, transmitted over long distances and reduced to the track pressure in transformer stations, and in cases of emergency the supply could be taken from the general three-phase network.

For the same distance between feeding points as with single phase pressure at 15 kV, the direct pressure would have to be 5 300 V (assuming cos $\varphi = 0{\cdot}7$; rail section, 58·1 sq. cm.; overhead conductor, a.c. 95 sq. mm., d.c., 2×95 sq. mm.; a.c. resistance, 0·209 Ω; d.c. resistance, 0·059 Ω; pressure drop in overhead conductor, a.c., 20 per cent., d.c., 30 per cent.). A direct pressure of 5 300 V is neither easy to produce in the converting machines nor easy to utilise on the locomotive. With the 3 000 V direct pressure recommended from America, the ratio of the distance between feeding with a.c. and d.c. would then be: $5\,300^2 : 3\,000^2 = 3{\cdot}1$. Actually it is not possible to make the distance between a.c. feeding points three times as great as with d.c. because of junctions, which it is rational to use as feeding points. The result is that with a.c. the feeding points will be 60 to 80 km. apart, and with d.c. 30 to 40 km. apart. With these distances the d.c. is fully utilised, while the a.c. can take overloads. Also with d.c. traction as with three-phase traction, there would be either an unduly large number of 100 kV sub-stations or a second 60 kV network.

A mainline network of 1 480 km. was investigated for d.c. at 3 000 V and single phase current at 15 000 V. The d.c. needed 44 and the a.c. 18 sub-stations. The excess of material required by the d.c. system, starting from the prime mover, is: 20 000 tons iron = 25 per cent.; 10 000 tons copper = 80 per cent.; 100 tons oil = 11 per cent.; 500 tons porcelain = 25 per cent.

In these figures are included the increased weights of generators and transformers needed for single phase current at 16⅔ cycles.

The annual energy required by the locomotives is 180 000 000 kWh. The efficiency of transmission, including generation loss, is 0·5 for the d.c. system and 0·7 for single phase system. Thus, 100 000 000 more units would have to be generated every year if d.c. were used. For main line work, therefore, the d.c. system requires more material and more energy than the single phase system. Nor does the excess of energy required by the d.c. system equalise the load on the stations—for this to be the case the night load on the railways would have to exceed the day load. Again, the railways can permit much greater variation in pressure and frequency than a general supply can tolerate, so that it is cheaper to transmit separately for the former. Also, if the railways were to draw their supply from the general network a double loop of the high voltage, three-phase system would be required.

Advantages of the Single Phase System.

Single phase at 16⅔ cycles offers many advantages for transmission. Since only two-thirds as many lines and insulators are required, the poles can be 3 m. shorter when the wires are 3 m. apart, and the material necessary for the transmission line is reduced by 30 per cent., while the factor of safety is 50 per cent. higher. For the same amount of material and stress on insulators, inductive and capacity effects are less with 16⅔ cycle single phase than with 50-cycle, three-phase current. Also the ratio of the pressure at receiving end to that at sending end is much nearer unity with the single than with three-phase.

As regards interference with communication circuits, d.c. is much more favourable than a.c. The proximity of communication lines, which sometimes entails their removal to make room for the overhead conductor, etc., forms a continual danger, equally with d.c. as with a.c., owing to the disastrous results which may follow a line breaking during storms or frosty weather. The only certain remedy is to remove the telephone and telegraph lines or to replace them by cables. With d.c. there is further the danger arising from earth currents, and this increases with the current. Though this trouble is overcome with the three-wire system, using the rails as earthed wire, yet this is no remedy when the two-wire system has to be resorted to in large stations, etc.

Weight Problems.

In connection with the locomotives, the a.c. locomotive has the extra weight of the transformer. The total weight

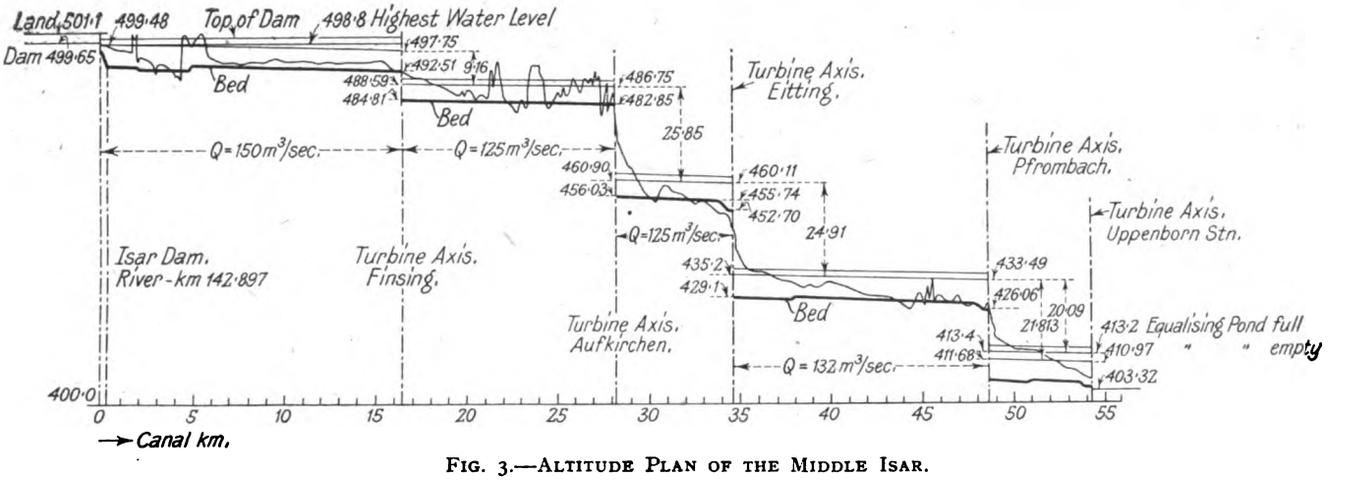

FIG. 3.—ALTITUDE PLAN OF THE MIDDLE ISAR.

can be so distributed, however, that, in addition to the desired number of driving axles, the only pony axles required are for smooth running and negotiating curves. The transformer introduces the advantage, on the other hand, that low-pressure motors and apparatus can be used, while no starting resistances are necessary. With 3 000 V d.c. on the locomotive, the equipment and insulation are not so simple. This may partly account for the fact that the English, Dutch and French railways have not followed the advice of American firms, but have chosen 1 500 instead of 3 000 V, despite the extra sub-stations, copper, and possible need of adopting a third rail instead of an overhead conductor. In Germany the third rail has been excluded on account of its attendant dangers and climatic conditions.

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Heaton Revisited.

Modern Turbo-Alternator Construction and Gear Manufacture.

A recent visit which we were able to pay to the headquarters of the well-known firm of C. A. PARSONS AND CO. showed that in spite of trade depression and all the other factors which go to make up a state of slump, plenty of work was in progress, though not so much we gathered as the firm would like or could deal with. We shall not insult the intelligence of our readers by stating for what the firm is famous, but we may remark that there is no falling off in progress, details are being perfected and workmanship is being maintained at a high level. Besides turbo-generators (now we have let the cat out of the bag) Parsons and Co. are manufacturing surface condensing plant with steam operated ejector air pumps and a separate condensate extraction pump, and a closed system of forced ventilation for turbo-alternators. The turbines are, besides driving generators, being used for a variety of other purposes, notably mill and marine work.

Details of the Works.

The works at Heaton consist of the old shop, which contains the small machine department, where are installed a variety of machines and lathes, the punching department, the gear and lever shop, the works school, where a practical and theoretical training is given to apprentices, and the test house. In the new shop condensers are built in the balcony and turbo-alternators in the various bays, while the blading department requires no further description. In the electrical department stators and rotors are constructed, while in the insulating department a special note may be given to the cable-making machine, which is used for making up the coreless cables for the stator conductors, and the wrapping machine for insulating the stator bars. Other departments are the foundries, rolling mills, and draw benches.

On the occasion of our visit the process of rotor and stator winding was seen in progress, the substantial bracing and heavy clamping of the end turns being particularly noticeable. Air coolers for the closed circuit system of alternator ventilation was also seen in course of manufacture and the machine for cutting the helical gear wheels by the patented creep process was examined.

Alternator Conductor Construction.

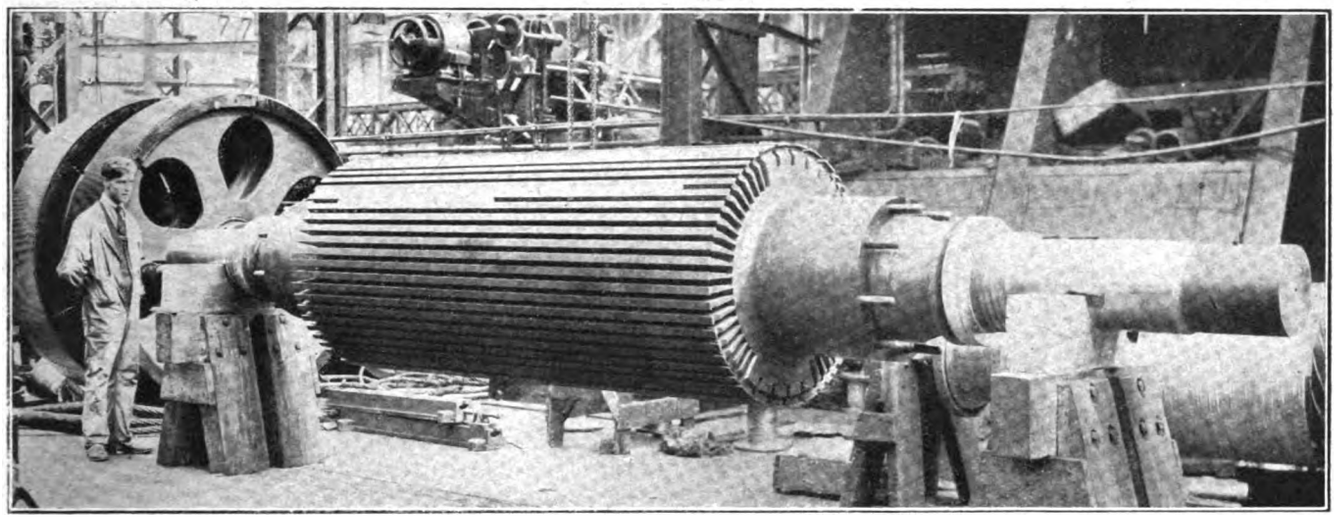
The process of building up and insulating the alternator bars is of particular interest. The bars are built up from single cotton covered wires arranged in layers in the form of a flat cable. The requisite number of layers of the single wires are built up on each other and taped up as a whole, forming a cable of approximately rectangular section. The cable is then inserted in a machine on which the mica insulation is wound on. The mica sheet is passed over a heated table towards the cable (or conductor, as it may now be termed) which is turned over and over by an ingenious arrangement of a continuous band. The winding of the mica insulation is thus a continuous and even process until the requisite thickness is obtained.

Reduction Gearing Manufacture.

The reduction gearing is a most important feature of the output, and lavish care has been taken in its design, which embodies the fruits of long manufacturing experience. The wheels and pinions are of the double helical type, and are cut by the Parsons patented "creep" process, which eliminates mechanical errors and enables the gears to carry heavy loads without noise or wear. Each pinion is carried on three bearings, one at each end and one in the space between the right and left-hand helices, thus giving rigid support.

The Ventilation Problem.

In the past it has been customary to ventilate alternators by forcing through them a continuous stream of cool air, which air had to be filtered to prevent the ventilating ducts in the core and windings from becoming quickly silted up with dust. Both wet and dry filtering systems have been developed for this purpose, but these have many disadvantages, the chief of which are: (1) the length of ducts required, (2) the amount of space required, (3) the necessity for the periodic removal of the accumulated dust, and (4) the danger of free moisture being carried over into the alternator insulation with the wet designs of filters, and the danger due to the inflammable nature of the filtering material in the case of the dry systems.



VIEW OF ROTOR OF 20 000 KW TURBO-ALTERNATOR IN COURSE OF CONSTRUCTION.

The Closed Ventilation System.

To obviate these disadvantages the Parsons closed system of ventilation has been developed. In this system the same air is continually circulated round the alternator, the heated air after leaving the machine being cooled down by passing through a surface cooler, the function of which is to absorb the heat from the air. This system has many advantages over the others. It is compact, because it is generally possible to accommodate the cooler in the alternator foundation block, the only external gear being the fan, and its short connecting ducts. Little or no dirt can collect in the machine. The cooling air does not come into contact with water, but the entering air can be maintained at a temperature below that of the surrounding atmosphere in the engine room. The cooler is similar in design to a motor-car radiator, but is of very substantial construction. The tubes are of copper with gills or fins sweated on to give sufficient surface for rapid absorption of heat. The cast iron water boxes are placed vertically on end so that the water tubes are horizontal. A cooler of this type has been in commercial operation for over two years and although very dirty water has been used, no troubles of any kind have been experienced.

Our illustration shows the rotor of a 20 000 kW turbo-alternator which is being built at Heaton for the South Wales Electrical Power Distribution Company. It is typical of modern construction, and we must express our thanks to Mr. W. A. Chamen for permission to illustrate it.

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The Electricity Commissioners' Report.

Results of Efforts to Re-organise the Industry.

The second annual report of the ELECTRICITY COMMISSIONERS, which has just been issued by the Stationery Office, deals with a variety of subjects. After some prefatory observations authorised and non-statutory undertakings, the reorganisation of electricity supply, special orders, sanction of borrowings, arrangements for mutual assistance, systems of supply, fringe orders, accounts, returns and statistics, experimental work and research and the appointment of electrical inspectors are discussed. Under the heading of "Advisory Duties of the Commissioners," charges for electricity, overhead lines, wayleaves, revocation of powers and private Bills are dealt with. The period covered is from April 1st, 1921, to March 31st, 1922.

Effect of Industrial Depression.

The severe industrial depression which prevailed throughout the year and the uncertainty as to further legislation had a material bearing on development, while the coal strike caused a reduction in the output. The absence of the powers sought in the 1922 Bill adversely affected the preparation of schemes for re-organisation, and imposed restrictions on the progress possible in giving them effect. Nevertheless, the organisation of electricity supply was improved, and the influence upon the welfare of the country when trade revives should be beneficial.

Transfer of Irish Undertakings.

On April 1st, 1921, the total number of authorised undertakers in Great Britain was 532, while on March 31st, 1922, it was 531. During the year the position was modified by the granting of additional electricity supply powers, the acquisition of company undertakings by local authorities, the revocation of a number of electric lighting orders and special Acts, and the transfer to the Governments of Northern and Southern Ireland of the administration of electricity supply in that country.

Non-Statutory Undertakers.

There are a large number of cases where a public supply of electricity is given by undertakings without statutory powers. The majority of these undertakings are small, but there are some of considerable size which have been established mainly for supplying energy in bulk to authorised undertakers or for the purpose of converting waste heat into electrical energy for similar disposal. The Commissioners present at considerable length the arguments for and against the obtaining of statutory powers. An obstacle in the way of such acquirement has been the expense, though this will be much less under the new procedure, and the deciding factor must be the public interest. Non-statutory undertakings are under no obligations to the public, and their consumers have none of the safeguards and rights enjoyed by the consumers of an authorised undertaking.

While private generating stations coming under section 36 of the Act of 1919 would not be affected except that the establishment of a comprehensive distribution system would provide an outlet for surplus supply or for obtaining supplementary supply in the case of a non-statutory undertaking giving a general supply, a joint electricity authority would have power to establish an undertaking in competition with that undertaking.

Progress with Re-organisation.

Some thirteen pages of the report are taken up with the discussion of the important question of the re-organisation of electricity supply. During the year ended March 31st, 1922, the Commissioners provisionally determined two electricity districts in Scotland, making a total of fifteen districts provisionally determined up to that date. In all schemes have been submitted for twelve districts, seven during the year under notice, and twenty-three schemes relating to these districts have been lodged. Fifteen of these schemes provided for the establishment of joint electricity authorities, two for advisory boards, one for an advisory committee, the remainder being mainly concerned with engineering matters. The Commissioners have held local inquiries in respect of six districts, and statements embodying their conclusions on three of these, as well as of two inquiries dealt with in the last report, have been issued.

Less Progress than Anticipated.

The progress made in giving effect to schemes of re-organisation has been slower than was anticipated for several reasons. The Act of 1919 does not confer financial powers upon joint electricity authorities and there were therefore difficulties in proceeding with the issue of draft orders. The Commissioners also found it necessary, with the object of securing uniformity, to give careful consideration to the conditions contained in the various schemes with a view to framing standard clauses for matters likely to be common to the majority of schemes. While the time thus occupied has given the appearance of slow progress, it is considered that the results so far achieved cannot but have a beneficial effect during later stages, and will probably be conducive to more rapid settlement in the case of other districts.

Definite technical progress has been facilitated in all districts where schemes have been investigated at the first inquiry. The information thus provided has been of considerable value in dealing with applications for the extension of stations.

The Determination of Districts.

In making some general observations on schemes and local inquiries, the Commissioners point out that the district as provisionally determined is not settled beyond doubt, and that it is open to the promotors of any scheme to include proposals for altering or adjusting its boundaries. The position of an authority whose area is on the fringe of a district and who may find it advantageous to take supply from a source outside the district has also been discussed. This course would not be precluded if it was proved to the satisfaction of the Commissioners that it would be to the best interests of all concerned.

The Advantages of Unified Control.

While interlinking alone will result in considerable economies in individual cases, greater advantages to the district as a whole must accrue when all the interconnected stations are operated under a unified control. Such a centralised system of generation can be brought about by the transfer to a joint authority of the generating stations and main transmission lines, or by conferring upon some other body powers of control over the working of the stations. The transfer of generating stations to a joint electricity authority must be by agreement and, in the event of the owners of any station not agreeing to this transfer, the alternatives would be the vesting of some stations and the control of others or control only.

The Acid Test of Sincerity.

In the opinion of the Commissioners the first of these would be the most satisfactory and would lead to the maximum economies, provided the transfer can be effected on reasonable terms. Such agreement or the acceptance of a unified system of control will constitute the acid test of the sincerity of co-operation among the authorised undertakers concerned. The success or otherwise of the efforts now being made to bring about re-organisation on a voluntary basis is dependent upon the outcome of such a test.

The Advantages and Disadvantages of Joint Authorities.

While the majority of the schemes submitted to the Commissioners have involved the setting up of joint authorities, three of them have provided for the establishment of advisory boards, and certain questions as to the relative advantages and disadvantages of joint electricity authorities have therefore arisen. It has been assumed that a joint electricity authority can be set up against the wishes of the majority of the existing undertakers in a district and would, therefore, have no customers for a considerable time. But co-operation is essential for the establishment of a joint authority, and that body must be representative of the various undertakers in the district. The lines on which re-organisation of supply will proceed will probably be as follows: Generation and main transmission will be centralised under the joint authority, new stations will be constructed as necessary to compensate for the shutting down of obsolete or inefficient stations and to meet new demands. Local distribution and commercial development would remain in the hands of the authorised distributors, and the latter will therefore constitute the principal customers of the authority. The Act of 1919 lays down the duties of a joint authority, and the Commissioners have, therefore, been unable to accede to suggestions that

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certain important powers specifically issued with these bodies should be handed over to other bodies.

The Expense of Preparing Schemes.

Comments have sometimes been made regarding the expense of preparing schemes and holding local inquiries, but it is obvious that these are essential preliminaries to any re-organisation. The inquiries constitute part of the statutory procedure set down for bringing into effect a new and improved organisation. Having regard to the importance and complexity of the problems at issue, the expenses are, in the opinion of the Commissioners, relatively small compared with the economies thereby ascertained to be possible.

Probable Future Progress.

The plant capacity of the stations and extensions sanctioned during the year amounted to approximately 174 000 kW, as compared with 697 000 kW for the preceding fourteen months ending March 31st, 1921. While this diminution was only to have been expected in the circumstances prevailing, the detailed investigations made by the promoters of the schemes point to a period of great development upon the resumption of more normal conditions. For instance, in eight of the provisionally determined districts the aggregate maximum demand in 1920–21 was 833 226 kW, while in 1926 it is estimated to be 1 542 435 kW, and in 1931, 2 207 890 kW. The output for the same district in 1920–21 was 1 923 million kWh, and this is estimated to increase to 3 799 million kWh in 1926, and to 5 624 million kWh in 1931. These figures indicate an estimated increase by 1926 of 709 929 kW, or 85 per cent. in the maximum demand, and of 1 876 million kWh or 97 per cent. in the output. By the year 1931 the figures as compared with 1920–21 are estimated to show increases of 1 374 664 kW or 165 per cent. in the maximum demand, and 3 701 million kWh or 192 per cent. in the output.

Statistics—Some Criticisms.

An indication was given in the previous report of the steps that had been taken by the Commissioners to compile statistics covering the various aspects of electricity supply. In consideration of representations it was decided to compile certain of the less variable particulars from official records and to confine the *questionnaire* to those engineering and financial particulars which are subject to annual variation. It is a matter of regret that greater progress was not possible during the year under review. A number of undertakings unduly delayed the return of the *questionnaire*, and in many cases there was a lack of appreciation of the necessity for accurate statistics. A preliminary examination revealed a large number of omissions and arithmetical and other errors, and it was obvious that much time would have to be devoted to the completion and verification of the returns. A more satisfactory position has to be recorded in connection with the four weekly returns of fuel consumption, units generated, etc. These returns constitute the most up-to-date information concerning the output and working of the undertakings concerned, and the promptness and regularity with which they have been submitted is a matter of considerable satisfaction to the Commissioners.

During the year the Commissioners received returns relating to 433 generating stations belonging to authorised undertakers, and in addition voluntary returns from 103 generating stations owned by tramways and railway authorities or non-statutory undertakings. From them it appears that in the year ending March 31st, 1921, the number of units generated in 536 stations was 4 884 666 038, and that 6 475 531 tons of coal and coke and 145 541 tons of oil fuel were consumed.

Progressive Increase in Work.

Finally, it is pointed out that the work of the Commissioners has shown progressive increase in volume during the year under review, and that this work has been undertaken without augmenting the staff of the Commission, which now numbers forty-two. As regards expenses, the estimated expenditure over the estimated receipts amounted to £44 000. The actual excess of expenditure over income was £36 509, or a saving of £7 491 on the estimate. As from April 1st, 1922, the expenses of the Commissioners will fall directly upon the Electricity Supply industry, and as the advances made by the Treasury during the two preceding years, together with interest, will have to be repaid by annual instalments during the next three years, the first three apportionments will be of an abnormal character, and under the Electricity Supply Act of 1922 will be based on the number of units sold by each undertaking.

The Electrician "All-Electric" House.

Conditions of the Competition

1. Competitors are required to obtain from the Editor of THE ELECTRICIAN plans and elevations of the house illustrated on pp. 12 and 13 of this issue, and to submit suggestions for wiring the house so that electricity may be used for domestic purposes in it to the greatest possible extent. The house is assumed to be in Hackney. The plans and elevations should be re-drawn to a ¼ in. = 1 ft. scale on tracing cloth in black ink.

2. Competitors must give the following information :—

(*a*) A specification of the materials to be used and the method of fixing.

(*b*) A schedule of all points, controls, fittings and apparatus to be erected.

(*c*) A priced bill of quantities.

(*d*) Plans showing the runs and sizes of all conductors and the position of all materials installed.

(*e*) Wiring diagrams (if necessary) of any work or connections that cannot be clearly indicated on the wiring plans.

(*f*) A brief description not exceeding 1 500 words of the methods proposed to be employed, with reasons.

(*g*) A letter to a prospective client, quoting for the job and describing concisely what is offered in non-technical language.

3. While technical correctness will be the first essential, the judges will take into account literary and artistic presentation in the competitors' work. Financial soundness will also be a very important consideration.

4. Drawings, specifications and typescripts must bear in the top right hand corner a pseudonym by which the competitor wishes to be known and must be accompanied by a sealed envelope bearing on the outside the pseudonym and on the inside the full name and address of the competitor, and a certificate (see para. 10.)

5. The typescripts, drawings and pseudonym envelope must be sent by registered post to the Editor, THE ELECTRICIAN, 8, Bouverie Street, London, E.C.4, and must reach him not later than first post on Thursday, March 29th, 1923.

6. Typescripts, etc., bearing the pseudonyms will be sent to the judges, but the names and addresses of competitors will not be disclosed to them until the awards have been made.

7. The names and addresses of the successful competitors will be published in THE ELECTRICIAN as soon as possible after the close of the competition.

8. The following prizes will be given : First, 25 guineas ; Second, 15 guineas ; Third, £5.

9. The Editor of THE ELECTRICIAN will act *ex officio* as judge, and his decision on all matters relating to the competition is final. He can enter into no correspondence on the competitions.

10. Competitors will be required to submit with their typescripts, etc., a certificate agreeing to abide by the conditions of the competition.

11. The proprietors of THE ELECTRICIAN will not be responsible for the loss of or damage to any typescripts or drawings. Every care of the matter submitted will, however, be taken.

12. Competitors must take their own steps to protect any patentable suggestions in the plans or essays sent in. The Editor reserves the right to publish any matter he receives, and will not be responsible if protective steps have not been taken before publication occurs. Solutions other than those of the prize winners, if published, will be paid for at £2 2s. each.

13. The Editor will not be responsible for any opinions which may be expressed about apparatus, methods, or systems by the competitors.

Anglo-American Unity.

The following Christmas and New Year greeting has just been received from the influential party of American trade journalists who visited this country in 1918 (arriving just in time to join in the Armistice celebrations) and who since their return have been working steadily to promote closer intercourse between the two nations :—"A message of goodwill and holiday greetings to our British brothers, pledging anew our devotion to English-speaking unity and friendship as a beneficent and powerful influence for world-wide peace and prosperity." This message is signed by a number of leading American publishers and journalists.

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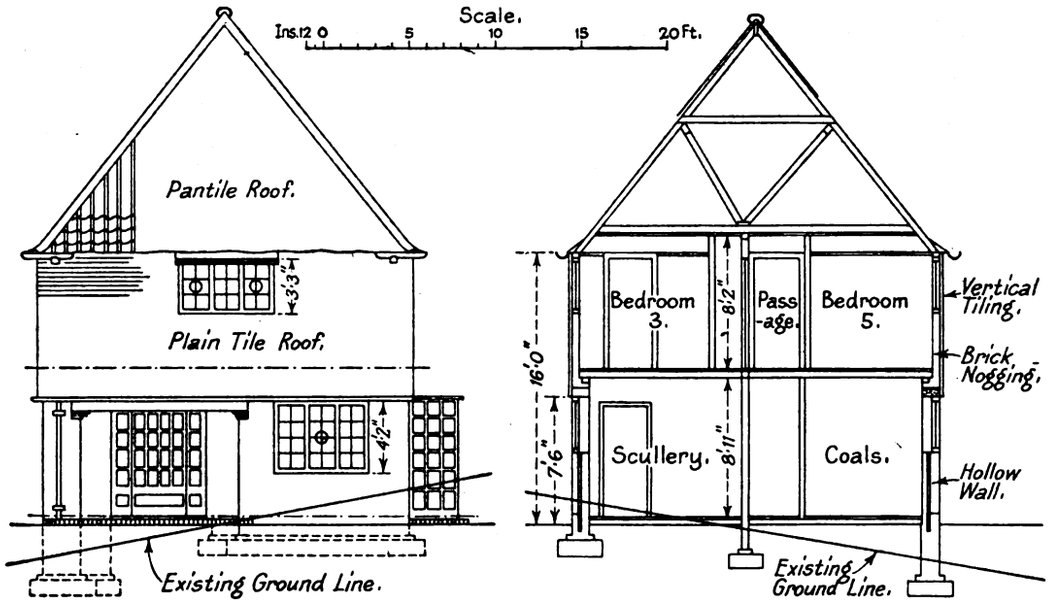
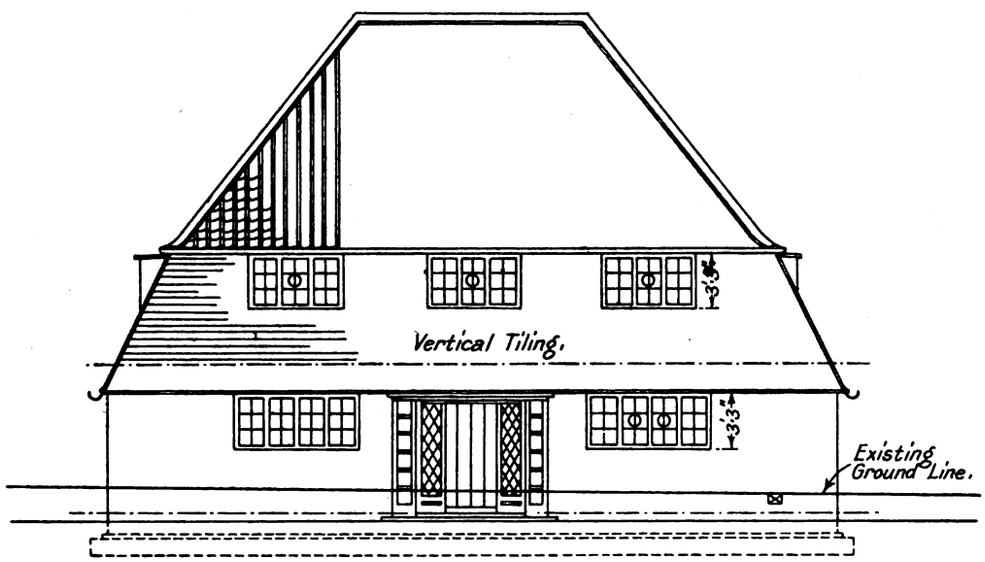
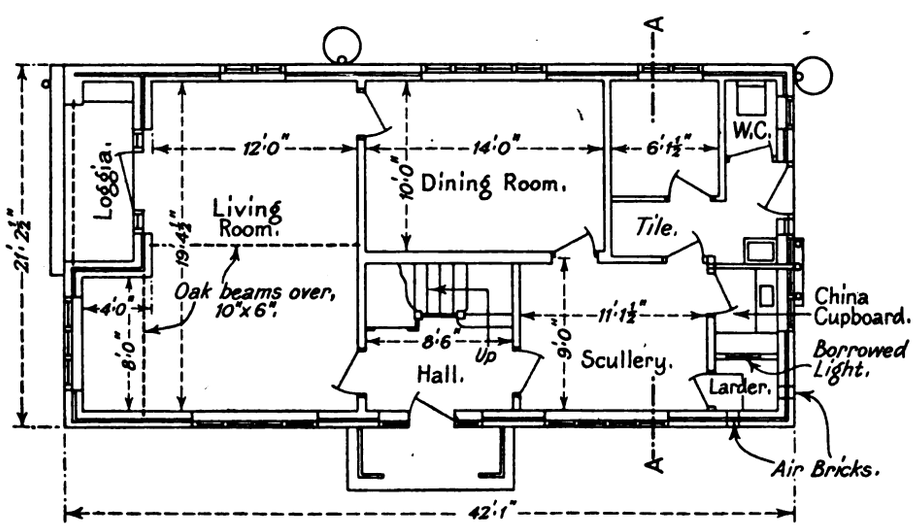


SOUTH ELEVATION. SECTION A-A.



EAST ELEVATION.



GROUND FLOOR.

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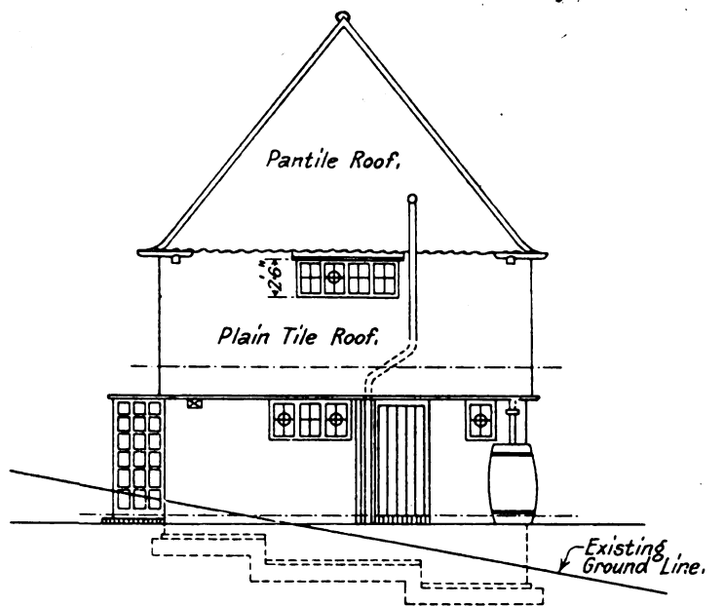
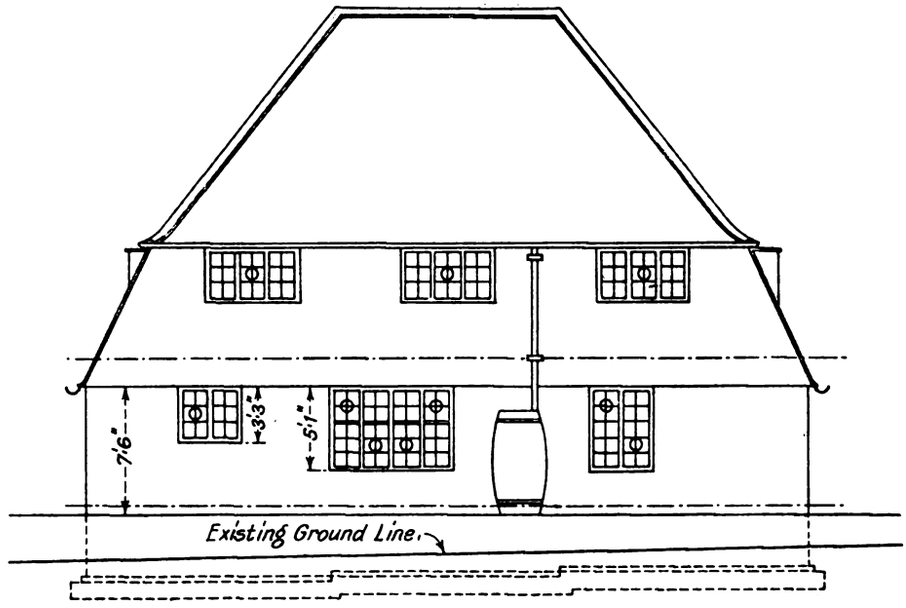
OUR ALL-ELECTRIC HOUSE.

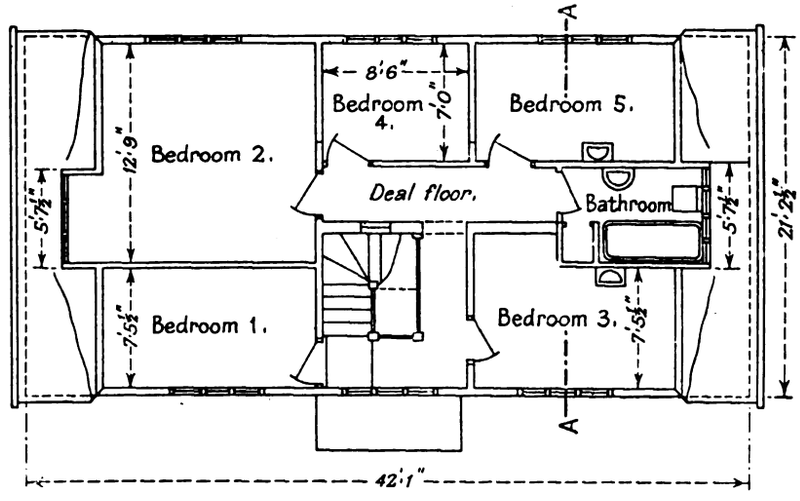
Complete Elevations and Plans for the Use of Competitors.



NORTH ELEVATION.



WEST ELEVATION.



FIRST FLOOR.

Architects:
Messrs. G. Blair Imrie and T. G. Angell.

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Correspondence.

RECENT ELECTRICAL DEVELOPMENTS AT WALSALL.

To the Editor of THE ELECTRICIAN.

SIR,—The article on page 716 of your issue of THE ELECTRICIAN of December 22nd, in connection with recent electrical developments at Wallsall, is of particular interest.

On close analysis the figures obtained on the tests must certainly be admitted to be exceptionally good for such sized plant, and the interesting method adopted for obtaining the required circulating water must in itself be unique in this country.

I was, however, surprised to note that the thermal efficiencies of the station were so high, and after looking into the figures given it became evident that these efficiencies were based on the units generated. If this is so, I suggest that it is not true to refer to these figures as " thermal efficiencies," for it is obvious that they are not based upon the complete cycle of the plant, as no deduction has apparently been made from the units generated for the units used in driving the essential auxiliaries of the plant. In other words, the thermal efficiency should have been based on the units sent out.

My object in raising this matter is to point out that the figures given as thermal efficiencies cannot be considered comparative, owing to these facts.—I am, etc.,

W. N. C. CLINCH.

London, N.,
December 29th.

POWER TRANSFORMER FOR 60 000 VOLTS.

To the Editor of THE ELECTRICIAN.

SIR,—Will any of your readers kindly inform me if a power transformer, to operate at or above 66 000 volts across the transformer phase-winding, has, up to the present date, been manufactured in this country ?—I am, etc.,

WILLIAM T. TAYLOR.

London, N.10,
December 22nd, 1922.

UNEMPLOYMENT.

To the Editor of THE ELECTRICIAN.

SIR,—As an admirer of the excellence of THE ELECTRICIAN and the broad-minded opinions expressed in the various leading articles, I wish you and all members of your staff a Happy and Prosperous New Year.

In THE ELECTRICIAN of December 8th last you devoted a full page to the subject of unemployment. This, of course, was nothing new, but the idea of dealing with it was original and what is more, you struck an entirely new note. You mentioned the word customers. This is the key to the solution, as without customers we may as well shut up shop.

It is a well-known fact that this country is largely dependent upon its export trade and, therefore, we must have lost many of the markets abroad. Why we have lost them does not matter. Our principal concern is how shall we regain them ? No good will come by making excuses and blaming the war. It is of no use sitting tight and waiting for work to come to us. It will not do that. If that were the case I should not be in my present unfortunate position, and I should be richer by the amount I have spent in postage and stationery, making unsuccessful applications. We may wait twenty years and still be in precisely the same position, perhaps worse.

You will remember that in August, 1914, we had a " contemptible little army." What did we do ? Are we not able to do the same again under different conditions, and where there will be no bloodshed ? Put an army in the commercial field and retrieve our lost laurels. It is encouraging to read that a few members in the new Parliament realise that there are excellent opportunities in South America, and have banded themselves together to safeguard our interests there.

It would not be a bad plan to adopt the policy of Mr. Bonar Law and give a chance to men with second-class brains. Surely they could do no worse than some of the present leaders of industry have done already. But whatever we decide to do must be done now. We must organise our whole resources and strike hard and the future will have no terrors. The year 1923 must not be a repetition of its predecessor.

Perhaps you will think I am pulling the strings, and you will be quite right. I am one of those keen, ambitious young men, still under 30 years of age, and am longing for action. I do not profess to be a highly trained technical engineer. I should never be a designer were I to live a thousand years, but I have made a study of business and am not lacking in foresight. In other words, I belong to the " second-class " order. As an ex-service man I have always endeavoured to patronise everything British and it is demoralising to know that the present state of affairs exists.

I would very much like to make known my name and address, but it might prejudice my chances of employment, so I enclose it on a separate sheet of paper, and prefer to sign myself

ORGANISER.

THE LITTLE WINDOW.

To the Editor of THE ELECTRICIAN.

SIR,—My question to Mr. Wallace Attwood at his first E.D.A. Salesmanship Lecture as to how he would sell through a foot-square window appears to have created considerable interest. In the discussion at the third lecture, I noticed that Mr. E. E. Sharp considered Mr. Attwood's reply to my query as incomplete. May I now through your valuable columns and on behalf of many hundreds of electrical salesmen carry the matter a stage further ?

The E.D.A. Conferences will help to make a better salesman, but are they to be without their influence on the buyer ? Of what use will be our white collars, shaved faces, clean nails, smart clothes, polished boots and engaging smiles if that little window is still to intervene ?

The inquiry window is legitimate enough, but the buyer need not flatter the salesman to the extent of conducting interviews through it. With many large firms the little window has given place to the open counter and waiting room, but this embarrassing device is still all too common in the electrical industry. I hope it may soon be piled on that scrap heap of barriers which the E.D.A. conferences have already broken down.

Away with that little window !—I am, etc.,

W. E. WARRILOW.

London, W.C.
January 1st.

Will " Inquirer," who has sent us a letter on " Heartbreak Villa," please forward his name and address for our information.

Industrial Lighting by Electricity.

How Dr. Frank Crane Might Help.

In an address on " Industrial Illumination by Electrical Energy," recently delivered by Mr. George Herbert before the ELECTRICAL SOCIETY OF GLASGOW, the author explained the nature of correct industrial lighting. The costs and benefits of good illumination, and technical considerations such as the choice of reflectors and the avoidance of glare were also dealt with. A summary was given of the reports of the Home Office Departmental Committee on Lighting in Factories and Workshops. Mr. Herbert, as a member of the Illuminating Engineering Society, is familiar with developments in industrial lighting, and is doing good work in dealing with this important subject in various provincial cities. There is room for more work of this kind in the manufacturing centres where industrial lighting is of primary importance. We notice that the address was prefaced by a quotation from George Herbert the poet (a namesake of the lecturer), whose advice, " Be Useful," is followed by all good electrical engineers. Quotations of this kind are somewhat unusual in technical addresses, but we see no reason why they should not be introduced where appropriate. In fact, engineers engaged in propaganda work might more often with advantage lighten the dry facts they present by a little of the philosophy of, say Dr. Frank Crane.

We have received a copy of a recent special number of the " Illustrierte Elektro Woche," of Berlin, which contains a series of articles on TELEGRAPHY AND TELEPHONY IN GERMANY. The subjects dealt with include a history of telegraphy in Germany, a description of the German post office exhibits at the Munich Industrial Exhibition, telegraph woodpoles, porcelain insulators, the development of modern telegraphy and of various telegraph systems, including the Siemens and the Huth-Johnsen-Rahbek high speed instruments, telephony and long distance telephone cables, radio telegraphy and radio telephony, railway signalling, fire alarms, and other matters. The articles, which are well illustrated, are contributed by experts and the whole give a good idea of the present position of telegraphy and telephony in Germany.

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East Midlands Electricity District.

Details of the Reconstruction Scheme.

The scheme constituting the East Midlands Electricity District into which, as we announced last week, the Commissioners will hold an inquiry on January 23rd, provides for the establishment of an advisory committee of twenty-seven members, three of whom will be appointed by Leicester, three by Nottingham, three by Derby, two by Burton-on-Trent, one by Loughborough, one by Mansfield, one by Newark, and one by Long Eaton. The Derbyshire and Nottinghamshire Electric Power Co. will be entitled to three members and the Leicestershire and Warwickshire Electric Power Co. to two members. The Derbyshire, Leicestershire and Nottinghamshire County Councils will each be entitled to one member, as will each of the railway groups operating in the district, while consumers taking more than 200 000 kWh per annum will be entitled to elect two members. Provision is made for the appropriate officials of the local authority or company to attend the meetings of the Committee, and permission is sought to establish an Engineering Advisory Sub-Committee consisting of the engineering representative of both local authorities and companies.

The Technical Scheme.

The technical scheme provides for the generation of three-phase alternating current at a frequency of 50 cycles. The main transmission pressure will be 33 000 V and the secondary transmission pressures 11 000 V and 6 600 V. The main transmission lines will be partly overhead and partly underground, and their construction will be dependent upon the development of the load and the advisability of substituting bulk supply for local generation. Transformers and switchgear in connection with the main transmission lines will be accommodated as far as possible in existing power stations. The generating stations existing or under construction at the following places will continue to be utilised: Nottingham (North Wilford), Leicester (Central), Derby, Burton and Spondon, while a new generating station will possibly be erected at Newark.

Powers of Committee Limited.

It is laid down that nothing in the scheme shall constitute the Committee a joint electricity authority or authorise them to construct or acquire any generating station, main transmission lines or other works or to supply electrical energy, but within two years they shall submit proposals for securing the supply of electricity in any area not forming part of the area of supply of any authorised distributor in which there is a demand for supply, and shall investigate matters connected with the improvement and development of the supply of electricity in the district. The constituent authorities of the Committee must submit details of alterations affecting the plant capacity of generating stations, of the construction of new generating stations and of the extension or alteration of main transmission lines for approval of the Committee.

General Powers of Control.

The Committee may make recommendations as to the running hours of generating stations so as to effect the maximum economy in the production of electricity, and make recommendations as to the principles which should govern the charges to be made for reciprocal, stand-by and bulk supplies.

Tidal Power.

French Project at Finistere.

In a Paris message dated December 30th, Reuter states that the French Chamber has passed without discussion a Bill for the erection of an experimental tidal electric-power station at Aber-Wrach (Finistere). It is proposed to build a barrage of 150 m. across the estuary, the top of which will be level with the land at either end and 4 m. above the spring tides highwater mark.

The barrage is to be constructed of hollow reinforced concrete blocks. The centre block will be 35 m. long and 22 m. broad, and will contain the turbines and alternators; on the right hand side of the barrage a lock will be constructed to allow the fishing craft to pass. It is thought that, according to the height of the tide, the barrage will retain from 2 000 000 to 3 000 000 cub. m. of water. The turbines will work on difference in level between the water inside and outside the barrage, and will act whether the tide is flowing or ebbing, except for a short time when the water is nearly the same height on both sides. A difference of 70 cub. m. or so (it is stated) is all that is necessary to set them in motion.

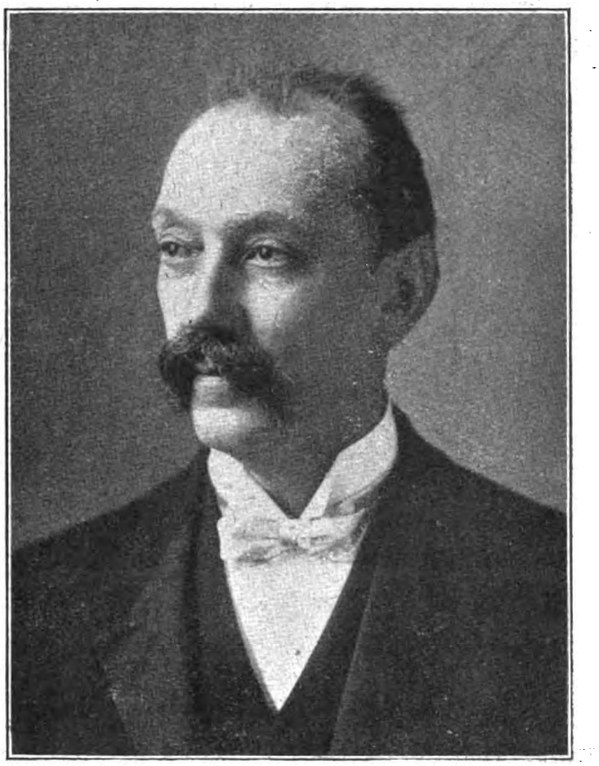
Four turbines will be used, and the two alternators attached to them will furnish a current at 1 500 V. Owing to the fact that the turbines will each furnish from 75 to 1 200 H.P., according to the state of the tide, it has been necessary to evolve some scheme for making the power obtained less irregular. It is proposed to build across the river Diouris, above tide level, a dam which will store 12 000 000 c. m. of river water, and which, even at high water will give the river a fall of 8 m., and at low water a fall of 29 m.

It is estimated that a maximum of 4 800 H.P. will be furnished by the installation and the regular production will be 1 600 H.P. It is hoped that the annual output of the power-station will be 11 million kW. The expenditure will probably amount to 20 million francs.

The Late Sir John Gavey.

A Pioneer in Telegraph and Telephone Work.

We regret to announce the death of Sir JOHN GAVEY, C.B., which occurred at The Croft, Hampton Wick, on New Year's Day. He was 80 years of age, and began his career with the former Electric and International Telegraph Co. in 1860. Ten years later, when the telegraphs were transferred to the State, he was appointed Superintendent of the South-Eastern, and subsequently of the Great Western Sub-Division of the Southern Division of England. In 1878 he became Superintending Engineer of the South Wales district of telegraphs. In 1892 he was appointed chief technical officer at the G.P.O., London, becoming second assistant engineer-in-chief in 1897, assistant engineer-in-chief and electrician in 1899, and engineer-in-chief three years later. From this post he retired in 1907, but was retained as consulting engineer from 1908 to 1913.



[Photo by Elliott & Fry

THE LATE SIR JOHN GAVEY, C.B.

Sir John Gavey was closely associated with most of the important developments of the telegraph and telephone service of the Post Office. Experiments made by him resulted in the speed of Wheatstone signalling being greatly increased. When the telephone was introduced, he at once devoted himself to this new development and had much to do with the erection of the first trunk telephone line connecting exchanges in two separate British post towns (Cardiff and Newport). He subsequently did much experimental work in wireless telegraphy, and in 1899 was successful in obtaining articulate speech between two parallel lines on opposite sides of Loch Ness. When the Post Office acquired the trunk telephone system, he valued the trunk lines to be acquired from the National Telephone Co., later organising and developing the system. He visited various foreign countries to inquire into the telephone systems in use, and eventually supervised the system of construction of the Post Office system of telephone exchanges in the metropolitan district. As official delegate, he attended many international conferences. He read numerous papers before the Institution of Electrical Engineers, being president in 1905-6. At the time of his death he was one of the trustees.

The funeral service is being held to-day (Friday) at St. John's Church, Hampton Wick, at 11 a.m., followed by the interment at Teddington Cemetery.

Insurance by Industries.

A committee of the General Council of the Trades Union Congress has been appointed to examine the conditions of unemployment in relation to the recent circular issued by the Ministry of Labour on insurance by industries. The executive committee of the Shop Assistants' Union consider that if the distributive and commercial employées were insured as a separate service it would, on account of the low average of unemployment, be possible to get the same benefit for a lesser contribution than would be required in most other industries.

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Merchandise to Sell and Profit By.

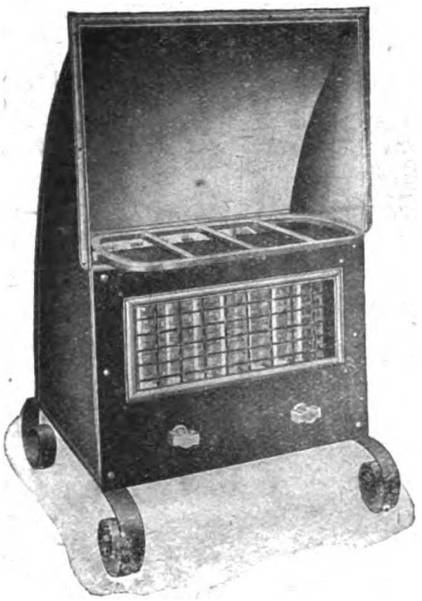
In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

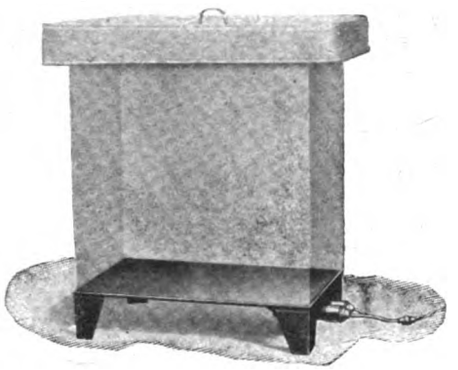
A Cheery Fire.

The new No. 572 "Cheery" Fire, recently placed upon the market by the JACKSON ELECTRIC STOVE CO., will catch on with the public, and contractors and retailers must order stocks now. Utility is the pre-dominant feature which will make this fire sell, and the list price of £5 14s. will be another factor to compel buyers.



Hotplate for Photographic Developing Tank.

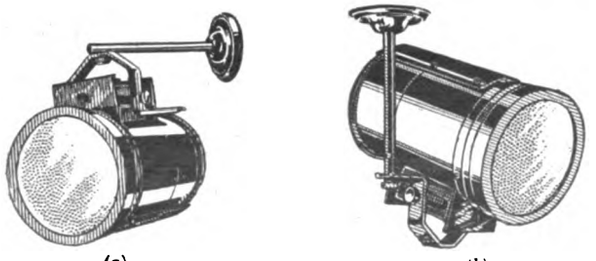
The possibilities of the market created by the needs of photographers (both amateur and professional) are not realised. This is probably due to the fact that the electrical retailer has never before been offered such a compelling range of devices as shown in this season's catalogue of "Heatrae" Home Comforts. The illustration shows a hotplate designed for use with a standard developing tank, and is but one of the several service novelties with which to make an appeal to this market. The plate is rated for 600 W, and is listed at 22s. 6d. It is made by ELECTRIC FIRES, LTD.



HOTPLATE FOR DEVELOPING TANK.

The Latest in Shop Window Lighting.

The BRITISH THOMSON-HOUSTON CO. have advanced a stage further in the art of shop-window lighting by placing on the market a new spotlight, made very strictly to the minimum in dimensions. The projector is only 7 in. long, and 6 in. high, and can be fixed to floor, wall, or ceiling. A simple form of attachment for a colour screen is provided. The increasing anxiety of every shopkeeper to eclipse his neighbour in window lighting means a profitable harvest to the contractor who demonstrates this new B.T.H. spotlight. Full particulars can be obtained from any local office of the B.T.H.

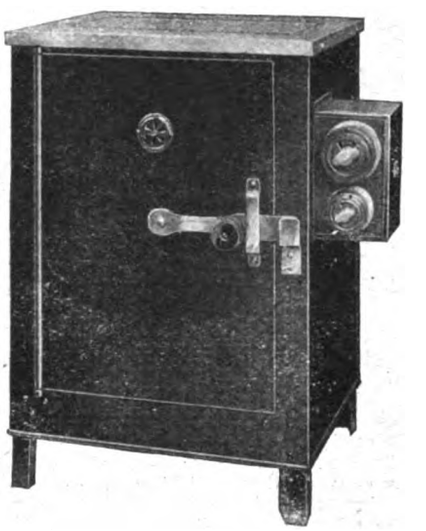


(*a*) (*b*)

B.T.H. SPOTLIGHT PROJECTORS—(*a*) FIXED TO WALL; (*b*) FIXED TO CEILING.

An Electric "General" Servant.

Another addition to the "Magnet" cooker family is a serious question for the contractor and supply companies, because the price and design of a "Magnet" appliance is such that the demand comes of itself. Where business is lost is where no stock is on hand. The new cooker is dealt with in Catalogue H. 5760, and has been designed to meet the demand for an inexpensive range for use in medium-sized houses where the number in the family is anything between six to eight persons. Taking into consideration the list price is only £9, the GENERAL ELECTRIC CO. have put out a line which will sell well. Among the many technical and mechanical features which can be obtained from a study of Leaflet H. 2867 is the fact that the maximum loading of the oven is 2 700 W, variable in steps down to a minimum of 300 W.



THE LATEST G.E.C. COOKER.

Getting Rid of the Counterweight.

The accompanying illustration is of a cord absorber designed by STURGE AND BAKER to take the place of one of the primeval devices which persist in lighting installation work—to wit, the counterweight. The need for an adjustable light must be filled, and the most satisfactory alternative is the cord absorber made on the Sturge's patent. It is accepted too readily that the hackneyed counterweight is the cheapest method of installing a drop pendant. Against the initial cost of the counterweight, however, one has to debit the cost of loading shot and wiring, and the labour which the installation wastes. When this has been done it will be seen that the price of cord absorber complete with its artistic merit and other advantages, comes well into focus. The device is made in several sizes, and all are supplied complete with flex. The essential part is a good English clock spring. Stocks are held and distributed by factors. It should attract buyers in numbers when its undoubted advantages are brought to notice.

THE LATEST CORD ABSORBER.

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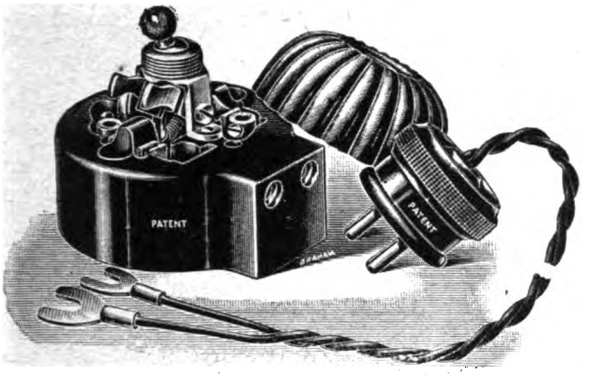
Combined Battery Charging Switch and Plug.

Battery charging rectifiers for a.c. circuits and small charging boards for d.c. circuits spring to the mind of the retailer when asked for charging apparatus, but the usefulness of, and consequently the large market for, the simple switch-plug manufactured by A. P. LUNDBERG AND CO. should not be overlooked. The switch-plug illustrated is for use on d.c. circuits, and may be fitted in place of ordinary s.p. switch without any disturbance of the permanent

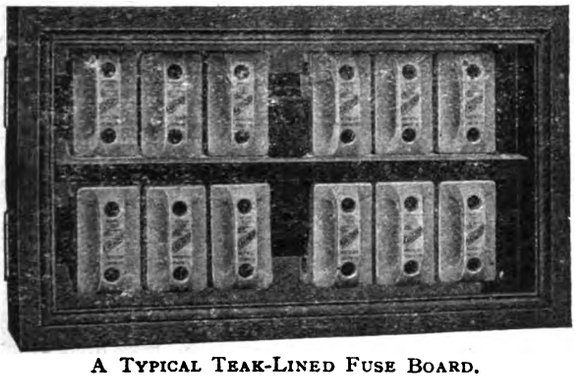


A SWITCH-PLUG COMBINATION FOR GARAGES.

wiring. The cells are connected with the plug (which is supplied complete with 6 ft. of twin flexible), and are so controlled by the switch that they may be charged in series with the lamps in circuit, or the lamps may be used independently. This device will sell readily if demonstrated to owners of small garages on d.c. circuits, who cannot be attracted by the higher-priced charging panels.

Achieving an Ideal.

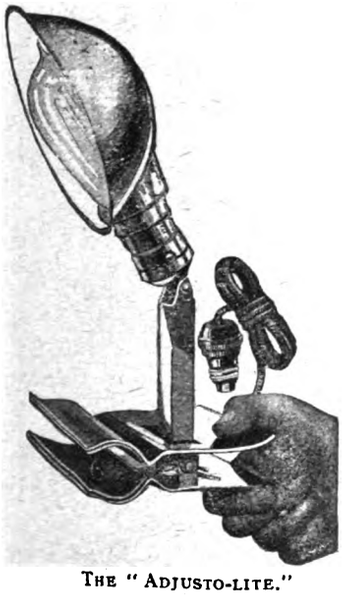
To the progressive contractor the text "Raising the standard of electrical practice" has a real meaning. A study of the MIDLAND ELECTRIC MANUFACTURING CO.'s line of teak-cased distribution boards proves the claim that these boards are a contribution towards the



A TYPICAL TEAK-LINED FUSE BOARD.

achievement of that ideal. The range, of which the illustration is typical, is a complete one of varying number of ways up to 10-way. The fuse units are the well-known "Baby Paragon," and have a maximum capacity of 15 A at 250 V. Stocks of the boards can be obtained from all M.E.M. factors.

A Useful Office Fitment.



THE "ADJUSTO-LITE."

The name "Adjusto-lite" is well given to this fitting. It will clamp anywhere, and the range of adjustment makes the device one which will sell well in the domestic field. It is attractively boxed, and sells at 21s., in satin brass finish. Stocks are being distributed by the leading factors, and as the device is being largely advertised in journals with a large circulation, such as the "Daily Mail" and "Punch," retailers must see to it that their stocks are ready to meet the demand which must come as a result of such forceful advertising. It is made by GUTERMAN & CO. In these days it is a useful adjunct to the office desk, or even the home table.

Price Lists, Catalogues, etc.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

MADE ENGINEERING CO.'S latest list describes the Remca patent electric rivetter.

JOSEPH ADAMSON AND CO. send us particulars of their electrically operated one ton blocks.

THE AVAMORE PUMP CO. have issued a descriptive folder on the Avamore "Squeegee" Positive Rotary Pumps.

The December issue of nett trade price list published by the WHITWORTH ELECTRIC LAMP CO., covers accessories, cables, conduits, and other lines in regular demand.

An abridged catalogue of ball and roller bearings, containing full details of the equipment manufactured by them, has been issued by the SKEFKO BALL BEARING CO.

BRITISH THOMSON-HOUSTON CO. have published descriptive list No. 4305C on porcelain handle fusible cut-outs; also price list No. 2251A, on direct current motors.

THE BRITISH THOMSON-HOUSTON CO. have published a small booklet entitled "The B.T.-H. Magneto." It should be read by all who follow the development of British-made magnetos.

"Electrical Equipment for Ships" is the title of a new price list just issued by THE GENERAL ELECTRIC CO. It is a *vade mecum* for ships' engineers and contractors specialising in marine work.

The "Losles" automatic temperature controller and the "Lecfur" electric tubular furnace, are fully described in two booklets just received from the LEEDS ELECTRICAL CONSTRUCTION COMPANY.

A new catalogue with separate price lists of Brittain's A.C. motors is issued by BRITTAIN'S ELECTRIC MOTOR CO. The list will be of exceptional interest to those contractors who specialise in, and cater for, industrial work.

The "Omega" insulator and conductivity tester made by the CAMBRIDGE AND PAUL INSTRUMENT CO. is briefly described on a mailing card just received. The trade is invited to write to the Cambridge Co. for list No. 163.

CREDENDA CONDUITS CO., have issued a comprehensive list of "Creda" heating and cooking appliances. Particular attention is invited to the "Creda" tilting fire and a new pattern steriliser; also to the "Creda" patent safety device.

THOS. BROADBENT AND SONS have published the fourth edition of a descriptive catalogue on automatic centrifugal clutches, which demands the close study of all engineers, because of the advantages claimed when the clutches are used with motors.

A compelling leaflet "On reducing costs of services," with an explanatory letter in Henley's inimitable style has been published by W. T. HENLEY'S TELEGRAPH WORKS. It is worthy of study by all progressive contractors and supply engineers.

Radiophone valve receiving sets are illustrated in the catalogue we have received from RADIOPHONES, LTD. It is claimed for this equipment that it is neat, compact and portable besides being easy and simple in operation. Great care and attention is being paid to the details of manufacture.

IMPERIAL ELECTRIC HEATERS have sent us a pamphlet dealing with their oil rings, toasters, water heaters and fires. The first of these is of somewhat novel appearance and we should like to illustrate it, but the firm puts no address on their publication. Perhaps they will repair the omission.

The STERLING TELEPHONE AND ELECTRIC CO.'S latest publications deal with the Stadium Magnavox, the details of which are well known to readers of THE ELECTRICIAN; a special head phone which has been designed for ladies to avoid disarrangement of the coiffure, and rotary filament resistance which provides good current regulation on the valve.

Contractors who specialise in industrial lighting will welcome the folder entitled "Light Topics," which has just been issued by the BENJAMIN ELECTRIC CO. We understand that a large issue of the folder has been made to all contractors on the Benjamin mailing list. To those who have not received a copy we proffer the advice to apply to Benjamin's at once.

Price lists of "National" D.C. motors and dynamos and "Zenith" oil engines have been issued by the OVERSEAS ENGINEERING CO., LTD. These lists will be of particular interest to exporters as all prices are quoted c.i.f. The domestic trade will be particularly interested in the price list of "Federal" electric lamps in both regular shapes and for automobiles.

A leaflet received from the ENGINEERING AND LIGHTING EQUIPMENT CO. deals with their cast iron fittings for metal filament and gasfilled lamps. An important feature of these fittings is the anti-vibrator disc which, it is claimed, absorbs all vibration from the filaments of the lamps, and thus reduces maintenance costs. It consists of a number of strips of phosphor bronze gauze cut on the bias with the warp and web strands disposed obliquely so that the diagonal of the mesh runs in the direction of the length of the strip. This interrupted mesh damps out the waves of vibration before they reach the fragile filament, and at the same time holds the lamp rigidly in place.

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Pacific Cable Board.

Cheap Services Result in Smaller Receipts.

In their report for the year ended March 31st last the Pacific Cable Board state that nearly 8 500 000 paying words of international traffic were transmitted by the cable during the twelve months. This was approximately 600 000 words in excess of the total during the previous year. In addition, approximately 2 300 000 paying words were carried between Australia and New Zealand and between those Dominions and the Pacific Islands. This was some 200 000 words less than in 1920–21. The ordinary or full rate international traffic showed a decrease of approximately 1 160 000 words, and the Government traffic a decrease of approximately 350 000 words. On the other hand, there was an increase in deferred ordinary traffic of approximately 100 000 words, and in week-end messages of over 2 000 000 words. The decrease of the traffic exchanged between Australia and New Zealand was due solely to the effect of trade depression, which resulted in a substantial reduction of cabling. The growth of the week-end telegram traffic has been rapid, and it has now reached the limit of the cable's capacity.

As a result largely of the reinstatement of this and other cheap services, traffic receipts, amounting to £521 624, fell short by £98 408 of those of 1920–1921, and were less by £121 305 than the record receipts in 1919–1920. At the same time these services have created a considerable volume of new traffic. This has not sufficed to maintain the revenue at its previous standard, but, taking into account the general depression from which trade suffered throughout the year, the board regard the situation of their undertaking as highly gratifying.

Receipts exceeded ordinary expenditure by £210 257, and from this excess a special contribution of £100 000 was made to the reserve and renewal fund for cable duplication.

Interruptions in the System.

Interruptions on the cable system occurred on three occasions. Two of the breaks were in the vicinity of Norfolk Island, where the conditions are singularly unfavourable to the life of cables. It is proposed to lay new cables between Suva and Auckland direct, and between Southport and Sydney. When these are available the conditions at Norfolk Island will no longer give ground for anxiety.

The other interruption was at Fanning Island, where, in September, 1914, the shore ends of the cable were destroyed by the German cruiser "Nurnberg," and later replaced by new ends of the only type of cable available—a light pattern, which would not ordinarily have been used. New shore ends were therefore laid in 1921, but as both cables had to be cut into, the interruption occurred.

New Apparatus Installed.

The new system of working at Auckland with Cox magnifiers and interpolators and Creed printers was brought into effect with good results. Large reductions in the staff at Auckland were made possible, and traffic now passes between Australia and Fiji without retransmission, being automatically relayed at Auckland.

Mr. H. Tinsley, of H. Tinsley and Co., London, in January conducted experiments on the board's cables at Auckland which it is hoped will enable him to devise methods of reducing or eliminating impedance, thereby increasing the speed of working. A report on the result of the experiments has not yet reached the board.

The board have decided to defer, for a short time, the carrying into effect of that part of the scheme which relates to the provision of additional channels of communication for the long stretches between Canada and Fiji. They are, however, anxious to provide additional facilities on the Southern Sections, *i.e.*, those between Fiji and Australia and New Zealand. They accordingly are making further representations to the Partner Governments with a view to laying a direct cable between Suva and Auckland, and one between Southport and Sydney. (The contract for these two cables has since been placed with the Telegraph Construction and Maintenance Co. The cables have to be completed and in working order by August 14th. Their total length is 1 850 nautical miles.)

The introduction of the new system of fast speed Wheatstone working with Creed apparatus between Sydney and Melbourne was delayed owing to the withdrawal by the Commonwealth Post and Telegraph Department of the special direct telegraph line which since July, 1915, had been allocated for the exclusive use of the board's traffic, and operated by their staff. One leg of an imposed telegraph circuit on the telephone trunk lines between Sydney and Melbourne was substituted for the direct wire, but while this connection was suitable for hand-speed working, it was useless for "Creed" working, even at slow speed. The original wire was returned to the board in February, 1922. Wheatstone working is now successfully employed between Sydney and Melbourne at a speed of 100 words per minute.

The death has taken place at the age of 88 years, of Mr. JAMES WRIGHT SALISBURY, of Limbrick Hall, Harpenden Common, Herts, who was chairman of the Bastian Meter Co. He was founder and president of the Harpenden Conservative Association and as a churchman had been warden of the churches of St. Nicholas and St. Mary.

Electrical Engineers' Ball.

Committee and Executive for Hotel Cecil Function.

The Electrical Engineers' Ball will take place at the Hotel Cecil, London, W.C., on January 26th. Messrs. A. M. Sillar and W. S. Lonsdale are joint hon. secretaries, Mr. J. E. Kingsbury is hon. treasurer, and the following gentlemen form the General and Executive Committees in connection with the function :—

General Committee : Messrs. G. L. Addenbrook, H. Alabaster, H. Allcock, Leonard Andrews, Ll. B. Atkinson, O. H. Baldwin, George Balfour, J. H. Bowden, E. G. Byng, Sir T. O. Callender, Messrs. R. A. Chattock, A. C. Cramb, A. J. Cridge, P. F. Crinks, H. W. Couzens, Sir James L. Devonshire, Messrs. T. C. Elder, H. W. Fairman, Dr. S. Z. de Ferranti, Messrs. E. J. Fox, E. Gatehouse, K. Geipel, Frank Gill, James Gray, J. P. Gregory, A. E. Hadley, J. S. Highfield, C. W. Hill, Hugo Hirst, P. V. Hunter, R. W. Hughman, Sir James Kemnal, Major D. Kerr, Messrs. J. E. Kingsbury, H. M. Leaf, Lt.-Col. F. A. Cortez Leigh, Messrs. W. Stanley Lonsdale, J. J. McGregor, H. T. S. McKay, P. V. McMahon, W. L. Madgen, W. Lee Matthews, W. M. Mordey, E. W. Moss, F. H. Nalder, Sir Wm. Noble, Col. H. E. O'Brien, Col. W. A. J. O'Meara, Messrs. G. W. Partridge, T. Petersen, F. Pooley, Major T. F. Purves, Messrs. P. J. Pybus, M. J. Railing, J. H. Rider, M. F. Roberts, L. L. Robinson, P. F. Rowell, W. Rutherford, C. E. Sayer, H. Scholey, Sidney Sharp, H. C. Siddeley, A. M. Sillar, Sir John Snell, Mr. C. P. Sparks, Col. H. C. Sparks, Sir George Sutton, Mr. C. D. Taite, Capt. G. Taylor, Messrs. James Taylor, J. M. G. Tresize, Capt. R. J. Wallis-Jones, Messrs. A. H. Walton, David Wilson, C. H. Wordingham.

Executive Committee : Messrs. O. H. Baldwin, J. E. Kingsbury, W. Stanley Lonsdale, P. V. McMahon, A. M. Sillar, C. H. Wordingham, A. H. Walton, and Capt. R. J. Wallis-Jones.

Diesel Engine Users' Association.

Alteration of Title Proposed.

Mr. A. E. Farrow, engineer to the Windsor Electrical Installation Co., has been elected president of the Diesel Engine Users' Association for the ensuing year, and Messrs. E. W. Johnston, R. Birkett, and J. G. Griffin have been elected to fill vacancies on the general committee. A considerable amount of work has been done during the past year by the Association in collecting particulars of heavy oil engine working costs. It has been suggested that these particulars should in future be collected from members from year to year, the idea being that the Association should be in a position to give definite and authentic average figures of the results obtained in the working of Diesel and semi-Diesel engine plants. In the matter of maintenance costs, which would include any renewals or replacements of parts besides the ordinary overhauling and repair work, it is considered necessary to work out an average figure over a period of about five years in view of the irregular incidence of certain comparatively heavy costs such as renewal of liners, pistons, etc.

The committee have given consideration to the suggestion that the name of the Association should be altered to "The Heavy Oil Engine Users' Association." In view of the progress which is being made and of the adoption of certain types of internal combustion engines using heavy oils to which the appellation of Diesel or semi-Diesel engine cannot properly be applied, it is thought that it might be desirable to alter the name, but no definite decision has been arrived at, and the matter will be dealt with later.

Maidstone Electricity Undertaking.

Anniversary Dinner : Presentation to the Engineer.

The 21st birthday of MAIDSTONE electricity undertaking was celebrated on December 19th, when Councillor J. Hillier French, chairman of the Electricity Committee, presided at a dinner of the employees, the company including the Mayor and members of the Corporation. Among those present were Messrs. E. E. Hoadley (Engineer), G. E. Wintle (station superintendent), E. E. Pope (mains engineer), P. Fletcher (meter superintendent), and R. S. Blake (chief clerk). In proposing the toast of the "Maidstone Corporation Electricity Undertaking," Alderman William Day remarked that in the 21 years of its existence the undertaking had paid off the interest on its capital and had repaid no less than one-third of its capital. Mr. Hoadley, who has been engineer ever since the commencement of the undertaking, was presented by Mr Wintle, on behalf of the staff, with an electric percolator, complete with tray, sugar basin and milk jug, "as a mark of the respect and esteem in which you are held by those who have been privileged to work under your command during the past 21 years." Besides Mr. Hoadley, three other employees have been in the service of the undertaking since its inception, viz., Messrs. J. Bonny, stoker-engine driver-storeman ; A. Ralph, boy-cable jointer ; and C. A. Wallace, street lighting foreman.

The late Sir ALEXANDER WILLIAM SHIPLEY, chairman of the Windsor Electrical Installation Co., and deputy chairman of the Slough and Datchet Electric Supply Co., left estate to the gross value of £79 624, with net personalty £62 382.

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Contravention of Electricity Regulations.

Fatality Leads to Prosecution of Clyde Firm.

In Dumbarton Sheriff Court, on December 21st, Sheriff Menzies gave a considered decision and imposed penalties in a case against NAPIER AND MILLER (Ltd.), the Old Kilpatrick shipbuilders, brought at the instance of Mr. J. Beith Lauder, Factory Inspector. The firm were charged with three separate offences under the Factory and Workshops Act, 1901 to 1911. To the second and third of these charges—viz., failing, on September 29th, to have posted in the works the Electricity Regulations, and failing to have posted in the works on the same date the instructions for treatment of men injured by electric shock—pleas of guilty were tendered.

The first charge, to which a plea of not guilty was tendered, and on which evidence was heard, was neglect of a regulation made by the Secretary of State, which provides that "all conductors shall either be covered with insulating material, and further efficiently protected where necessary to prevent danger, or they shall be so placed and safeguarded as to prevent danger, as far as reasonably practicable." The proceedings arose subsequent to a recent fatal accident inquiry into the death of a young man named Angus M'Lean, who was killed by coming into contact with an electric conductor passing over the roof of the smiths' shop in the shipyard, on which he was engaged painting.

The Sheriff, in his judgment, says that respondents asked him to find them not guilty of the charge in respect that (1) they had so placed the conductors as to "prevent danger." The means adopted to this end were the raising of the conductor to a considerable height off the ground on poles, and then passing it on to the ridge of the roof of the smithy; and also (2) by so safeguarding the conductor as to prevent danger, and the means adopted to this end were the arranging to switch off the current when the workmen had to enter what was called "the danger area" in the execution of their instructions. This attempt to discharge the onus accepted by the defenders failed. He therefore reached the conclusion that respondents were guilty of the offence. An argument that the deceased Angus M'Lean met his death solely through his breach of the instructions given to him by the respondents was tentatively put forward, but in the face of the decision in Fotheringham *v.* Babcock and Wilcox (Ltd.), it could not be successfully pressed. The evidence left on his mind, continued the Sheriff, was that the conductor in question, which was erected in 1906, was allowed to continue in the state in which it was erected after the regulations affecting it were issued in 1909, instead of being changed over then to meet the regulations, and that it was so left unchanged on the sporting chance that, by care on the part of the staff, nothing would happen to bring the state of the conductor in question actively within the sweep of the regulations. The offence found proved seemed to him to be a very serious one, in view of the long-continued neglect of obvious and efficient practical safeguards to prevent danger—danger of which the nature was lucidly illustrated by the fatal result in that case. He imposed a penalty of £70 for the charge found proved, and £2 10s. fine for each of the two charges, to which there was a plea of guilty, with £2 costs.

"Scientific Novelties."

Electrical Displays at King's College Exhibition.

Organised in aid of the Hospitals of London Combined Appeal, the "Scientific Novelties Exhibition," which was opened on Thursday of last week, will continue open until Wednesday next at King's College, London.

Viscount HAMBLEDEN, who presided at the opening ceremony, said the exhibition was part of the educational "offensive" organised by Mr. E. A. H. Jay in aid of the London Hospitals. It served the useful purpose of enabling everybody to realise that one of the reasons for the appeal for aid at the present time was that new discoveries entailed extra expenditure.

Viscount BURNHAM, who performed the inaugural ceremony, explained his inability to elucidate the wonders the visitors were to hear and see by the fact that he was born in the pre-scientific era. When he was at school electricity was "in its infancy," and the Eton science teacher was invariably one who had failed in classics or mathematics, and took over a department which had a familiar but ill-sounding name. The present exhibition was a great demonstration of goodwill and self-sacrifice on the part of teachers of the highest rank who were engaged in the fatiguing work of physical research. In addition to Mr. Jay, their warm thanks were due to Mr. Clay and Professor Winifred Cullis. Already £37,000 had been collected in the schools and similar institutions as a result of the combined appeal which was now being made.

Dr. R. S. CLAY, in moving a vote of thanks to Lord Burnham, and to the lecturers and organisers, remarked that probably such an exhibition, combining the collection of money for hospitals and the imparting of scientific instruction to the public had never before been organised. There would be about forty lectures and demonstrations.

Lectures and Demonstrations.

On the opening day Sir W. H. Bragg lectured on "Crystal Models," Prof. F. J. C. Cheshire on "The Polarisation of Light," and Prof. E. Wilson on "High-tension Discharges," and the last-mentioned lecture was repeated on Tuesday. Prof. Cheshire's lecture will be repeated to-morrow (Saturday). On Saturday last Mr. C. I. Graham lectured on "High-Frequency Experiments," and on Monday Prof. E. G. Coker spoke on "Some Applications of Polarised Light to Engineering," and Mr. A. G. Tarrant on "The Story that Light Waves Tell." On Wednesday Mr. R. P. Howgrave Graham lectured on "Rapid Vibrations of Electricity," and yesterday (Thursday) addresses were delivered on "Drops and Globules" by Mr. C. R. Darling, "Liquid Air," by Mr. R. R, Butler, and "Hydro-Electric Installation," by Mr. P. Kemp. Amongst the disquisitions still pending are "Liquid Air" by Dr. W. E. Curtis, to-morrow (Saturday), "Hearing by Light," by Prof. A. O. Rankine, and "Industrial Fatigue," by Prof. C. S. Myers on Monday, "Lightning and Thunder" by Prof. McGregor Morris, "Photography as the Handmaid to Science," and a repetition of Mr. Kemp's lecture on Tuesday.

In addition to the lectures, demonstrators have been making continued interesting displays in the various laboratories. Amongst those assisting in this work, in addition to those already mentioned, are Mr. W. C. Clinton, Dr. T. Moule, Dr. R. Mullineux Walmsley, Mr. B. L. Worsnop, Mr. J. E. Calthrop, Mr. Gause, Prof. Griffiths, Mr. W. C. S. Phillips, Dr. Lowndes, Mr. A. B. Tarrant, Mr. J. Nicol, Mr. D. Humphrey, Mr. T. B. Vinycomb, Prof. F. G. Donnan, Prof. Smiles, Prof. Allmand, Dr. G. Seuter, Mr. S. Sugden, Mr. T. J. Drakeley, Dr. D. Owen, Mr. R. H. Humfrey, Dr. H. D. S. Sand and Mr. S. E. Weston.

An Interesting Siemens Display.

Apparatus lent by the Cambridge and Paul Instrument Co., was used in some of the demonstrations in the Physics Department. Among many interesting exhibits, that of Siemens Brothers—a model of a four-figure full automatic telephone exchange—has come in for considerable attention. It comprises all the essential features of the large modern automatic exchange, including first and second preselectors, first, second, and final selectors, together with a machine for providing switch-driving ringing and tone currents, enabling the action of the various switches and the progress of a call to be readily demonstrated. Motors for recording the number of calls originated are fitted, as well as apparatus for dealing with calls for private branch exchanges. The apparatus and general circuit arrangement are similar to that used by Siemens Brothers for the large automatic exchanges they are now supplying for the public service in Swansea, Southampton, Winnipeg, Port Elizabeth and Pietermaritzburg.

Railway Grouping.

The Extension of Electric Traction.

On January 1st the "Financial Times" published a special railway supplement, to celebrate the inauguration of the grouping system. The present and future of electric traction on the railways were dealt with at length, and the opinion was generally expressed by writers that the grouping system will lead to further developments in this direction. One writer remarked: "It is certain that in the near future electric traction will be considerably extended and that power signalling will be more widely introduced, not only for large installations, but to meet the needs of individual locations and particular sections of line, while in default of large installations of this class there will certainly be many detail applications of electrical appliances of many kinds to assist working. A further development, which is already in its early stages, is that of the general provision of freight handling appliances, even in the smaller depots and yards, while many applications of conveying and similar apparatus to meet the conditions and requirements of railway premises are now receiving close attention, and some have already been installed."

Mr. R. H. Selbie, general manager of the Metropolitan Railway, contributed an article entitled "Electricity *versus* Steam—Experience of the 'Metro.'" Dealing with the relative cost of electric and steam working, Mr. Selbie says that the former is undoubtedly cheaper in cases where the line has already reached its maximum capacity in steam working. "It must not be assumed from this statement," he says, "that the actual working cost per train mile would be less under electrical conditions, but rather that the further expenditure required to enable any considerable increase to be made in the steam service would be such as more than to counterbalance the greater cost of electrical haulage."

Mr. Selbie points out that in order adequately to increase the steam service, additional terminal facilities, platforms and platform roads are necessary, whereas if electric motive power is substituted for steam it is possible to increase the train-carrying capacity of a line without widening it and without the enlargement of terminal stations. The use of electric trains on the multiple-unit principle obviates the shunting of engines, thus in practice doubling the capacity of terminal stations. More rapid acceleration is also provided by electricity, while a third advantage lies in the greater flexibility of the electric train, or, as Mr. Selbie puts it, in the readiness with which its composition can be adapted to the varying needs of the traffic. In conclusion, the writer states that, in his view, there is hardly any case of a suburban line running out of London that would not repay the cost of electrification.

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Transatlantic Wireless Telegraphy.

Successful Experiments by British Amateurs.

A series of experiments in Transatlantic wireless telegraphy under unusually economical conditions has just been completed in South London by members of the Radio Society of Great Britain, the amateur organisation formerly known as the Wireless Society of London.

The object of the experiments was to show the practicability of wireless communication between this country and America on a far shorter wave-length and much lower power, and with a much smaller, less complicated and expensive aerial, than are used by the great official and commercial stations. The experiments were held on ten successive days, from December 22nd. They were carried out with an apparatus installed by the experimenters in a building at the base of the chimney on the premises of the County of London Electric Supply Company at Wandsworth. The aerial consisted of six wires on a hoop 5 ft. in diameter, fitted to the chimney 170 ft. high. The maximum wave-length used throughout the ten days was 200 m. and the maximum power 1½ kW. The call number of the station was 5 W.S., and this, with groups of code letters belonging to the code of the Radio League of America, was sent out during two periods of 15 minutes each, between midnight and 4 a.m., every day. Replies from the American amateurs, through their league, relayed by the Carnarvon station, were received at Wandsworth to all the transmissions except those of the first day, and these replies were confirmed by telegram.

Mr. L. McMICHAEL, the secretary of the Radio Society of Great Britain, claimed that these successful experiments were a unique achievement for British amateurs. Their importance could best be appreciated by bearing in mind that our big official and commercial stations, when communicating with America and other distant countries, used wave-lengths of from 15 000 to 30 000 m., and power from 250 to 350 kW. The aerials, too, in such cases were tremendous structures, with a complicated system of wires. The society's recent tests, carried out under atmospheric conditions that were by no means satisfactory, would cause many experts to consider whether the great expense represented by existing high-power stations was altogether necessary. He thought the tests had impressed the authorities, who had been inclined to doubt their usefulness ever since the society first contemplated making them, nearly a year ago, and it might be that drastic revisions of the Empire wireless schemes would come under consideration.

For many months past, Mr. McMICHAEL said, reports had come from various members of the society throughout the country of their having picked up signals emanating from American amateurs on very short wave-lengths and, perhaps, power of only ½ kW. At the end of this year the committee of his society hoped to make experiments in economical Transatlantic wireless telephony.

Miscellaneous.

BAUGHAN AND CO., electricians, Duke Street, Reading, as their contribution to the Royal Berkshire Hospital Christmas festivities, illuminated the Christmas tree free of cost.

For the purpose of working the WOLFRYN PROCESS OF THE ELECTRIFICATION OF SEEDS a company is in the course of formation at Oxford under the name of the Midland Growers' Association, Ltd.

The OXFORD ELECTRIC CO. supplied current to the premises used for the Mayor of Oxford's Christmas Fund for the unemployed, and HILL, UPTON AND CO., electricians, provided the fittings, both free of cost.

Falsely representing himself to be in the employ of the Hendon Electric Supply Co., Henry Keeling gained admission into a Golders Green house and STOLE £70 WORTH OF JEWELLERY. He was sentenced to two months' imprisonment at Hendon last week.

The ENGINEERS' SECTION SUB-COMMITTEE of the Committee for the RELIEF OF RUSSIAN INTELLECTUALS is appealing for funds on behalf of men of science in Russia, many of whom are in acute distress. Sir Robert Hadfield is honorary president of the Sub-Committee, and remittances should be sent to the hon. treasurer, Mr. R. C. Griffith, 8, Victoria Avenue, Bishopsgate, London, E.C.2.

FINSBURY OLD STUDENTS' ASSOCIATION will hold a smoking concert at the Engineers' Club on January 19th, when the chair will be taken by the new president, Mr. W. M. Mordey, at 8 p.m. Tickets, 2s. 6d. each, may be obtained from members of Council or from the hon. secretary, Mr. H. P. Guy, 74, Silver Street, Edmonton, N.18. An informal dinner at 6.45 (5s. 6d., payable at the Club) will also be held, but it is essential that intending diners notify Mr. Guy beforehand of their intention to be present.

The past and present ENGINEERING STUDENTS of UNIVERSITY COLLEGE, London, will hold their annual dinner, under the chairmanship of Sir Alexander Kennedy, F.R.S., at the Engineers' Club, 39, Coventry Street, London, W.1, on February 1st. As many students as it is possible to get into touch with are being communicated with directly, but should any past students not receive notices of the dinner, details will be sent to them on application to R. A. Bell, hon. secretary of Past U.C.L. Engineering Students, 116 Worple Road, Wimbledon, S.W.19.

Calendars and Diaries.

Much Ingenuity, Not a Little Enterprise.

Christmas time brings with it a large influx of calendars, pocket diaries, and other useful literature for the New Year. Some of these are ingenious and some are artistic and some are both. We are, for instance, glad to receive the SIMPLEX pocket diary for 1923. This diary has been our constant companion for the last few years, and we have no doubt that references to it will be as frequent during the coming year as they have been during the past. It contains a large amount of interesting information about the Simplex equipment, together with fuse and wiring tables and model specification data for heating, for power and cable formulæ.

SIEMENS' pocket diary for 1923 hardly needs any introduction to electrical readers. At the beginning it contains a good deal of interesting information about the firm itself, and some useful electrical details to which we feel sure constant reference will be made. The compilers have evidently realised that an ordinary diary hardly contains enough space for the electrical man, and they have, therefore, added a number of blank pages at the end.

The HART ACCUMULATOR CO.'s blotter is also an old friend. In journalistic circles, there is always a great deal of blotting to be done, and so we can use this present to good purpose. The same firm send us a calendar, which besides containing the usual information, has interesting illustrations of their products.

Among the calenders mention may be made of that from the WESTINGHOUSE ELECTRIC INTERNATIONAL CO., whose principal feature is an artistic painting by Warde Traver. BRUCE PEEBLES AND CO.'S contribution is a desk calender which has the original feature that the used up dates in a month can be blotted up by a thick red line. As we find it difficult to remember dates this will find an honoured position on our table.

The TROUGHTON AND YOUNG calendar for 1923 is headed by a picture of "The Princess," painted by Jennie Harbour, accompanied by Goethe's dictum that "Beauty is a welcome guest everywhere." It might be added that electricity ought to be, even if it is not.

The B.T-H. pocket diary for 1923 is a handsome affair. It contains a great deal of useful information on physical and electrical matters which leads us to suppose we shall constantly refer to it.

CHARLES SELZ, silk shade manufacturers, have sent us a pocket diary which contains, among other things, a list of commercial phrases, and an insurance coupon for use against various types of accidents.

Further calendars received include one of daily tear-off block type from the ENGLISH ELECTRIC CO., which is chaste in design and succinct in its information, one from FRANCIS POLDEN AND CO., which is of the monthly tear-off type and is just as chaste, but a little more informative about the doings of the firm, refills for the "SUNCO" desk calendar, which is so well known to all electrical men, and also refills for the FULLER ACCUMULATOR CO.'S minsterline date remembrancer. A goodly show and all likely to prove useful to such of us as can never remember dates.

One of the most useful Christmas presents we have received is the thermometer sent us by GEORGE NOBBS, Ltd. Being cold-blooded, we have put it near the window, and are therefore able to assure people how chilly the room is when they think it warm. The real idea of the thermometer is to economise electricity by switching off when a "healthy temperature" is reached. This healthy temperature is carefully indicated on the thermometer.

We always welcome the OSRAM diary because it has our name printed on it in gold lettering. There is therefore no doubt as to its owner, which is an advantage to the absent-minded. It also contains a large amount of useful information and plenty of space for making notes.

JOHNSON AND PHILLIPS produce much useful electrical equipment, but just now we may be forgiven for thinking that their most useful product is not electrical at all but their blotting pad and book diary. This invaluable production has just arrived on our desk and we shall doubtless find it as useful during 1923 as we did its predecessor during 1922. Its most delightful feature is its wealth of scribbling space upon which we can note down telephone numbers, epigrams and our opinion about printers. Long may Johnson and Phillips flourish to produce it.

Telegraph and Telephone News.

The "LIVERPOOL Journal of Commerce" is dissatisfied with the number of public telephone call offices in the city, and urges that a larger number should be provided in public places, where they should be available day and night.

A sub-committee of the BURNLEY Town Council, after inspecting the local telephone exchange, has reported that no great improvement in the service could be expected until the exchange was removed to more commodious premises. The report added that it was understood that the proposed removal of the exchange to premises adjoining the Post Office would probably take place in about two years' time. It was decided to ask the Postmaster-General to accelerate the time within which the work was to be done.

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Electricity Supply.

Proposed Reductions in Charges.

At WEST HAM charges have been reduced as follows:—7d. to 6d. per kWh for lighting, 1½d. to 1¼d. for power and 2d. to 1½d. for heating.

HULL Electricity Committee has reduced charges from 8d. to 7d. per kWh for lighting, and from 120 per cent. to 75 per cent. above pre-war rates for power.

DARWEN Electricity Committee has recommended a series of reductions in electricity charges, as well as the removal of the minimum charge and of meter rents.

At ROTHERHAM the Electricity Committee recommends that the percentage charge on pre-war prices for electricity for manufacturing purposes be reduced from 100 to 75. It is also proposed to remove the minimum charge of 10s. per quarter to users of electricity for lighting.

BRADFORD Electricity Committee is to consider a reduction of charges when the accounts for the year are completed. Present charges are 7d. per kWh for lighting and 1½d. for heating, but householders have the alternative of paying 25 per cent. of the rateable value of their house in 1914, and a flat rate of 1d. per kWh for electricity for both heating and lighting.

Extensions and Developments.

Electrical Distribution of Yorkshire, Ltd., will shortly give a supply of electricity to SELBY.

LOUGHBOROUGH Town Council are undertaking mains extensions at an expenditure of over £3 000.

CARDIFF Electricity Committee has adopted the scheme for extensions submitted by the engineer, to which reference was made in THE ELECTRICIAN last week.

Lord Ripon has intimated to the RIPON City Council that if they wish to acquire the power station at North Camp, he will be willing to sell them the land and approach.

EASTLEIGH AND BISHOPSTOKE Urban Council has consented to the Southampton Town Council applying for a special Order authorising the latter body to supply electricity in the urban area.

DERBY Electricity Committee recommends the Council to apply to the Unemployment Grants Committee for a grant of 60 per cent. of the wages bill in connection with the trench work for new cables.

MAIDSTONE Town Council has been approached by the Electricity Commissioners as to the possibility of giving a bulk supply of electricity to Ashford, instead of the Ashford Urban Council providing its own generating station, under an order just applied for.

WREXHAM Rural Council has applied to the Electricity Commissioners for a special Order to supply electricity in its area, and has appointed Mr. Freeman, of Sir Douglas Fox and Partners, to advise in the preparation of the scheme, subject to their terms being acceptable.

Reference was made last week to the new generating station being built at DOUGLAS (I.O.M.). It is now stated that the building will be roofed in by the end of January. Two Ruston and Hornsby oil-driven engines of 300 H.P. each are being installed, and already about 120 applications for current have been received. Mains are being laid and current is expected to be available by Whitsuntide.

For the purpose of giving a supply of electricity to ABERGELE, the North Wales Power Co. have offered to erect a transforming station at their own expense at the nearest point. From the transforming station the company will bring their line into Abergele at their own expense, and will not require the Council to take a minimum supply of electricity, but they calculate that the cost of the scheme to the Urban Council would be £10 000.

CHORLEY Electricity Committee has reported that Lancashire Electric Power Company has decided to proceed with the supply of current to Chorley, under the provisional order granted by the Board of Trade. It is proposed to extend the company's mains and to ensure that the supply is available before the end of the summer of 1923. It has been decided to discuss the possibility of receiving the supply in bulk, thus retaining to the Council the distributive rights.

The output at the BLACKPOOL Corporation Electricity Works during November totalled 1 003 320 kWh, an increase of 79 190 on the corresponding month of last year. The total output from April to November, inclusive, was 6 220 350 kWh, an increase of 1 258 619 on last year. The details are:—Lighting, heating and power, 3 478 700 (increase 845 379); tramways, 2 584 550 (increase, 376 440); and public lighting, 157 100 (increase, 36 800). Since April 729 new consumers have been connected, as against 297 for the corresponding eight months in 1921.

Loans Applied for and Sanctioned.

WEST HAM Town Council has applied for a loan of £6 915 for auxiliary additions to the generating plant.

STIRLING Town Council has received sanction to borrow £5 700 for extensions to the electricity works and plant.

EBBW VALE Urban Council has received from the Electricity Commissioners sanction to a loan of £7 500 for electricity purposes.

KINGSTON-ON-THAMES Town Council has decided to apply for a loan of £16 000 for a new turbo-alternator and other plant for the generating station.

COLNE Corporation has received sanction from the Electricity Commissioners to borrow £19 764 to cover capital expenditure incurred to August 31st, 1922.

WHITSTABLE Electric Co. has decided to increase its borrowing powers from £10 000 to £20 000 in order to extend the plant. When the new plant is completed the present H.P. will be increased by over 200 per cent., which will be ample to cover all the requirements of the company during the next ten years.

GUILDFORD Town Council has applied to the Electricity Commissioners for a loan of £20 000 for extensions to the electricity works, and the Commissioners have requested the Council to inform them of the amount of any tenders accepted, or proposed to be accepted, in respect of the boiler house plant, etc. The Commissioners have sanctioned loans of £5 850 for mains, distributors and boxes and services, and £600 for meters.

Miscellaneous Supply Items.

At MARAZION (Cornwall) the idea of lighting the streets by electricity has been abandoned for the time being. The present lighting is by oil lamps.

The Electricity Commissioners have extended the final date for lodging objections to or representations concerning the proposed WEST OF SCOTLAND ELECTRICITY DISTRICT to June 30th, 1923.

Cannock Urban Council have informed the RUGELEY Urban Council that as the latter body objects to being included in the Cannock Electric Lighting Order, they will withdraw Rugeley from the schedule.

HIGH WYCOMBE Town Council has entered into a new contract with the Electric Lighting Power Co., Ltd., for public lighting for three-and-a-half years at an annual standing charge of £700, plus 3d. per kWh up to 40 000 kWh per annum and 2½d. beyond.

HARROGATE Corporation at a recent meeting authorised the Borough Electrical Engineer to purchase a number of electrical cookers, to be hired out to consumers. This is an experiment to test the reliability of electric cookers of recent design, and to explore the field of probable business in this particular line.

HECKMONDWIKE Council are entering into an arrangement with the Yorkshire Power Co. for the supply of electricity in bulk. The loss on the town's electricity department was £2 940 in 1920-21 and £2 200 last year. It is anticipated that the new arrangement will reduce the loss on the undertaking by between £800 and £1 000 a year (equal to fivepence in the rates), and that in about four years there will be no loss at all.

HOYLAKE Electric Supply Committee has decided to charge shopkeepers a special rate of 5d. per kWh for the illumination of their windows, subject to the following conditions: To light the windows six days per week from dusk to 9 p.m.; to provide a separate circuit for the lights, and a switch cloth or other means of control, at their own expense; the Council to provide a separate meter for that circuit at a rent of 1s. 6d. per quarter.

Personal Items.

Mr. FRANK EDWARD SMITH, director of Scientific Research at the Admiralty, has been appointed C.B.E.

Mr. F. GEERE HOWARD has resigned his directorship of F. Geere Howard, Ltd., electrical engineers, 59, Berners Street, London, W.

MR. J. A. BROMLEY, general manager and engineer, City of York Tramways, has been elected a corporate member of the Institute of Transport.

Mr. NORMAN LAND, of the staff of the Leatherhead Electricity Works, is leaving for Australia, and has been presented with a silver cigarette case.

Sir VINCENT L. RAVEN, late chief mechanical engineer of the North-Eastern Railway Co., has joined the board of Metropolitan-Vickers Electrical Co.

Mr. J. H. TONGE, who has for nearly thirty years been engineer and manager to the Preston Corporation Electricity Department is now retiring from that post. He intends to practise as a consulting electrical engineer in Preston, and will shortly open an office. In the meantime, letters may be addressed to him at Ash Grove, Nooklands, Preston.

The New Year Honours List contains the name of Mr. EDWARD MANVILLE, upon whom a knighthood is conferred for services to the Board of Trade. Mr. Manville began his career with the Brush Electrical Engineering Co., and in 1892 entered into partnership with Mr. J. Edward Waller as consulting engineers. They were later joined by Mr. Joseph Kincaid and Mr. (now Sir) Philip Dawson. He was the first president of the Engineers' Club and is M.P. for Coventry. In this connection, however, the "Westminster Gazette" states he intends to resign his seat in order to make room for Sir Arthur Griffith-Boscawen.

New Managing Director of B. T.-H. Co.

We understand that Mr. W. C. Luck, manager of the London office of the International General Electric Co., has been appointed managing director of the British Thomson-Houston Co., in place of Mr. H. C. Levis, who has resigned. Mr. Luck is already a director of the company.

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Foreign Notes.

Machinery of all descriptions, says Reuter, will be exhibited at an International Fair to be held in COLOGNE in May.

A scheme for improving Paris in 1923 includes considerable expenditure on the ELECTRIC LIGHTING of the Bois de Boulogne.

"La Revue Générale de l'Electricité" states that the five Germans present at the recent meeting of the INTERNATIONAL ELECTROTECHNICAL COMMISSION in Geneva were there as visitors and not as delegates.

The manufacture of porcelain has been established as a national industry at TONKIN, INDO-CHINA. The local government is supporting the venture by giving an order for electric insulators required by the Post Office.

The following FRENCH municipalities, says Reuter, are contemplating electrical installations: Francheval (Ardennes), Paray-le-Monial (Saone et Loire), and Le Vigan (Gard). Particulars in each case from the Mairie.

According to news from Bilbao, says Reuter, an early start on the ELECTRIFICATION OF THE VASCONGADOS RAILWAYS is contemplated. The system consists of 158 km. of narrow gauge line. Inquiries might be addressed to the Secretario, Ferrocarriles, Vascongados, Estación de Achuri, Bilbao, Spain.

Extensions are in progress of the electric power system on the Anglo-Dutch Plantations in JAVA, involving the erection of a further power station and the linking up of certain factories, with an extension of the present 30 km high tension line with a further 50 km. It is expected that ultimately about 6 000 H.P. will be utilised by the company.

In the debate on the Post Office estimates in the FRENCH CHAMBER, it was stated that the State Cables would not be ceded to private companies. With regard to the Brest-Dakar-Pernambuco cables, it was stated that the prolongation of the Dakar-Pernambuco line was being considered. It had not yet been decided whether the new line would be developed by the State or a private company. The estimates were eventually adopted.

The Detroit Electric Furnace Co., says the "Iron Age," has arranged to supply a 2 000 lb. 300 kVA Detroit ELECTRIC BRASS MELTING FURNACE for the Ford Motor Co. at Highland Park, Mich. This furnace, when installed, will complete a battery of eight 2 000 lb. furnaces in the brass foundry of the company. These furnaces are expected to handle the entire brass melting requirements of the Ford organisation. The Detroit company is also installing a battery of three furnaces in the plant of the Neptune Meter Co., Long Island City, N.Y., which manufactures water meters. Other installations now being made by the Detroit company are one 2 000 lb. furnace in the plant of the Tottenville Copper Co., Staten Island, N.Y., and one 500 lb. furnace in the United States Arsenal, Watertown, Mass. With the exception of the furnace at the Watertown Arsenal, all of the installations above mentioned are equipped with automatic electrode control, thus eliminating the necessity of an operator in attendance at the furnace.

Water-power works projected near NARVA, ESTHONIA, are expected to yield 94 000 H.P., of which 62 000 H.P. are to be utilised for the present. Narva is situated about 60 miles from Petrograd, in the east, and twice as far from Reval, the capital of the State, in the west. There are some waterfalls above the town of Narva, and some rapids near Omut, six miles further up the river. The falls make a head of over 20 m. (68 ft.) available; in the rapids the head fluctuates considerably between 12 and 24 ft. The depth of the river near the power station is small, and fluctuates between 4 and 6½ ft., but it will be regulated by means of a dam across the river near the Peipus Lake. In his estimate of the cost, E. Tiltzen, of Narva ("Zeitschrift des Vereines Deutscher Ingenieure," December 16th), concludes that, with current transmission by two lines of 110 000 V to Petrograd and to Reval, it will be possible to supply a kWh at 3·93 marks Esthonian (of which 1 500 go to the £1), whilst the cost in a large power station, also under construction, would be 7·50 marks.

Wireless News.

Fifty thousand private wireless installations are now in use in FRANCE, according to the Under-Secretary for Posts and Telegraphs.

A reception was given in Rome by the Italo-American Association in honour of Senator Marconi on December 27th, the TWENTIETH ANNIVERSARY OF WIRELESS TELEGRAPHY.

Mr. T. B. Trott, a Plymouth wireless amateur, on December 23rd succeeded in hearing the whole of the evening PROGRAMME BROADCASTED BY THE GENERAL ELECTRIC CO., NEW YORK. A loud speaker was used, and six persons heard the concert plainly without using headphones.

Speaking on the subject of "Wireless" to the MANCHESTER Rotary Club on December 28th, Mr. Y. W. P. Evans said that as far as transmission was concerned Manchester was easily beaten by such cities as Birmingham London, and Paris. It would be well for those responsible to concentrate on the improvement of their transmission, even though it meant going for advice to the local amateur wireless society, who were responsible for a much more successful transmission both of speech and music.

The second number of the "Readers' Bulletin," the bi-monthly magazine published by the Coventry Public Libraries Committee, contains a select bibliography of BOOKS AND PERIODICALS ON WIRELESS TELEGRAPHY AND TELEPHONY. Sir William Noble has written a foreword. Coventry is to be commended for the enterprise shown in the matter.

The Norwegian Radio Co., the Norwegian Marconi Co., and the Norsk Telegram Bureau have submitted to the Government a request for a concession to build and carry on a broadcasting telephone system from stations in NORWAY, says "The Times" correspondent. It is said that the companies intend to form a joint broadcasting telephone company for the purpose of building sending stations in Christiania, and subsequently at Bergen and Trondhjem, each with a radius of one hundred miles for the regular transmission of concerts. Receiving apparatus, for hire by subscribers at an annual fee, will be placed under the control of the telegraph board.

The wireless section of the Model Engineers' Exhibition, which opens to-day, Friday, at the Royal Horticultural Hall, embraces several of the principal makers of apparatus. AUCKLAND and SON are showing a self-contained cabinet receiver for use in connection with broadcast reception. This will be used for demonstration purposes during the exhibition. At the stand of MCMICHAEL, Ltd., there are a number of wireless sets, some of the four and five valve sets being capable of receiving the American signals. The "Aerofone" set is to be seen at the stand of the BOWER Electric, Ltd. This is a crystal wireless set in parts, complete in a box, with diagrams and instructions for making up by the amateur.

Addressing members of the Sheffield Reform Club on Saturday last, Mr. F. LLOYD, President of the Sheffield Wireless Society, criticised some of the regulations in force in connection with the use of wireless. He agreed that it was right of the Government to insist on wireless being used only under licence, but pointed out that one of the conditions of the licence was that only instruments bearing the trade mark of the British Broadcasting Company could be used. He did not say the Government had no right to compel them to buy their apparatus under this limitation, but he did say that such a step should only be taken after the matter had been thoroughly discussed in the most public manner possible. He was, he said, very dissatisfied with the treatment meted out to Sheffield, which ought to have been made a broadcasting centre.

Imperial Notes.

JOHANNESBURG Town Council is considering the offer of the Victoria Falls and Transvaal Power Co. for the supply of electric power for five years. The net earnings of the company, including those of the Rand Mines Power Supply Co., for the quarter ending September 30th, 1922, amounted to £239 082 before providing for British and South African taxation.

The Victorian Railways Standing Committee have reported to the State Parliament on the scheme for bringing the Essendon tramway and the proposed West Brunswick ELECTRIC TRAMWAY INTO THE CITY OF MELBOURNE by constructing a line along Flemington Road, and Peel Street, North Melbourne, and William Street. This is the first proposal submitted by the Tramways Board to construct an electric tramway in the city, and it raises the question whether electric tramways should be permitted in the principal streets; and, if so, whether the overhead or conduit system should be used. The committee considers that the proposed extension is a necessary public utility, and that the estimated loss of railway revenue will, in a few years, be more than compensated for by increased railway travel that will be caused by the large additional population which will be induced to reside in the West Brunswick and South Coburg districts by reason of the tramway facilities.

The Hon. J. G. Coates, Minister for Public Works, who presided at the New Zealand Power Board's recent Conference at Wellington, said the development of the HYDRO-ELECTRIC POWER OF NEW ZEALAND was making rapid strides, and the arrangements for its distribution must keep pace. Since the last conference the Lake Coleridge power plant had been increased from 8 000 H.P. to 16 000 H.P., contracts had been placed for the increase of the Horahora plant from 8 400 to 14 000 H.P. and of the Waipori plant from 8 000 to 12 000 H.P. The Mangahao plant (24 000 H.P.) and the Monowai plant (5 000 H.P.) were well in hand, and the New Plymouth plant was being extended from 1 000 to 6 000 H.P. The Waikaremoana plant of 1 000 H.P. was nearly ready for starting; and the Arapuni plant of 36 000 H.P. had been started. It was calculated that by 1925 the total H.P. of the electric power plants in the Dominion would have been increased from 69 000 to 147 000 H.P. —*Reuter's Trade Service.*

Reduction in Staff Wages Postponed.

As a result of national negotiations, the reduction of 6s. a week on the basic rates of staffs employed by electricity supply undertakings has been postponed until February 1st. The employers and Corporations have agreed to continue the sliding scale pending further negotiations.

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Electric Traction.

Tramway Extensions and Developments.

Something of a new era will be opened in NEWCASTLE's tramway system next week, when it is expected that the first tram will cross the high level bridge over the Tyne between Newcastle and Gateshead. All the necessary alterations to the bridge have been completed, and the lines have been laid and connected up. The overhead equipment for the cars has been fitted up by the Tramways Department of the Newcastle Corporation, and is placed in an inverted trough attached to the cross girders carrying the railway. A solid bronze T-section is being used, on which the trolley will run, the object being to eliminate noise. The service over the bridge will be, approximately, one car per minute in each direction, speeding up to 90 cars per hour in rush periods. The work has been planned and supervised by Mr. Ernest Hatton, general manager of the Tramways Department.

A new type of car is now in use on the trackless trolley service in BRADFORD. The car is the first of six which have been built to the design of Mr. R. H. Wilkinson, tramways manager, and is of the type in which the driver also performs the duties of the conductor. Several improvements have been embodied in the new car, one of the most important being that its motors can be interchanged with those on the ordinary tramcar.

At GLASGOW, arrangements have been practically completed by Mr. James Dalrymple, manager of Glasgow Corporation Tramways for the inauguration of a scheme of route numbers on the tramcars. In combination with the figure, letters of the alphabet will be used to indicate the distance along any route passengers will be conveyed. The Glasgow Corporation are also about to proceed with the laying down of a set of double rails on their system between Coatbridge and Airdrie.

Fare Reductions, Actual and Contemplated.

The reduction of fares on the LEEDS tramways is not to come into operation this week as was at one time hoped. An all-round reduction of a half-penny has been recommended, but the proposed increase in workmen's fares and the revision of the conditions attaching to them has evoked criticism from the local Labour party, through the Trades and Labour Council. Now the sub-committee's proposals cannot come before the City Council earlier than the February meeting. At WALLASEY the Tramways Committee recommended a return to the fares and stages in force during 1918-1920, but the matter has been deferred at the suggestion of the Finance Committee. At EDINBURGH also the proposed new fares have been deferred and are not expected to come into operation for some three weeks. The revised scheme is awaiting the approval of the Ministry of Transport. The General Purposes Committee of the BURNLEY Council is considering a reduction of tram fares at its meeting on January 8th.

So far as actual fare reductions are concerned, considerable changes came into force in LONDON on January 1st. These apply both to the trams controlled by the Underground Group and by the London County Council. On the former two stages instead of one will be given for a penny, while on the L.C.C. trams three sections instead of two are included in the "midday" penny fare, an average of nearly two miles. NEWPORT Corporation also introduced lower tram fares on January 1st.

Cases where Receipts are Declining.

The Borough Treasurer and Tramways Manager of ACCRINGTON, however, have presented a report on the reduction of tram fares to pre-war rates, and suggest no reduction should be made. At present the fares are 50 per cent. above the 1914 level. It is pointed out that if fares are lowered, the receipts will be reduced by £16 000 per annum. Even assuming there was an increase of 50 per cent. in passengers the income would still show a decline of over £7 000. The same state of affairs exists at YORK, where the Tramways Committee have decided, after a report by the manager, to apply for an Order from the Ministry of Transport to continue the power to charge a universal two-penny fare. The manager reports that the greater part of their revenue is derived from passengers paying the basic rate of twopence, and the adoption of penny fares would in his opinion, based on the figures since 1918, when penny fares were in operation, involve the department in a loss of revenue of £24 000. He believes that the adoption of four or six one-man tramcars would reduce their operating costs enormously.

It was reported to PRESTON Council, on December 28th, that while for the week ending December 13th, 1921, the tramway receipts were £1 898 those for the corresponding week this year were only £1 496, a loss of £400. BRADFORD presents a similar case. Receipts for the week ended December 16th amounted to £12 163, as compared with £14 459 for the corresponding week last year, a decrease of £2 296.

Edinburgh Contract Goes Abroad.

EDINBURGH Tramways Committee has decided by eight votes to two to recommend that a contract for 2 500 tons of tram rails be given to the Compagnie Anglo-Belge d'Importation et Export, Brussels. The tender of the Belgian firm amounts to £19 375, and the minority of two voted in favour of giving the contract to the firm of Alex. M'Bean and Son. This latter firm's quotation was £24 375 or a difference of about £5 000. Though a number of Scottish and English firms competed, the tenders submitted in many cases were for rails of Continental manufacture. This matter has caused a good deal of controversy, and several letters have been written to the Press, both upholding and condemning the Committee's action. Commenting on the matter, the "Scotsman" says:—"While it is a natural inclination to prefer the British to the foreign article, the element of price must be taken into consideration. It would be a dangerous precedent to establish that preference should be given to the British manufacturer over the foreigner irespective altogether of economic conditions. . . The lesson to be derived from this Belgian contract is that British cost of production is still too high. Why is that? Partly at any rate because of Trade Union restrictions. It is not to be believed that the British workman is less skilful than his foreign rival; the reverse is probably the fact. But he does not work so hard, does not give so great an output as formerly; in short, gets a higher wage for less work. It is not possible for British industry to prosper with such a handicap. . . . It would be interesting if an investigation could be made to show how the Belgian firm is able to supply these rails so much more cheaply. The standard of living is lower in Belgium than in this country, and the state of the exchange may offer an advantage but the disparity seems too great to be explained by these factors alone."

A contract for new tram rails at HULL has also gone to a Belgian firm, whose tender amounted to £9 547 as against the lowest British tender of £14 330. The subject has been before the Council on on several occasions and, as at Edinburgh, some members preferred to pay a higher price for rails made in this country.

Hours and Wages Questions.

It is understood that there will be no stoppage of work by SUNDERLAND tramway employees on the issue of the further reduction of 1s. a week to come into force this month. ABERDARE tramwaymen are objecting to work on Sundays unless they are paid time-and-a-half. The local Council has resolved that the matter in dispute be submitted by the employees and the Council to a committee of the National Industrial Council, and that pending a decision, the District Council pay the men at the rate of time-and-a-quarter for Sunday work.

BURNLEY Tramways Committee have brought before the Arbitrator the question of merit pay for employees. The point for decision was whether merit pay was wages or emoluments, the Committee's contention being that it was the latter, and that they were, therefore, not compelled to pay. The Arbitrator has upheld this contention, and has also decided that overtime pay on Good Fridays should be time-and-a-quarter instead of time-and-a-half. The Council has been recommended to discontinue the disbursement of merit pay to tramway employees—reporting a saving of approximately £1 400 per year.

Railway Electrification Developments.

It seems likely that the new railway grouping system will lead to further electrification in the near future. Some views on the subject appear on page 19. The electrification of some of the lines in the ISLE OF WIGHT is said to be probable, and other developments are foreshadowed.

Lower fares on the LONDON underground railways have come into force with the New Year, and a good many accelerations and improvements are also being introduced by the Metropolitan Railway.

A New Underground Contract.

The Underground Company have just placed a contract for two steel bridges, value £8 155, with Charles Brand and Son, for use on the extension of the Hampstead line from Golder's Green to Hendon. One of these traverses Elmcroft Crescent. The girders of this bridge will be 129 ft. 6 in. long and 9 ft. 8 in. deep. The other will carry the line over Woodville Road, the girders in this case being 101 ft. long and 8 ft. in depth. The work, which is to be completed in five months' time, is to be started at once.

Electricians' Wages.

Five per cent. Reduction as from January 7th.

In accordance with the National Agreements between the National Federated Electrical Association and the Electrical Trades Union of August 7th, 1920, and September 22nd, 1922, and the agreed recommendation of the National Conference of the National Federated Electrical Association and Electrical Trades Union, at York, July 27th, 1922 (confirmed by the signed declaration of December 10th, 1922), all rates of all grades will be reduced by a further 5 per cent. on the April 1921 rates, making a total reduction of 32 per cent. on the April 1921 rates to come into effect on the first pay-day following January 7th for the period covered by that pay-day. The revised rates will be as under:—Grade A, 1s. 8½d. (this rate includes a travelling allowance. No further allowances to be paid except as provided by Rule 9 of the London Rules dated February, 1920); Grade B, 1s. 6½d.; Grade C, 1s. 5d.; Grade D, 1s. 3¾d. The above rates will remain current until further notice.

The next smoking concert of the ELECTRO-HARMONIC SOCIETY will be held on Wednesday, January 10th, at the Caxton Hall, Westminster, at 8 p.m. Mr. Archibald Page will occupy the chair.

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Companies' Meetings, Reports, etc.

A dividend of 2 per cent. on the capital stock of the BELL TELEPHONE OF CANADA is payable on January 15th.

The GENERAL ELECTRIC Co. (U.S.A.) will pay on January 15th a dividend of 2 per cent. on the common stock for the quarter.

An interim dividend at the rate of 5 per cent. per annum, less tax, has been declared by the LIVERPOOL DISTRICT LIGHTING Co.

A final dividend at the rate of 9 per cent. per annum, less tax, making 8 per cent. for the year, is announced by ALLEN-LIVERSIDGE, LTD.

Warrants for the interest to December 31st on the 4½ and 5 per cent. debenture stock of BRITISH INSULATED AND HELSBY CABLES have been posted.

The directors of BENN BROTHERS, LTD., proprietors of THE ELECTRICIAN, have declared an interim dividend of 5 per cent. on the ordinary shares.

Warrants for the dividend to December 31st on 6 per cent. cumulative preference shares of the AUTOMATIC TELEPHONE MANUFACTURING Co. have been posted.

The report and accounts of C. A. VANDERVELL AND Co., summarised in our last issue, were unanimously adopted at the third ordinary general meeting last week.

An interim dividend at the rate of 7 per cent. per annum on the preference shares of CROMPTON AND Co. for the six months ending September 30th last will be paid on January 11th.

The directors of the AGRICULTURAL AND GENERAL ENGINEERS have decided to defer the consideration of the payment of dividends on the first and second cumulative preference shares until the accounts for the company's financial year ending March 31st next are completed, and the result of the year's trading definitely ascertained.

At the annual general meeting of LOW TEMPERATURE CARBONISATION, LTD., on December 29th, Sir Harry Brittain said that the company had been approached by financial groups in the City of London, who had discussed proposals to finance the erection of carbonising plants at electricity undertakings, gas plants, etc. The meeting was adjourned to a later date.

For the year ending September 30th last, the net profit of DURELCO LTD., was £417, after writing off £545 as part of debenture expenses. No dividends have been received on any of the ordinary shares held by the company. The businesses controlled have suffered from abnormal trading conditions, added to depreciation of exchanges in countries abroad where a large proportion of the business is transacted The directors report that during the last few months business has much improved and shows every prospect of gradually becoming normal. At the annual meeting last week the report and accounts were unanimously adopted, the Chairman, Mr. W. L. T. Arkwright, stating that during the last few months the businesses controlled by the company had shown a marked improvement.

Mr. Alex. J. Fergusson presided at the annual meeting of CLAUD HAMILTON, LTD., in Glasgow, on December 27th. In moving the adoption of the annual report, he stated that in common with the experience of other similar companies the depression in trade and the fall in prices had adversely affected the profits for the year. The company had been expending considerable sums on capital account in connection with their branches which had to be provided partly out of profits. Under these circumstances the directors considered it necessary to conserve the resources of the company, and although the amount at the credit of profit and loss was £19 523, they only recommended the payment of a dividend of 5 per cent., less tax, on the ordinary shares, carrying forward the balance subject to Excess Profits Duty and Corporation Tax. The report was unanimously adopted.

New Companies.

RADIO GRAMOPHONES, LTD.—Private. Reg. Dec. 20th. Cap. £2 000 in £1 shares. To carry on business as indicated by the title and that of electrical engineers and contractors, etc. Reg. office: 10, Coleman Street, London, E.C.

ELECTRIC AUTO SUPPLIES, LTD.—Private. Reg. Dec. 27th. Cap. £500 in £1 shares. To carry on the business of manufacturers of and dealers in electric lamps of all kinds, etc. Reg. office: 30, Langham Street, Great Portland Street, W.1.

DORCO ENGINEERING Co., LTD.—Private. Reg. Dec. 23rd. Cap. £100 in £1 shares. To carry on the business of electricians, manufacturers of generators, accumulators, suppliers and distributors of electricity and electrical energy. Reg. office: 86, Granville Road, Child's Hill, Cricklewood, N.W.

SAVOY ELECTRIC CONSTRUCTION Co., LTD.—Private. Reg. Dec. 22nd. Cap. £2 000 in 1 300 10 per cent. preference shares of £1 each and 14 000 ordinary shares of 1s. each. To adopt an agreement with C. A. Crosbie, and to carry on the business of electrical, etc., engineers. Directors: C. W. Crosbie and Margaret Crosbie. Reg. office: Doric House, 1, Museum Street, London, W.C.

J. W. BARNARD AND HAYNES, LTD.—Private. Reg. Dec. 22nd. Cap. £3 000 in £1 shares. To take over the business of a mechanical and electrical engineer carried on by J. W. Barnard at 45, Great Ormond Street, and 55, Ormond Yard, W.C., and 4, Great Winchester Street, E.C. J. W. Barnard is permanent chairman and managing director. Reg. office: 4, Great Winchester Street, London, E.C.

Tenders Invited and Accepted.

UNITED KINGDOM.

BELFAST PUBLIC HEALTH COMMITTEE, January 9th.—Electric lighting and heating installation work in the new storey of Pavilion 3 of the Infectious Diseases Hospital, Purdysburn. Specifications from the City Surveyor.

MANCHESTER EDUCATION COMMITTEE, January 10th.—Wiring and fitting for electric lighting of Holland Street, Webster Street, Upper Lloyd Street and Christ Church Municipal Schools. Specifications and schedules from the Education Offices, Deansgate, Manchester.

LEEDS GUARDIANS, January 11th.—Electric light wiring and fitting in two blocks of the Guardians' Institution, and also in the church and clock tower, Beckett Street, Leeds. Specification from the Clerk, Poor Law Offices, South Parade, Leeds.

DUNDEE TOWN COUNCIL, January 19th.—Electricity meters, for public supply service work. Specifications from Mr. D. H. Bishop, general manager and engineer, Electricity Department, Dudhope Crescent Road, Dundee.

NEWPORT (MON.) CORPORATION, January 22nd.—Marine water-tube type boiler, with superheater, economiser, stokers, steam and feed-water piping, etc. Specification, conditions and form of tender from Mr. A. Nichols Moore, M.I.E.E., Borough Electrical and Tramways Engineer, Town Hall, Newport, Mon.

BELFAST CORPORATION, January 23rd.—One 12 500 kW turbo-alternator, with condensing plant and auxiliaries (Specification W1) and three 500 kW rotary converters, with transformers, l.t. and h.t. switchgear, etc. (Specification W2). Specifications and form of contract from Mr. Johnstone Wright, M.I.E.E., City Electrical Engineer and Manager, East Bridge Street, Belfast.

VAN ROAD CONGREGATIONAL CHURCH, CAERPHILLY, January 30th.—Wiring and fitting the church for electric lighting, and supply of 5 H.P. motor for organ blowing. Tenders to the Secretary.

CAMBERWELL (LONDON) BOROUGH COUNCIL, February 5th.—Maintenance of private telephones and electric bells at the Town Hall and other buildings. Forms of tender from the Borough Engineer, Town Hall, Camberwell, S.E.5.

AUSTRALIA.

VICTORIAN ELECTRICITY COMMISSION, March 31st.—Transformers, in connection with the Morwell power scheme. Specification (No. 23/8) and form of tender from the Agent-General, Melbourne Place, Strand, London, W.C.2.

HULL TRAFFIC SUB-COMMITTEE recommend, conditionally, acceptance of the tender of G. P. Trentham, Ltd., for laying tramway track in Osborne Street, at £2 750.

Sir W. G. Armstrong, Whitworth and Co. have in hand a contract for equipping the works of the Humber Hydro-Electric and Paper-mill concern at ST. JOHN'S, NEWFOUNDLAND.

Cartagena (Colombia) Waterworks, Ltd., have received a contract from the MUNICIPALITY OF CARTAGENA for the extension of the waterworks and the installation of electric lighting and power plant, the total amount of the contract being about £400 000.

Business Items.

Mr. Lionel Dekteréff informs us that his firm will in future be known as DEKTEREFF, FRANCKE AND REPPMAN, as he has entered into partnership with Mr. Victor Francke and Mr. Albert Reppman. The address of the firm is 118, Queen Victoria Street, London, E.C.4.

In our issue of December 22nd, reference was made to the new address of the Bristol branch of W. T. HENLEY'S TELEGRAPH WORKS Co., and owing to a typographical error the telegraphic address was given as "Henletee, Bristol." This should have been "Henletel, Bristol."

Mr. TERENCE G. BACON, formerly with the St. Marylebone Electricity Department, and latterly with English Electric and Siemens Supplies, has commenced business as an electrical engineer and factor, trading as Lighting, Heating and Traction Supplies Co., 43, Doughty Street, London, W.C.1.

PARMITER, HOPE AND SUGDEN, LTD., electrical engineers, have removed their head offices and works to Fluvent Electrical Works, Vernon Street, Longsight, Manchester, to which address all communications and goods should now be sent. The new telephone number is Rusholme 1486.

PALMER, RILEY AND Co., electrical factors, Market Chambers, Accrington, are removing to larger premises at 90–94, Abbey Street. Large showrooms will be provided, and the general and private offices, as well as the stores, will be at the same address. A trade counter will be available for personal orders. The company's motor delivery service will also be extended.

We are in receipt of a very handsome and informative book issued by TRAFFORD PARK ESTATES, LTD., and its associated companies, drawing attention to the advantages offered by Trafford Park as a site for new factories. The development of Manchester as a seaport is outlined, and stress is laid on the facilities for overseas trade enjoyed by the Manchester manufacturer. Full information may be obtained from the Estate Office, Trafford Park, Manchester.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

DUNNING AND WATSON, Castlegate, Stockton, electrical engineers. £11 18s. November 10th.

STANDARD ELECTRIC SIGN CO., LTD., 62, Oxford Street, W., electrical engineers. £11 6s., November 7th; and £22 7s. 2d., November 10th.

Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

AIREY (GEORGE) AND CO. (ELECTRICIANS), LTD., 25, King Street, Sheffield.—A circular has been issued to creditors in this case by Mr. J. W. Fenoughty, solicitor, of Bank Court Chambers, Bank Street, Sheffield: "I beg to inform you that owing to the pressure of creditors, this company has been compelled to go into voluntary liquidation, and a resolution for voluntary winding up was passed at an extraordinary general meeting of the company, held on the 19th day of December, 1922, and Mr. John Hancock, of 57, Surrey Street, Sheffield, C.A., was appointed liquidator. Pursuant to subsection 188 of the Companies (Consolidation) Act, 1908, a meeting of the creditors of the company will be held at the offices of Messrs. Hancock and Ashford, 57, Surrey Street, Sheffield, on Thursday, the 4th day of January, 1923, at 4 o'clock in the afternoon. I enclose form of proxy, and shall be obliged if you will please send particulars of your claim to the liquidator at your early convenience."

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Winding-up Petition.

MODERN ELECTRICAL SUPPLY CO., LTD.—A petition for winding-up, or alternatively an order for the continuance of the voluntary winding-up subject to the supervision of the Court, has been presented by the General Electric Co., Ltd., and is to be heard at the Royal Courts of Justice, Strand, London, on January 16th, 1923.

Company Winding Up Voluntarily.

RADIOELECTRICO, LTD.—A. W. Deering, Chartered Secretary, 3, Broad Street Buildings, Liverpool Street, London, E.C.2, appointed liquidator.

Bankruptcy Information.

PRICE, W., AND CO., 29, Russell Street, Plymouth, electricians, First meeting, January 8th, 3.30 p.m., 7, Buckland Terrace, Plymouth. Public examination, January 20th, 11 a.m., Western Law Courts, Guildhall, Plymouth.

WILDE, Frederick, 18 and 20, Vauxhall Road, Liverpool, as THE LIVERPOOL ENGINEERING CO., electrical engineer. First meeting, January 11th, 11 a.m., offices of the Official Receiver, 11, Dale Street, Liverpool. Public examination, February 13th, 10.30 a.m., Court House, Government Buildings, Victoria Street, Liverpool.

Notice of Intended Dividend.

MAGSON, Reginald Silver, 10, Stoney Stanton Road, Coventry, as R. S. MAGSON & CO., electrical engineer. Last day for receiving proofs, January 17th. Trustee: C. J. Band, 9-11, High Street, Coventry.

Edinburgh Gazette.

MARTIN & M'GREGOR, electrical engineers, Coltness Road, Wishaw.—In this summary sequestration the public examination of the bankrupts is fixed for Tuesday, January 9th, at 10.15 a.m., in the Sheriff Court House, County Buildings, Hamilton. Meeting of creditors at the office of the trustee, W. B. Galbraith, C.A., 87, Saint Vincent Street, Glasgow, on Wednesday, March 28th, at 3 p.m.

Bankruptcy Proceedings.

BUSFIELD AND CO., 6, Wilfield Street, late 215, Padiham Road, Burnley, electrical engineers. The receiving order in this matter was made on November 9th, on a creditor's petition. The statement of affairs shows gross liabilities of £431, of which £423 is expected to rank. The first meeting of the creditors was held recently at the Official Receiver's Offices, 13, Winckley Street, Preston, when the case being a summary one was left with the Official Receiver as trustee of the estate. The following are creditors: Palmer Riley and Co., Accrington, £125; Pemberton, G., Burnley, £100; Baxendale and Co., Manchester, £77; Whittaker Bros., Manchester, £56; Pye, W. G., and Co., Cambridge, £28.

Forty Years Ago.

"The Electrician," January 6th, 1883.

THE FERRANTI DYNAMO MACHINE.—We are informed that the Australasian Electric Light and Power Company have taken the sole agency for the Ferranti dynamo-electric machine in the Australias, and the first machine will be sent out shortly.

ELECTRIC LIGHTING COMPANIES' CAPITAL.—The "Journal of Gas Lighting" says that at the end of last year (1882) "the nominal capital of the various registered electric lighting companies amounted to £24 895 500; of which, however, not quite three millions sterling appear to have been actually paid up by the public."

THE ELECTRIC LIGHT AND TEXTILE MANUFACTURERS.—The Mayor and Corporation of Leicester and the leading manufacturers visited the hosiery manufactory of Messrs. Corah, Sons, and Cooper, Leicester, last week, to witness the first introduction of the electric light into a textile factory in the town. The many shades of yarns used in ladies' jerseys and other fancy fabrics make it difficult to manufacture and make up these goods by gas light, but on this occasion it was proved that colours undistinguishable by gas light were easily matched by the electric light. The Brush arc and Swan incandescent lamps are used. Leicester is not the first town by any means where this fact has been ascertained, and many textile manufacturers and dyers have adopted the electric light, including the well-known Messrs. Fuller, of Perth.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"Period Furniture in America (the work of Duncan Phyfe)"; "Special Designs for Sideboards and Mirrors"; "Portrait Gallery of Furniture Buyers."

THE CHEMICAL AGE.—"The Nitrogen Industry in U.S.A.," by Hartland Seymour; "Recent Researches on Cellulose," by J. F. Briggs.

THE EUROPEAN COMMERCIAL.—"What Leading Men are Saying."

THE FRUIT GROWER.—"The Colorado Potato Beetle"; "Growing for Market: The Tomato"; "The Storage of Fruit."

GARDENING ILLUSTRATED.—"Autumn Colouring in Cornwall"; "Growing Seakale"; "Winter Flowering Pelargoniums."

THE GAS WORLD.—"Water Heating by Gas"; "The By-Product Coking Industry in 1922"; "Pushing Gas Cookers."

THE HARDWARE TRADE JOURNAL.—"The Aluminium Ware Industry—Outlook for 1923"; "Aluminium Ware Display"; "Railway Charge for Hardware and Hollowware."

Prices of Metals, Chemicals, etc.

TUESDAY, January 2.

		Price.	Inc.	Dec.
***Copper*—**				
Best Selected	per ton	£68 0 0	10s.	—
Electro Wirebars	„	£72 0 0	5s.	—
H.C. Wire, basis	per lb.	10 1/16d.	—	—
Sheet	„	10 1/8d.	—	—
***Phosphor Bronze Wire (Telephone)*—**				
Phosphor Bronze Wire, basis	per lb.	1s. 2 1/16d.	—	—
***Brass* 60/40—**				
Rod, basis	„	7d.	—	—
Sheet, basis	„	9 1/4d.	—	—
Wire, basis	„	10 1/8d.	—	—
***Pig Iron*—**				
Cleveland Warrants	per ton	£4 16 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£18 0 0	—	—
***Lead Pig*—**				
English	„	£27 10 0	—	—
Foreign or Colonial	„	£26 7 6	—	—
***Tin*—**				
Ingot	„	£182 5 0	£1 5 0	—
Wire, basis	per lb.	2s. 5 1/4d.	1/4d.	—
Aluminium Ingots	per ton	£100 0 0	—	—
Spelter	„	£37 12 6	2s. 6d.	—
Mercury	per bottle	£11 15 0	—	10s.

***Sulphur* (Flowers)—Ton £9** ***Sodium Chlorate*—Per lb. 3d.**

„ (Roll-Brimstone)—„ £8 10s. ***Sulphuric Acid* (Pyrites, 168°) per ton, £7 10s.**

***Copper Sulphate*.— „ £26**

***Boric Acid* (Crystals). „ £55.** ***Sodium Bichromate*.—Per lb. 4 1/2d.**

***Rubber*.—Para fine, 1s. 1 1/4d.; plantation 1st latex, 1s. 2 1/8d.**

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Patent Record.

APPLICATIONS FOR PATENTS.

December 15, 1922.

34 313 J. Cell. Electric terminal connector.
34 316 T. Torda. Asynchronous induction machines. (21/10/22 Hungary).

December 16, 1922.

34 362 Radio Communication Co., and E. H. Robinson. Thermionic discharge devices.
34 363 Radio Communication Co. and E. H. Robinson. Use of fluid conductors in high frequency signalling systems.
34 374 A. R. Angus. Devices for charging accumulators.
34 379 V. E. Antrique. Electric drive for gramophones.
34 385 H. C. Barker. Induction coils variometers, etc.

December 18, 1922

34 409 L. S. Walton. Electric lamps.
34 447 E. Mallett. Wireless telegraphy and telephony.
34 451 J. Pownall. Electric switch.
34 458 Vacuum Brake Co. and G. Mitchell. Controllers for electric traction systems employing vacuum brakes.
34 475 D. A. V. Rist. Electric horns.
34 494 W. R. and K. I. Goodman. Aerials for wireless installations.
34 497 and 34 498 Waygood-Otis, Ltd. Electric lifts, etc.
34 502 Whitecross Co., C. E. Hill and H. D. Lloyd. Electrodes for welding, etc.
34 503 Chamberlain and Hookham and S. James. Prepayment electricity apparatus.
34 507 British Thomson-Houston Co. and H. C. Hastings. Electric switches.
34 508 British Thomson-Houston Co. (General Electric Co.). System of electrical distribution.

December 19, 1922.

34 521 F. Adcock. Self-induction coil.
34 525 Clear-Hosters, Ltd., W. J. Spicer and T. S. Rogers. Electric contacts or switches.
34 526 Clear-Hosters, Ltd., W. J. Spicer and T. S. Rogers. Electric horns.
34 527 Lancashire Dynamo and Motor Co., W. Stansfield, A. R. Wood and R. S. McLeod. Electric motors.
34 542 H. G. Wood. Tramcar body.
34 544 Veritys, Ltd., and F. W. Thorpe. Globe fittings for electric lamps.
34 563 J. Eggleston. Electric light fittings.
34 587 H. J. Fisher. Electric connectors.
34 594 A. R. Angus. Control of trains.
34 597 Allmanna Svenska Elektriska Aktiebolaget. Turbines. (2/1/22, Sweden.)
34 598 Allmanna Svenska Elektriska Aktiebolaget. Reversible power transmission devices. (2/1/22, Sweden.)
34 624 W. H. and F. Murdoch. Electric signalling to moving trains.
34 630 J. H. Runbaken and W. Torrance. Electric light installations.
34 632 Scintilla. Locking apparatus for distributing switch of automobile lighting installations. (5/1/22, Germany.)
34 634 P. A. Govaerts and P. M. Wenmaeckers. Distribution of metals by electrolysis. (19/12/21, Belgium.)
34 635 E. C. R. Marks (Soc. S.A.A.E. Soc. Anon.). Installation of self-inductances permitting increased delivery of rectifiers of alternating current.
34 637 Automatic Telephone Mfg. Co. Railway signalling systems.
34 638 Automatic Telephone Mfg. Co. and S. R. Smith. Electro-magnetic receivers.
34 639 and 34 640 Automatic Telephone Mfg. Co., C. Gillings and W. O. Passmore. Telephone systems.
34 646 G. Swann. Means for generating electric currents.
34 653 G. H. Janson. Automatic telephone exchanges. (20/12/21, Sweden.)
34 655 British Thomson-Houston Co. (General Electric Co.). Wireless receiving systems.

December 20, 1922.

34 663 B. W. Handley. Tumbler switches.
34 673 C. H. Woodward. Electric signs, etc.
34 702 Franco-British Electrical Co. Illuminated signs.
34 721 Metropolitan-Vickers Electrical Co. Elastic fluid turbines. (7/1/22, U.S.)
34 722 Metropolitan-Vickers Electrical Co. Elastic fluid turbines. (13/1/22, U.S.)
34 724 A. Lane. Electrodes.
34 726 M. Kawarada and T. Yamamote. Induction synchronous motors.
34 729 British Thomson-Houston Co. and A. A. Pollock. Electrical machines.
34 747 Oldham and Son and W. D. Wilde. Galvanic batteries.
34 748 C. R. Jones. Electrically operated changing mechanism.
34 755 Elektro-Thermit Ges. Heating articles to high temperatures.
34 760 R. Grak. Electro-deposition of chromium.
34 776 Barr and Stroud and J. W. French. Relays, etc.
34 780 W. Creber. Protective device for trailing cables.
34 790 F. H. Wood. Flexible pendant electric light fittings.

December 21, 1922.

34 784 Electric Control, Ltd., and O. Elletsen. Electric converting machinery.
34 812 A. E. Spencer. Electric control of points, signals, etc.
34 821 C. B. Kersting and T. J. Platt. Current limiting devices for wireless systems.
34 826 A. R. M. Sankey. Rotary current motors.
34 828 T. F. Francis. Anti-shock fitting for electric lamps.
34 836 W. T. Henley's Telegraph Works Co. Junction boxes for distribution systems.
34 837 General Electric Co., Ltd. Incandescent lamps. (21/12/21, Germany.)
34 836 E. E. Judge. Junction boxes for distribution systems.
34 853 Western Electric Co. Telephone systems.
34 854 and 34 871 M. Meinhardt and E. Viz. Production of thermo-induction currents.
34 857 J. M. Schmierer. Multiple safety fuse with rotary switch. (24/12/21, Germany.)
34 870 C. T. Wade (H. L. Dixon Co.). Electric furnaces.
34 899 British Thomson-Houston Co. (General Electric Co.). Electric switches.
34 900 British Thomson-Houston Co. (General Electric Co.). Automatic circuit breakers.

December 22, 1922.

34 909 E. Long. Bonding metallic sheathed conductors.
34 917 N. Fay. Control of electric circuits.
34 928 C. C. Smith. Automatic switches for electric current control.
34 938 G. H. Ide and M. J. Railing. Electric heater elements.
34 940 A. C. Hyde. Electrodes for arc welding.
34 948 H. P. Amphlett and J. E. Lewis. Arc ignition apparatus.
34 954 Akt. Ges. Escher, Wyss et Cie. Surface condensers. (5/1/22, Switzerland.)
34 959 G. E. Bairsto. Magneto-electric generators.
34 961 F. J. Froome. Switch holders for electric lamps.
34 962 E. E. Greville and F. W. Read. X-ray apparatus.
34 964 H. P. Rogers. Electric signalling.
34 980 Metropolitan-Vickers Electrical Co. Elastic fluid turbines. (7/1/22, U.S.)
34 990 Tungsten Mfg. Co. and W. L. T. Arkwright. Electric timing gear for internal combustion engines.
35 003 C. A. Vandervell and Co. and W. H. Glaser. Electric lighting and starting installations for automobiles.
35 006 J. H. Runbaken and W. Torrance. Interrupters for electric ignition systems.
35 008 W. T. Anderson and A. B. Ballance. Time switch.

December 23, 1922.

35 033 British Thomson-Houston Co. and H. Trencham. Electric switches.
35 034 British Thomson-Houston Co. Current amplifiers. (28/12/21, U.S.)
35 035 British Thomson-Houston Co. (General Electric Co.). Control of electrical machines.
35 050 W. H. Eccles. Electric insulators.
35 061 F. H. Grove. Distributors, etc., for controlling electric circuits.
35 065 J. Hester. Telephone receivers.
35 079 J. A Crabtree. Electric switches

Arrangements for the Week.

FRIDAY, JANUARY 5th (To-day).

Electrical Power Engineers' Association.
7 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Lecture entitled "Water and Its Action on Steam Boilers," by Mr. J. H. Paul.

Junior Institution of Engineers.
7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette entitled "Wave Power Transmission," by Mr. W. Dinwoodie.

British Electrical Development Association.
7.30 *p.m.* Salesmanship Conferences. At Caxton Hall, Caxton Street, London, S.W.1. "Possibilities of the Immediate Future and Competition with Other Forms of Light and Heat," by Mr. W. Beauchamp.

MONDAY, JANUARY 8th.

Institution of Electrical Engineers (South Midland Centre). (Students' Section).
Lecture entitled "Notes on Oil Switches," by Mr. D. J. Bawcutt, at Birmingham.

Institution of Electrical Engineers.
7 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London. Informal Meeting. Discussion on "The Protection of Inventions by Letters Patent." (Opened by Mr. E. W. Moss.)

Bradford Engineering Society.
7.30 *p.m.* At the Technical College, Bradford. Lecture on "Steel Castings," with Cinematograph Illustrations, by Mr. F. C. H. Lantsberry.

Institution of Electrical Engineers (North Eastern Centre).
7.30 *p.m.* At Armstrong College, Newcastle-on-Tyne. Visit and Address by the President, Mr. Frank Gill.

TUESDAY, JANUARY 9th.

Institution of Civil Engineers.
6 *p.m.* At the Institution, Great George Street, London, S.W.1. Paper entitled "Twelve Years' Operation of Electric Traction on the London, Brighton and South Coast Railway," by Mr. H. W. H. Richards.

Institution of Electrical Engineers (North-Western Centre).
7 *p.m.* At the Engineers' Club, Albert Square, Manchester. Lecture on "Electricity in the Home," by Mr. J. W. Beauchamp. (Ladies invited.)

Institute of Metals. (Birmingham Local Section).
7 *p.m.* At the Chamber of Commerce, New Street, Birmingham. Lecture on "X-Rays and Crystal Structure," by Dr. H. B. Keene.

Institution of Electrical Engineers (Scottish Centre).
7 *p.m.* At the North British Station Hotel, Edinburgh. Paper on "Domestic Load Building," by Mr. W. A. Gillott.

Institution of Electrical Engineers (East Midland Centre).
7 *p.m.* At University College, Nottingham. Paper entitled "Starters and Controllers for Electric Motors," by Mr. O. C. Dinerman.

Paisley Association of Electrical Engineers.
7.30 *p.m.* At the Palace Tea Rooms, 99, High Street, Paisley. Lecture on "Medical Aspects of Electricity," by Mr. Wm. Clow.

Electrical Society of Glasgow.
7.30 *p.m.* Lecture on "The Problem of the Small Consumer," by Mr. D. Berry

Institute of Metals (Scottish Local Section).
7.30 *p.m.* At 38, Elmbank Crescent, Glasgow. Lecture on "The Heat Treatment of some Industrial Non-Ferrous Alloys," by Prof. F. C. Thompson.

WEDNESDAY, JANUARY 10th.

Liverpool Engineering Society.
At the Royal Institution, Colquitt Street, Liverpool. Lecture on "Practical Ship Stability," by Mr. A. T. Wall.

North-East Coast Institution of Engineers and Shipbuilders.
At Newcastle-on-Tyne. Paper on "Turbines," by Mr. R. E. Kerr.

Institution of Electrical Engineers (South Midland Centre).
7 *p.m.* At the University, Birmingham. Paper on "Technical Research with special reference to Electrical Engineering Development," by Mr. W. Wilson.

The Industrial League and Council.
7.30 *p.m.* At Caxton Hall, Caxton Street, London, S.W.1. Lecture on "The Basis of Wages," by Mr. Tom Kennedy.

THURSDAY, JANUARY 11th.

Chelmsford Engineering Society.
7 *p.m.* At the East Anglian Institute of Agriculture. Students' Meeting.

Institution of Electrical Engineers (Dundee Sub-Centre).
7.30 *p.m.* At University College, Dundee. Lecture on "A Modern C.B. Telephone Exchange" (with lantern slides), by Mr. R. J. Lawson and Mr. S. D. Cawood.

FRIDAY, JANUARY 12th.

Institution of Heating and Ventilating Engineers.
7 *p.m.* At the Engineers' Club, Coventry Street, London. Lecture on "Automatic Temperature Control," by Mr. B. R. Wingfield.

Junior Institution of Engineers.
7.30 *p.m.* At 39, Victoria Street, London. Paper on "Transient Phenomena Arising in Transformers from Switching Operations," by Mr. S. A. Stigant.

Institution of Electrical Engineers (Scottish Centre). (Students' Section).
7.30 *p.m.* In Room 149, Royal Technical College, Glasgow. Lecture on "Air Driven Electric Generators," by Mr. W. Stirling.

Edinburgh Electrical Society.
8 *p.m.* At Philosophical Institute, 4, Queen Street, Edinburgh. Lecture entitled "Some Wireless Notes," by Mr. A. Whiteley.

The Editorial, Advertisement and Publishing Offices of "The Electrician" are at 8, Bouverie Street, London, E.C. 4. Telegrams: Benbrotric, Fleet, London. Telephone: City 9852 (6 lines). The subscription to "The Electrician" is £1 5 0 per annum in the United Kingdom and £1 10 0 per annum Abroad. Advertisement Rates can be obtained on application to the Manager. Advertisement copy and blocks should be received on the Friday preceding date of publication.

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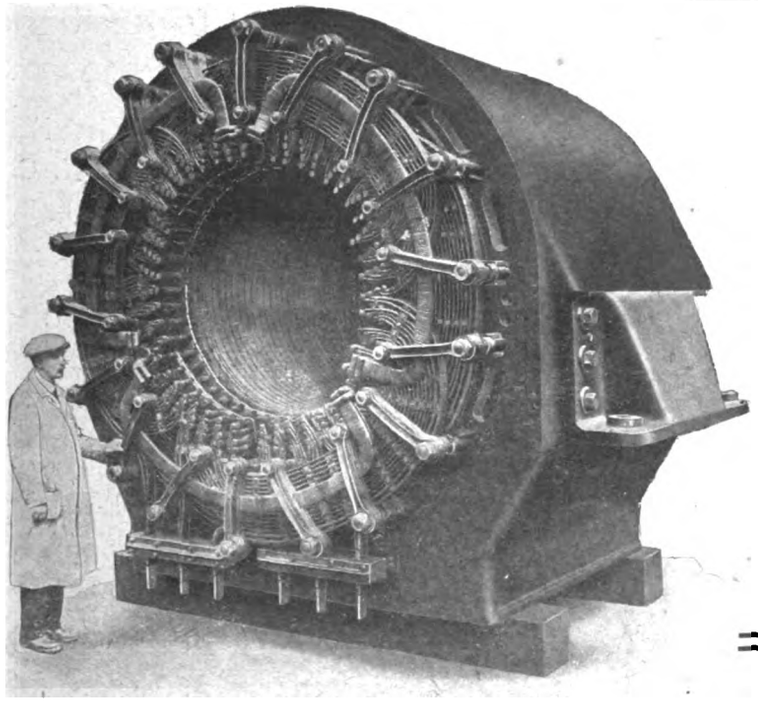

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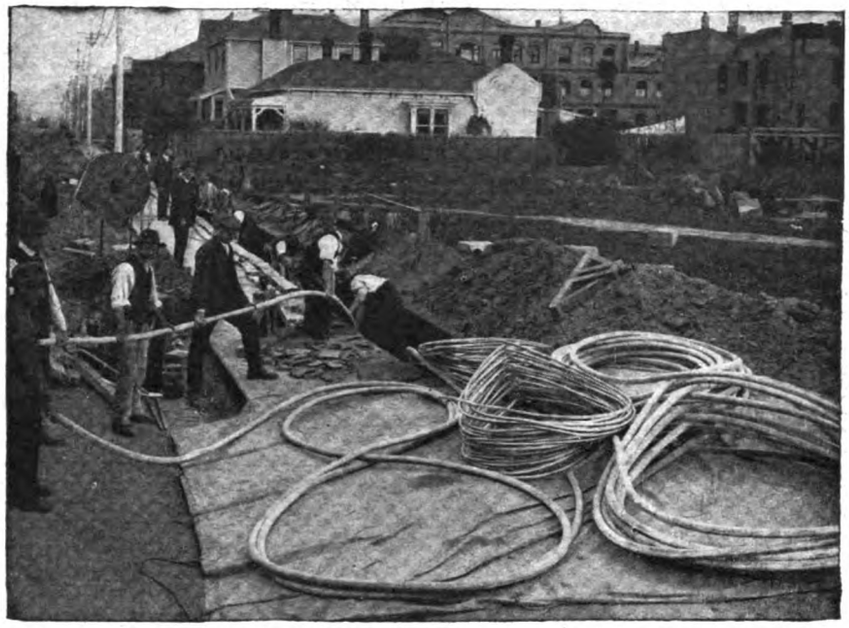

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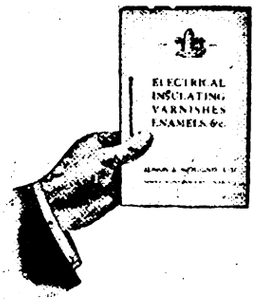

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CONTENTS.

Notes of the Week	27	Tasmanian Hydro-Electrics	45
1922—Some Technical Landmarks	29	Arc Regulation in Electric Furnaces	45
Notes on Wireless Matters. By Prof. G. W. O. Howe	30	Twentieth Century Cookery	45
Twelve Years of Electric Traction	31	I.E.E. Certificates and Diplomas	46
The Manufacture of Armour-Clad Switchgear. Illustrated	32	Calendars and Diaries	46
N.E. Midlands Electricity Inquiry	34	Association of Radio Manufacturers	46
Variable Speed Alternating Current Motors Without Commutators. By F. Creedy. Illustrated	35	Royal Warrant Holders	46
		Scottish Electricians' Wages	46
The Physical and Optical Societies' Annual Exhibition of Apparatus. Illustrated	37	Electricity Supply	47
		Electrical Progress in New Zealand	48
Mr. Beauchamp on Electrical Competition	38	Personal Items	48
Institution of Electrical Engineers	39	Imperial Notes	48
The Further Confessions of a Mere Buyer	39	Foreign Notes	48
Correspondence	40	Wireless News	49
British Electrical and Allied Industries Research Association	41	Electric Traction	49
Time Switch Development	41	Reference Index to Wireless Publications	50
Merchandise to Sell and Profit By. Illustrated	42	The Electrician Competition	51
Catalogues, Price Lists, etc.	43	Books Received	51
Patents Expiring in 1923	44	English Electric and Siemens Supplies	51
German Meters	44	Business Items	51
Electric Lifts	44	Companies' Meetings, Reports, etc.	52
Forthcoming I.E.E. Dinner	44	Tenders Invited and Accepted	52
Magnetic Separators	45	Commercial Intelligence	53
Aluminium in the Kitchen	45	Prices of Metals, Chemicals, etc.	53
Forty Years Ago	45	Patent Record	54
Institution Notes	45	Arrangements for the Week	54

Notes of the Week.

"The Electrician" All-Electric House.

We have been astonished at the number of applications we have received for the plans and conditions of competition for The Electrician All-Electric House. At the same time we feel sure that there are still many who would like, and ought, to go in for the competition, and who have not yet applied. We hope they will do so without delay, in order to give themselves as much time as possible for the preparation of their schemes. There is the more reason for this since success in this competition will not only mean monetary reward, but considerable *kudos*. For the prize-winning design is likely to be adopted as a standard in many of the "all-electric" houses which are now being built. We may support this argument by quoting a correspondent who informs us that he is building a house of exactly the same measurements and very similar in arrangement to The Electrician House. "The equipment," he says, "will, of course, be largely electrical, and I think that my own propositions would be suitable for entering in your competition." We congratulate our correspondent on his enterprise, and wish him every success. There are others who might follow his example.

Empire Wireless.

On Monday the Postmaster-General received a deputation from the Empire Press Union. This body desired to obtain a statement of the Government's policy with regard to Imperial Wireless Telegraphy. It received a good deal of sympathy, and a certain amount of information. The deputation's case, as presented by Lord Burnham, was, that owing to disagreement between the Government and the Dominions and the Government and certain private interests, a state of paralysis had set in, and, in spite of the vital importance of communication to the Empire, we were falling behind other countries in wireless matters. Complete and speedy agreement on the matters at issue was therefore urged. Mr. Neville Chamberlain, in reply, pointed out that Australia, South Africa and Canada had made their own arrangements, that it would be possible to communicate with them by employing less powerful stations than those scheduled for use in this country and that the inauguration of more powerful stations would not necessarily mean a corresponding increase in the time during which communications could be maintained. Upon the question of size the Government had not yet made up their minds, but they would do so soon, though the financial problem was a difficult one. There was no conflict between the Government and the Dominions. All this translated into plain language means that nothing has been done, and that the Dominions, like the Empire Press Union, have become tired of waiting. Fortunately there has been some technical progress and when the word to go is given we shall in this respect be in a better position than at any time since the controversy started.

Expiring Patents.

Elsewhere we give a list of the patents which will normally expire this year. On glancing through this list the reader will probably form the opinion that the electrical engineer in 1907 was quiescent, for there are not many patents of fundamental importance. Periods of rest, however, are desirable (or at least they occur) in most lines of activity, and we suppose that inventive energy is no exception. One of the most interesting patents is No. 13 417, describing the Cumberland process of preventing corrosion by applying an external e.m.f., as distinct from methods which utilise local action. This process is now used extensively for protecting boilers and condensers, but the present specification

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deals with the protection of marine propellers. In No. 14 262 S. G. BROWN obviates disturbances in the duplex working of cables by placing an inductance at the apex of the bridge. Early progress in metal filament lamps is brought to mind by patent No. 16 530, in which the B.T.-H. Co. protect the process of rendering tungsten ductile by heating it in air at a temperature below visible redness. The same company were evidently interested in electric heating, for in Patent No. 26 940 they protect a high-resistance refractory alloy of nickel, iron, chromium and manganese, which we presume in these days would be termed nichrome In Patent No. 21 271, EVERSHED and VIGNOLES describe the comparison of resistances (such as a tram-rail joint) by a deflectional instrument, the resistances being in series and being compared by the potential drops.

Wireless Patents.

It was in wireless telegraphy, however, that the year 1907 was the most fruitful. Thus, Patent No. 20 119 covers the well-known MARCONI spark discharger, consisting of a disc with studs on both sides, the disc being in rapid rotation so that the studs come in succession between electrodes of circular form, which are slowly rotated so as to bring new surfaces into action. A discharge takes place whenever the studs are between the electrodes. No. 4 593 is somewhat of the same nature. Patent No. 887 covers the use of a FLEMING valve in conjunction with a transformer for the reception of wireless signals; whilst No. 12 960 describes the MARCONI intermediate coupling circuit. The latter consists of two inductances in parallel across a condenser, the inductances being wound on a single slider so that the couplings with the aerial and receiving circuits can be varied simultaneously. Thus, simplicity in working is obtained, and at the same time more accurate tuning and freedom from interference is secured by loosely coupling the intermediate circuit. In Patent No. 21 299, BELLINI and TOSI describe their well-known system of directive wireless telegraphy, both for transmission and reception. American activity is noticeable in No. 18 842, in which PICKARD protects the use of silicon as a detector, and in No. 6 203, in which FESSENDEN describes the use of the heterodyne method of reception. In those days this method had a very limited application, but the advent of the triode valve has rendered it almost indispensable.

Too Much of a Good Thing.

THE number of stories whose moral is that it is possible to have too much of a good thing is legion, but we had not supposed that it would be possible to construct one on an electrical foundation. Mr. CREEDY has provided the opportunity. In his lecture on "Variable Speed Alternating Current Motors Without Commutators," which he delivered before the Institution of Electrical Engineers last week, he claimed for this type of machine that it not only produced no wattless current itself but would look after the wattless current produced by other less fortunate equipment. He also stated that he would have no difficulty in recommending a suitable variable-speed a.c. motor to meet any industrial conditions whatever. For many reasons we hope the day when this type of equipment is the rule rather than the exception is not far distant. But we may point out that when that day arrives its advantages as a power factor corrector will have disappeared. "When everyone is somebody then no one's anybody" is as true of a.c. motors as it is of human beings. And it may happen that in future as much ingenuity will have to be expended in getting rid of leading currents as to-day is spent in overcoming the disadvantages of those that lag.

Railway Organisation.

WE have all of us been made acquainted, by means of posters, newspaper articles, and other forms of propaganda, with the changes which took place in the organisation of the railway systems of the country at the beginning of the present year. But those who see in this reorganisation a greater chance for electric traction, and therefore for the opening of an era of more efficient working, are recommended to study the last two issues of "The Railway Gazette" before jumping to hasty conclusions. We have already called attention, in connection with the amalgamation of the London and North Western and Lancashire and Yorkshire Railways, to the subordination of the electrical engineering staffs to the mechanical engineer. This policy is apparently to be continued on the new London, Midland and Scottish Railway. Mr. GEO. HUGHES, formerly chief mechanical engineer of the Lancashire and Yorkshire Railway, becomes chief mechanical and electrical engineer of the entire group, with Col. H. E. O'BRIEN as electrical engineer. The present electrical engineering officers will continue to function pending final organisation, and the best we can hope is that that final organisation will recognise the importance of electrical engineering in modern railway working by establishing a separate electrical department, whose head will be directly responsible to the general manager.

Prospects of Stagnation.

IN the London and North Eastern group matters are still worse, for the claims of electrical engineering seem to have been ignored altogether. Sir VINCENT RAVEN, who though a mechanical engineer had decided electrical leanings, has retired, and the prospect of any great extension of electric traction may vanish with him. This is the more unfortunate, seeing that the section between York and Newcastle will be the first length of main line in this country to be converted, while the London suburban systems of the Great Northern and Great Eastern Railways would certainly be improved by electrification in more senses than one. In the Southern group the position is obscure. Apparently the existing officers are to hold their positions for a time, but the plethora of electrical systems, actual and proposed, will give rise to problems as important as the absence of any electrical system at all will do elsewhere. Only the Great Western group occupies a position of tranquillity which many must envy.

Finance as a Bar to Progress.

WHAT a wonderful world this would be for engineers if there were no finance. The best of material could be used in abundance, efficiencies (purely of the engineering kind) now only dreamed of could be obtained, and everyone would become fat and sleepy and lose all interest in their work. There is, perhaps fortunately, not the least chance of such a state of affairs coming to pass, but the speculation was engendered by a Paper on "The Commercial Economy of High Pressures and High Superheats in the Central Station," recently read by Mr. GEORGE ORROK before the American Society of Mechanical Engineers. He points out that the limitations of steam temperature are set at 750° by the properties of the materials available, but that manufacturers would be prepared to go considerably higher did not the extra fixed charges largely affect the fuel savings. In an article which we published recently it will be remembered that Mr. L. C. KEMP reached the same conclusion, showing that both temperature and pressure increases could only be obtained at a cost which might have an adverse effect on the balance sheet.

Technical Disadvantages of High Pressures.

BUT apart from economic reasons, higher pressures than those used at present have certain technical disadvantages. There is a considerable increase in the losses owing to gas escaping from the boiler surfaces, so that economisers or some other means of reclaiming the heat from the flue gas must be employed. But economisers seem rather unpopular at present. It is said (we hope we are violating no confidence) that they are not being used at North Tees and they are certainly not being employed at Gennevillers, where the alternating of air preheating has been adopted. Air preheaters, however, are not

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yet proved equipment, and should they be unsatisfactory the only method seems to be to use a regenerative cycle in which feed water between 300° and 400° enters an economiser, so considerably increasing the efficiency, especially at the higher pressures. At present, of course, high cost is the obstacle, but when the worth of the new idea is proved prices will fall. In any event, it is in this direction that a good deal of research might well be undertaken.

Who Leads?

OUR attitude towards the electrical contractor has always been one of puzzled pity rather than criticism. He is such an important link in the chain, perhaps, as he thinks, the most important link, but at times that link has shown a weakness whose cause is as distressing as it is difficult to determine. We are glad to see from an inspiring pronouncement in the current issue of the "Electrical Contractor" that this is to be changed. In organisation and in co-operation, it is claimed, the contractor has always led, and will continue to lead. But in the electrical army who leads is not so important as the spirit which inspires that leadership and the aims which influence every member. What matters, it may be said, who leads so long as we advance. *Palmam qui meruit ferat*—the contractor as well as any other.

1922—

Some Technical Landmarks.

As we stated last week 1922 was a year singularly lacking in engineering incident, and this statement is as true in the technical as in any other field. In this field doubtless the most spectacular occurrence was that of broadcasting, to which we have already referred, and with which Prof. HOWE deals at some length on another page of this issue. In an electric age such as we live in, novelties are not rarities; but most novelties are of a technical character, and scarcely appeal to the public in a popular sense. Broadcasting, however, forms not only a technical landmark, but a landmark in the truest sense of the term. Time was needed to get going in this country, but however irritating the delay it was well to take advantage of American experience and both avoid numerous troubles and regularise procedure. If "listening-in" is to become a permanent part of our daily life, two things must be kept in mind—first, the high quality of the subject matter of the programme; secondly, the technical excellence of reproduction. Second-rate performances, irritating ear-pieces, and gramophone-like scratchings are parasites which will not survive the initial enthusiasm.

Applications of the Thermionic Valve.

The thermionic valve has proved an even more remarkable discovery than many of its most ardent pioneers dreamed possible, but it is too early to expect to find it used for power transmission.

The valve has yet to be perfected, its cost reduced, and its life lengthened before high-tension transmission by its help can be thought of seriously. On the other hand, during the past year the study of high-tension phenomena has yielded further interesting results. There are now many three-phase lines worked at 100 to 220 kV; capacity effects are better understood; indeed, it is not improbable that means may be devised for suppressing many of the unpleasing phenomena of high-voltage alternating current by means of suitable devices, such as loading coils, etc.

Some Technical Advances on the Supply Side.

Linking-up has gone apace steadily, and engineers are more than ever concerned about the safety of their systems. The size of units can now satisfy most demands, and probably the 25 000 kVA unit at 3 000 revs. per min. will be standard for some time to come. Larger units and more extensive networks have been accompanied by stricter demands on the protective devices. Far-seeing engineers are looking for safety, however, in the machines themselves. Steel makers are learning how to make sound rotors and end covers. Machine builders are appreciating the need of constructing alternators that will not break down. Engineers will no longer allow water to be sprayed on windings by faulty cleaning devices, and many prefer to circulate a small quantity of air, and thus avoid serious consequences in case of fire. The tendency is to limit the use of protective devices to places which cannot be properly protected by careful construction and manufacture. Atmospheric disturbances, accidents, and short-circuits, are matters often outside human control, and provide legitimate applications for such equipment. Nevertheless, electrical systems show a decided tendency towards simplification—just as in other branches of engineering, elaborateness vanishes as perfection in manufacture of essential parts is approached.

Cable and Porcelain Manufacture.

Cable and porcelain manufacture continue to improve steadily. The fact that reliable cables for over 30 kV can be produced commercially deserves mention. It is also pleasing to note that as the shapes of porcelain insulators have been steadily improved, so their manufacture and testing has been conducted on more scientific lines. Indeed, recent specifications of porcelain insulators indicate much sound knowledge of the mechanical properties of ceramics.

Power Factor Improvement.

The problem of power factor improvement is not new, but the post-war impetus it received is well maintained. In this respect, the systems of tariffs introduced by large supply companies are having a decided effect. It may not be out of place to mention here the posthumous paper of Dr. G. KAPP, read at a recent meeting of the Institution of Electrical Engineers by Dr. MILES WALKER, wherein a fairly complete account of the whole subject is to be found.

Variable Speed A.C. Motors.

The variable speed a.c. motor keeps itself well to the fore. It was re-introduced at the beginning of 1922 by a kind of missionary lecture by Dr. S. PARKER SMITH, and this year opened with a similar effort from Mr. F. CREEDY. The multifarious ways of effecting economical speed control are now fairly well understood, and there is a growing demand for various types of motors or sets for attaining this end. Indeed, manufacturers only need a sufficient demand to justify standardisation in order to overcome the greatest obstacle—viz., high cost.

Electric Traction now Taken Seriously.

Turning for a moment to traction, it is increasingly evident that railway engineers are now taking the matter seriously to heart in this country. Hitherto Great Britain has been helpful in encouraging other countries to electrify their railways; *e.g.*, the scarcity and high price of British coal had much influence on Italy and Sweden in this connection, while Germany and Austria found their respective peace treaties good reasons for utilising water power or lignite for supplying railways with power. At the close of 1922, however, new works were already in hand around London, while further schemes are ready as soon as money is forthcoming. The battle of the systems, as it is called, is being waged as merrily as ever.

The Worst Feature of the Year.

Bad trade has been the worst feature of the year. Rightly or wrongly, political affairs, mainly abroad, are held to be responsible. All-round economy has made itself felt everywhere. The Post Office millions remain largely unspent, and automatic exchanges seem as far off as ever. Few years closed with stronger wishes and greater hopes than 1922, and at no time was the electrical industry better able to undertake a colossal amount of work.

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Notes on Wireless Matters.

Radio-Telegraphy in 1922.

By Prof. G. W. O. HOWE.

If we except broadcasting it cannot be said that there has been any very striking development in radio matters in 1922 in this country; in fact, we might almost say that there was a striking lack of development. After years of talking and squabbling about an Imperial Chain we had an Imperial Wireless Committee under the chairmanship of Sir Henry Norman; this committee duly reported and recommended the appointment of a small technical commission to work out the details. This commission, consisting of Dr. Eccles, Mr. Shaughnessy and Mr. L. B. Turner, devoted a great amount of time to the problem and issued a report containing definite suggestions and plans for the greater part of the proposed chain of stations.

All Not Well with Imperial Chain.

It may be that the scheme is being carried out according to programme, but if so, it is being done very quietly, and there is undoubtedly a feeling abroad that all is not well with the Imperial Chain. A weakness in the scheme was obvious from the reports of the Committee and Commission; to make it successful it was essential that the home authorities and the Colonial Administrations should co-operate and act in unison. It looks very much as if this essential co-operation has not been forthcoming, but that some of the Colonial Administrations have entered into direct negotiations with private companies which were openly antagonistic to the recommendations of the Committee, and have given contracts for the erection of stations for the establishment of communication with this country and with other Colonies.

The Commercial Radio International Committee.

One striking development in the international wireless situation during the past year has been the formation of the "Commercial Radio International Committee," including in this country the Marconi Company, with its many subsidiary companies in all parts of the world, such, for instance, as the Canadian Marconi Co. and the Amalgamated Company of Australia, in Germany the Telefunken Co. and the Goldschmidt Co., in France the Cie Générale and the Société Française Radioelectrique, in America the Radio Corporation, which is a combination of the American Marconi Co. and the General Electric Co. This powerful combination has formed a committee for the consideration of the problems involved in the extension of the world-wide radio network, and has already held meetings at Cannes, Paris and London. Such co-operation will become increasingly essential to avoid mutual interference and to utilise the available wave length range to the best advantage. It has been stated that the companies concerned will also co-operate in scientific research to overcome the difficulties due to atmospheric interference and other causes. This co-operation is very interesting in view of the different systems favoured by the different companies and should do much to further the development of reliable high-speed long distance radio communication.

The High-Power Spark Becomes Obsolete.

Of the various methods available for the generation of the high frequency current in a high-power station, the spark has become obsolete during the past year. The timed spark of Marconi as installed at Carnarvon and Stavanger, and the quenched spark at Nauen, were both brought to a high state of technical excellence but they were bound to be ultimately displaced by newer methods. We believe that they are all being replaced by alternators. For ordinary ship traffic the synchronous spark system has much to recommend it and is still the most commonly employed method of generating the high frequency current.

No Developments in Poulsen Arc.

No striking developments have taken place during the year in the Poulsen arc, but we understand that it has worked satisfactorily in the only link of our Imperial Chain which has so far been forged, viz., Leafield and Cairo. The arc is undoubtedly very suitable for those stations where it may be necessary to vary the wave length, since, the arc itself having no frequency controlling element, it is merely necessary to retune the aerial and the intermediate circuit if one be employed. It has, however, the serious disadvantage of requiring a method of signalling which disturbs the arc as little as possible and the usual method of varying the aerial inductance necessitates the keying of currents and voltages which make high speed signalling a difficult operation. Irregularity of operation and the production of harmonics are further disadvantages, and although we believe that tests have been made with the electrode shoe invented by Pedersen for improving the regularity, we do not know of any published results.

The All-Metal Valve.

Although we have not yet the all-metal thermionic high-power valve, considerable progress has been made in this direction. With glass bulbs the output is limited to 2 or 3 kW and even with silica bulbs 5 or 10 kW can only be obtained with great difficulty. The General Electric Co. (U.S.A.) have recently developed a compromise in their 20 kW valve which consists of a water-cooled copper cylinder closed at the top by means of a glass tube through which the leads are brought. The cylinder forms the anode inside which are the filament and grid; the filament takes 50 A at 20 V and the efficiency is about 70 per cent. The same company are developing a 100 kW valve of the same type, in addition to their "magnetron" which develops 1 000 kW at 20 000 cycles, but requires the "filament," which is 0·5 in. in diameter, to be supplied with 1 800 A at 10 000 cycles.

Little Progress in Reception.

In the reception of signals there has been an unusual dearth of devices which effectually prevent any interference due to atmospherics and this trouble is still the principal enemy of long distance communication.

Growth of Popular Interest.

The outstanding feature in this country has been the growth of popular interest in radio telephony in connection with the broadcasting boom. This interest was reflected in the shop windows at Christmas time by the display of broadcast receivers and accessories as suitable gifts. The difficulties which attended the formation of the Broadcasting Co. have been finally overcome after very protracted discussions between the various conflicting and competing interests, and several of the broadcasting stations are now operating. Much harm has been done to the movement by hastily improvised and imperfect transmission and still more harm by the demonstrations given at many exhibitions where, with the aid of much amplification and overworked loud speakers, sounds were produced which could only have the effect of frightening away prospective customers. Much complaint is also heard about interference both from Morse signals and from oscillating receivers. We fear that the latter difficulty is going to prove serious in spite of all precautions.

Radio telephony in its more restricted sense has made little headway. The Report of the Committee of the Radio Research Board appointed at the request of the Postmaster-General summarised very clearly the difficulties and disadvantages as compared with radio telegraphy and showed that, except in special circumstances, its costliness and lack of secrecy made its commercial development improbable. The broadcasting development will undoubtedly lead to the perfection of methods of modulation and reception which will be applicable to all branches of radio telephony.

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Twelve Years of Electric Traction.

Some Results on the Brighton Railway.

Almost exactly a year ago we gave an account of the thirteen years experience with electric traction which had been obtained on the Lancaster-Heysham branch of the Midland Railway. In a Paper which he read before the INSTITUTION OF CIVIL ENGINEERS on Tuesday, Mr. H. W. H. Richards performed the same function for the London, Brighton and South Coast Railway, the period covered being twelve years.

At the beginning of the Paper the author states that rapid development of electric traction had been prevented by the European war and, since its termination, by other factors. This period of comparative inaction, however, has permitted experience in practical operation to be gained, sometimes with unexpectedly heavy traffic under conditions of reduced facilities. Further, the detailed investigation carried out by the Ministry of Transport resulted in the whole question being reviewed from the broadest standpoint by all who are interested in electric traction.

In the case of the Brighton Railway the transport and consequent financial benefits which would probably result from electric traction were fully realised nearly 20 years ago, parliamentary powers for electrification being obtained in 1903; and since that date a scheme of electrification, intended to comprise finally both suburban and main-line operation, has been carried out. Certain important sections of the suburban lines have now been operated electrically on the h.t. single phase system, at 6 700 V, for about 12 years.

Engineering maintenance work does not usually excite much interest on the part of those not immediately concerned, except perhaps when something goes wrong, but in the case of electric traction further developments depend very much on conclusions drawn from practical operating experience. The author puts forward the following as main principles on which operation should be based: (1) The maximum reliability of equipment compatible with reasonable financial considerations; (2) the arrangement of renovation and general work so as to prevent undue fluctuation of costs, and (3) continual effort to improve the life or working of the equipment; and the following as measures calculated to assist in the application of these principles: (1) a group method of organisation for correctly allocating the costs of labour and material against the section concerned; (2) a clear division of all work under the two main headings of "running-maintenance" and "repairs" and (3) the preparation of graphic records and statistics of all results of practical operation and their circulation among the staff concerned.

The Paper deals with the operation of electric traction on the Brighton Railway on these lines.

Rolling Stock—Electrical Equipment.

The efficiency of the current-collector gear is of fundamental importance, a difficult matter when the contact-wire varies in height from 13 ft. 9 in. to 20 ft. and has occasional steep gradients. The original bow-gear is running to-day, with only slight modifications, on every motor-coach. The operating-springs are set to standard lengths at coach overhauls so as to maintain a pressure of 12 lb. on the bow-strip at a trolley-wire height of 16 ft.

As usual for motor-coach equipments, the control is of the multiple-unit type. There are three principal train-circuits, namely, h.t. main circuit at 6 700 V, l.t. power circuit at 450–750 V, and l.t. control circuit at 300 V. It is found that a new motor-man can obtain a working knowledge of the control system in 2 to 3 weeks. The presence of the h.t. chamber in the guards' compartment has caused no trouble.

The motors in use to-day are of the Winter-Eichberg single phase compensated repulsion type, designed about 15 years ago. Most of the motor troubles have been due to weakness in the mechanical design, and improvements have resulted in train defects being reduced by about 75 per cent. Split gears have been used hitherto with varying results, but gear-wheel and pinion lives of 250 000 miles have frequently been obtained. Solid gear-wheels of present-day manufacture should enable lives up to, or perhaps exceeding, 500 000 miles to be expected.

The transformers have so far been very satisfactory and reliable, only five defects having occurred among seventy-one transformers of the 310 kVA type, many of which have now reached 500 000 miles. After about 10 years' service the sheet insulation between the h.t. and the l.t. coils was renewed, and it is hoped that a considerable further life will accrue before further attention is required.

Rolling Stock—Mechanical Equipment.

In motor-coach bogies every effort should be made to keep all clearances down to the minimum practical limit of wear. For this purpose axle-box horn-cheeks have been fitted with U-shaped gun-metal liners, and similar attention has been given to all other points of wear, on bolsters, transoms, etc.

Good braking is of the utmost importance. The Westinghouse automatic air brake, combined with clasp brakes and an automatic slack-adjuster, enable an average deceleration of not less than 3 ft. per sec. to be maintained, and the brakes to be released within about 3 secs. Drivers' brake-valves are cleaned and greased in position once in three months, and triple valves once in six months.

The original decision to use "side-door compartment stock" has been completely justified by the operating results obtained. Trains can be emptied and filled at terminal stations in about the same time as the motor-man takes to walk from one end to the other. All the original slam locks of the safety-catch type, with internal operation, are still in use.

The voltage provided for train-lighting is 300 V, and four lamps are placed in series on each circuit. There are four 21 W lamps in each compartment, but on different circuits.

Repair Shops.

Repair-shop and car-shed facilities are limited, and it is important, therefore, that both general overhaul and inspection work should be kept strictly within the mileage limits fixed for each job. Further, detail inspection is done by day, once in three weeks, and night work is confined to indispensable electrical and mechanical examination. General overhaul of motor-coaches takes place at 60 000 miles, equivalent to eighteen months' running, and of trailer-coaches at 120 000 miles.

Electric Track Equipment.

In order that the current-collection by the bows may be good, considerable attention has been given to rendering the trolley-wire absolutely flexible at all points. It is also desirable to provide the overhead construction with such uniform strength and resistance to deterioration that inspection and minor repairs can be safely eliminated, and that renovation can be carried out in a wholesale and convenient manner, like the renewal of track, thus effecting the greatest economy. On sections where there is no steam traffic the renewal of catenary and dropper wires necessitated by corrosion is only about 10 per cent. of that on sections where a heavy steam traffic is still running. The rate of wear of the trolley-wire has been found to be almost directly proportional at any point to the amount of current collected there.

Two central distributing switch-cabins, with one attendant in each, together control the supply and distribution of energy to the whole 70 miles of electrified line. When necessary, the trolley-switches in local switch-cabins are operated by the staff at the station concerned in accordance with telephoned instructions from one of the central switch-cabins. As the whole line is divided into five group-sections, for which group-switches with instantaneous tripping are provided in the central switch-cabins, switch-gear operation and maintenance is chiefly confined to these group-switches. An advantage of high-tension distribution is that the difference between fault and normal currents is very marked, and the consequent automatic location of faults materially conduces to safety and reliability of operation.

Train-Driving.

The characteristic of the motors is such that the use of only five controller-steps increases the voltage in such a way as to obtain almost uniform acceleration until a comparatively high speed is reached. Motor-men change step by observing the value of the current indicated by an ammeter, and the points for shutting off current are marked by "coasting-boards" fixed at the side of the line. During 1921 the average energy consumption was 75·8 Wh per ton-mile, the train service being 5 959 737 coach-miles, with a distance between train-stops of 1·14 mile, an average running-speed of 24·36 miles per hour, and a schedule speed of 22·11 miles per hour including stops. A series of test runs was recently taken over a range of 0·4 mile to 9 miles between stops, from which it appeared that for the latter distance an average running-speed of 33·1 miles per hour could be obtained with an energy-consumption of only 40 Wh per ton-mile.

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The Manufacture of Armour-Clad Switchgear.

The Hebburn Works of Reyrolle and Co.—Some Historical Landmarks—Development of an Idea into an Ideal.

After a preliminary period of many attempts, many waverings and many failures, the manufacture of electrical switchgear seems now to have settled down along two well-defined lines : Armour-clad gear embodying the total enclosure of all conductors in earthed metal cases and cell structures of brick or stone housing supporting bare conductors and apparatus. Without entering into any discussion of the relative merits of these two systems, it may be pointed out that the former is essentially a British product and its development will always be closely associated with the name of Reyrolle and with that far-flung system which supplies electricity on the North-East Coast. But it is now many years ago since this localisation began to disappear. Stepney and Sheffield are early examples of stations not on the North-East Coast where ironclad gear was installed, while what has recently been done with this equipment at Glasgow (Dalmarnock), Sheffield (Blackburn Meadows) Birmingham (Nechells) and North Tees will be familiar to our readers. Progress has not been confined to this country, and contracts which have recently been obtained for the supply of armoured equipment to undertakings in Perth (Australia), Palmerston North (N.Z.), Cape Town, Salisbury (Rhodesia,) St. Auby (France), Retuo (Buenos Ayres), Singapore and Shanghai are sufficient indication that the advantages of this particular system are being realised abroad. In the case of the Australian plant, the equipment was actually manufactured in Australia by Australians.

Details of Manufacturing Processes.

This being so, it was with considerable interest that we recently paid a visit to REYROLLE and Co.'s works at Hebburn-on-Tyne, to see in detail the manufacturing processes by which this equipment is produced and the latest examples of the firm's output.

It is hardly necessary to say the present works have grown from small beginnings. Numerous extensions have from time to time been necessary, especially during the war. The site now covers over 5½ acres, on which is accommodated 3½ acres of buildings. The main works building is 200 ft. long by 200 ft. wide, and is divided into five bays, each being 40 ft. wide. These five shops are served by overhead cranes, and a standard railway track is run into the centre and side sections. The entire works are electrically driven.

The Machine and Assembly Shops.

In the machine shop is installed a great number of lathes, drills, shapers, slotting machines, and grinders. This section also contains a specially designed tool for drilling square holes and a planer-milling machine with a table 13 ft. 6 in. long by 5 ft. wide, capable of handling castings up to 15 tons. There is also a large double spindle vertical drilling machine, which has a radius of 7 ft., and is capable of drilling holes up to 3 in. diameter. Another tool of considerable interest is a grinding machine, 16 ft. long. The spindle of this machine carries a wheel 52 in. in diameter, into which carborundum segments, dovetailed in position, are inserted. This grinder is used to face up such surfaces as the steel top plates of switches and the faces of joints on the castings forming the chambers for busbars, switch panels and sealing bells. It is an indication of the care given to every detail of construction in the works. Its use ensures a perfectly tight joint, capable of retaining the compound with which the interior of the armour lining is filled.

In the large shop are carried out the operations of switchgear assembly, both of dovetailed parts and complete panels.

A Gargantuan Jig.

In the shops in which the h.t. switches are assembled, the jig equipment cannot fail to receive special attention. Large sums of money have been spent on these jigs, and they make it possible accurately to centre and align the switch contacts, the inter-connections and the busbars or any other conductors forming part of any particular panel or unit. Here, again, attention to detail is most noticeable, and is a further assurance of the reliability of the gear. Some idea of the size of these jigs may be gathered from the fact that the particular jig used for a 44 000 V 15 000 kW switch weighs five tons.

Assembly and Sound Engineering.

In the main gear assembly shop the simplicity of the armour-clad idea forces itself upon the visitor's attention. For interesting as are the details of the design, it is the assembled armour-clad panels that make it possible to realise how much thoroughly sound engineering work is put into the production. Throughout the whole of the assembly floor there are further evidences of, on the one hand, the solid design of the armour-clad gear, and on the other of its great flexibility in the matter of extension unit by unit. At the same time, in each assembled switch, particularly with hand operated switches, the care taken to protect the operator is made clear. Although in the case of the hand operated switch the operator may be standing within a few inches of extra high tension conductors there is no possibility of his receiving a shock, even deliberately. In the assembly shops also the interchangeability of the panel design becomes evident ; the complete unit—i.e., switch, transformers and busbars in one " suit " of armour—is arranged to be capable of withdrawal from the *live* busbars without risk of shock, without fear of arcing, and without any chance mistake on the part of the operator. Each panel is interchangeable with its neighbour of similar size ; when withdrawn from the busbars it can be wheeled away on a special switch truck for inspection or adjustment as may be required, apart from the main board and, of course, entirely disconnected from live conductors.

Testing Essentials.

The e.h.t. testing equipment of the works has been planned on lines which make it extremely difficult for any piece of apparatus to pass through with the slightest flaw. Transformer equipment is installed which gives a range of pressures up to 200 000 V, and this maximum pressure can be applied to any switch or section of gear with complete freedom from risk to the testing operator. Although the capital cost of this portion of the works is high, it is felt to be in every way justified. Obviously it has been necessary, because high test pressures in excess of the working pressure are specified by the purchaser, and the gear must be capable of standing up to the working pressure under normal and abnormal conditions.

New Testing Laboratory.

Arrangements are now completed for providing an entirely new testing laboratory, in which will be installed a transformer giving a testing range from 0 to 450 000 V. This transformer will be connected to an induction regulator which will be in turn connected to the Supply Company's mains. The combination will give a regulation on the primary side from 0 to 11 000 V, and correspondingly on the secondary side from zero to a maximum of 450 000 V.

The high tension testing section occupies a space of 120 ft. by 40 ft., and is served by a 5-ton overhead crane.

These shops are probably the largest of their kind in the country devoted exclusively to the production of specialised switchgear. Immediately adjoining this building is a packing department, a well-lighted building, into which a standard railway track is run, the packing floor being served by an overhead crane having a lifting capacity of 5 tons.

Insulating and Transformer Department.

At the north-west side of the site is a two-storey building, 242 ft. long by 40 ft. wide by 42 ft. high. The upper storey is reserved as an insulating and transformer department and for the production in large quantities of plugs and sockets up to 30 A capacity and other small repetition work. The ground floor is arranged for the fitting and assembly of mining type switchgear, and at one end of this shop is a section in which varnishing, black enamelling and stoving is carried out. By a recent extension, the space between this building and the main building has been roofed over, making an additional shop 242 ft. long by 25 ft. wide, which will permit of the provision of a separate department for the erection of control boards.

The pattern makers' and joiners' shop is in a separate building one storey high, and is 120 ft. long by 40 ft. wide. Its tool equipment includes planes, band saws, lathes, circular rip saws, etc., with the modern form of drive from motors fitted in a trench beneath the machines.

A few other small shops cover an area of about 30 000 sq. ft., which formed the original works, and are now used partly as stores and partly for light machine tool work.

The offices, which have recently been extended by 7 000 sq. ft. area, are roomy, well lighted, both by daylight and artificially, and are heated by hot water radiators, provision being made

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WHERE ARMOUR-CLAD SWITCHGEAR IS MADE.

1. A Group of Staff and Visitors near one of the Large Switches.
2. One of the Main Erecting Shops, showing Armour-clad Switchgear in course of Construction.
3. Another View in the Shops, showing Equipment in Various Stages of Manufacture.
4. A 33 000 V 400 A Class R Armoured Draw-Out Switch under Pressure Test in the Test Cubicle in the H.T. Test Room.

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in the wiring system for electric fires. The drawing office covers an area of 5 800 sq. ft.

An Outdoor Transformer.

The electrical energy for driving the works is supplied through a high tension feeder at 6 600 V from the three-phase system of the Newcastle Electric Supply Co. This feeder is brought through Reyrolle sealing bells into a 270 kW transformer of the outdoor type, situated in the yard, so that a test of the capabilities of equipment under the severest conditions is possible. The total consumption for lighting, power and heating is 2 900 kWh per day, part of this power being utilised in an electrically-equipped kitchen, from which meals are provided daily for the workmen and staff.

This cursory description gives a very inadequate idea of the organisation of the works. But it may be stated that widest use is made of jigs, special tools and other modern methods of construction. And this is considered essential in order that the equipment may perform adequately under both normal and abnormal conditions. The enormous amount of power that has to be dealt with in a very circumscribed space is sufficient guerdon of the necessity of this.

The works themselves are in fact an example of the persistent belief on the part of the makers of Reyrolle gear in the sound engineering of their job.

Away from Air Spacing.

If we were asked to describe in a word the distinguishing feature of Reyrolle's switchgear we should say, absence of air spacing. For the movement away from air spacing, which is typical of armour-clad equipment, is the most interesting incident in the progress of their designs. As is well-known, in Reyrolle's gear complete reliance is placed on well-tried insulating materials for the separation of one busbar from another and for the separation of the interconnecting conductors throughout the gear. This method enables the switchgear designer to enclose the entire gear in protective armour, either of cast iron or steel plate in accordance with the particular working requirements.

Making Switchgear Like a Cable.

There is no radical departure from standard practice in clothing any given conductor in suitable insulation and providing it with external metallic protection of one kind or another. The British cable industry furnishes abundant evidence of conductors working constantly at a pressure of 33 000 V with only 10 to 12 mm of insulation separating them. No one questions the employment of cables at such pressure. They are laid in the ground and practically forgotten. Similar confidence is placed in the insulating materials used in the windings of generators and in the primary and secondary windings of transformers; and in both cases an outer metallic armour is employed.

Given the requisite insulation, therefore, the armour-clad method, when applied to switchgear, is both logical and sound, and the reasons for its employment on generators and transformers can, with equal force, be applied to its use for h.t. and e.h.t. switchgear. To provide such protection at the generator, in the interconnecting and the transmission cables, and to omit it from the switchgear would be perhaps best described as illogical and the successful existence to-day of Reyrolle's works bears out the truth of this statement.

The Importance of Proper Insulation.

We have stressed the importance of insulation in the design and manufacture of armour-clad gear. The pre-eminent importance of the insulating materials employed in Reyrolle armour-clad designs is confirmed in the mind of the visitor in the departments in which these materials are subjected to searching tests. The wrapping of the conductors, ranging from wires of small section to heavy rectangular laminated busbars, is undertaken with as much care as the windings of a turbo-generator or the h.t. coils of a heavy duty transformer. Similar care is bestowed upon the insulating of all susidiary parts, such as current and potential transformers, which must function at the normal working pressures of the gear and be equally immune from breakdown.

Space Economy.

In many of the older power-houses and sub-stations the switchgear occupies a large amount of valuable space. The introduction of armour-clad gear will, it is claimed, effect great economies in this direction. A comparison of the plans of a modern power-house with one of fifteen years ago shows a marked decrease in the size of the room containing the generating plant. Boiler and economiser houses undergo practically no change, and down to 1914 the switch house had tended to grow in size quite out of proportion to its importance. The use of duplicate busbars, of remote control switches and selectors and protective gear had, with the brick cubicle type of gear, resulted in the control equipment occupying a greater floor area than the generating plant itself.

The Question of Cost.

It is not difficult, makers claim, to capitalise the advantages accruing from the employment of armour-clad control gears. At first sight it may be thought that the initial cost of such an equipment would be higher than that of the brick cubicle pattern. However, taking into consideration the immense saving in floor space and the saving due to mass production of standard parts with the most efficient machine tools, it is contended that there is little margin in the matter of initial costs. The increase in reliability with the modern type of gear is sufficiently great to justify a higher capital outlay. It might be argued that no price is too high to pay for assured reliability of supply. The British distribution engineer will pay high prices to install e.h.t. cables in preference to air lines, and experience has proved that the increased reliability has been worth the added cost.

Switchgear Without Buildings.

Another important point to notice with the extension of power supply into country districts is that armour-clad gear renders the use of high tension control gear out-of-doors absolutely safe, while complete panels can be built up and added to from time to time on the unit system. A simple adjustment of the busbars enables an additional panel to be introduced in the shortest possible time and with the minimum disturbance of the existing board. This flexibility is another important engineering feature of armour-clad control equipment. It has proved one of its chief attractions to central station men, and has been the means of its introduction in competition with all other types.

Conclusion.

It was at one time believed that switchgear construction was a simple matter involving the stringing on to an enamelled iron framework of a few oil switches and their accessories. It was even doubted that there could be any engineering work at all in switchgear production. The works and products of Reyrolle present a succession of facts which contradict these ideas. Reyrolle armour-clad gear complete in the assembly shops or erected in central or sub-stations, is a striking witness to the genius and doggedness of British engineers. It completes the work of the turbo-generator builder and that of the constructor of large transformers; in other words, it puts the switchgear upon the same level of durability and efficiency. Such are the impressions conveyed by switchgear of the Reyrolle armour-clad type and by an inspection of the works in which they are produced.

N.E. Midlands Electricity Inquiry.

Sheffield Views on the Proposed Joint Authority.

A special committee of the Sheffield Corporation has been dealing with matters arising out of the inquiry held there last month by the Electricity Commissioners. (See THE ELECTRICIAN, December 8th, p. 669, and December 15th, p. 694.) A report issued by the Special Committee states: "During the proceedings at the inquiry, the Commissioners invited the Corporations of Sheffield and Rotherham to consider the desirability of transferring or leasing to the proposed Joint Electricity Authority, when established, their respective generating stations and main transmission lines, and to state on what terms they would be prepared to do so. Your sub-committee have given consideration to this proposal and have conferred thereon with a special committee of the Rotherham Corporation. Instructions have been given to the Town Clerks and Electricity Engineers of the two Corporations to prepare a report on the question. In the meantime, the Commissioners have been informed that until their decision on certain questions of principle, particularly as to the area to be administered by the proposed Electricity Authority, and the representation on such authority of the two Corporations has been announced, it is not possible to give a definite reply to their inquiry, and further that the two Councils must be consulted and their instructions obtained before any binding arrangement can be entered into with respect to the question raised by the Commissioners."

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Variable Speed Alternating Current Motors Without Commutators*

By F. CREEDY.

The polyphase a.c. system will doubtless be ultimately adopted universally for power supply on a large scale, but the provision of a satisfactory variable-speed motor, preferably usable on h.t. circuits without transformation has been a difficulty. Applications of variable-speed motors vary widely. In speed-range most practical applications are covered by a range of 3 to 1 ; but ranges of 2 to 1 and 1·5 to 1 are in demand. Gradual variation over these ranges is desirable. Speed-stops should not be less than 4 to 6 in a range of 3 to 1. In some cases motors must be able to start with a high torque, and speed must be changeable under load and the change effected without serious shock. First cost of equipment and upkeep must be moderate and repairs easily executed. High efficiency and low wattless consumption are also desirable. In most cases the motor should give constant torque at all speeds, or horse power proportional to speed. For some machine tools, however, constant horse power is desirable.

Imitations of d.c. Machines.

Such requirements may be met by imitating the d.c. machine. But it is desirable to retain the simplicity and robustness of the polyphase induction motor and yet meet the above requirements. Commutator machines are the right type (1) on constant speed work where size of commutator and brush gear can be kept within due limits, (2) on very low frequency circuits where similar possibilities exist, and (3)

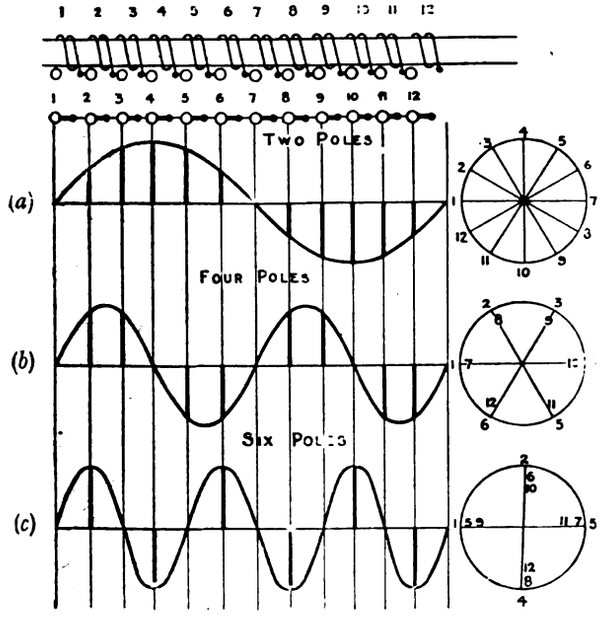

FIG. 1.

where there is an imperative demand for continuously adjustable speed justifying sacrifices in other directions.

Methods of controlling induction motors so as to obtain variable speed shunt characteristics follow two main lines of development:—(1) Alteration of the number of poles and (2) Cascade operation.

Speed Change by Changing the Number of Poles.

A few years ago speed changing by the number of poles appeared visionary, but it has now led to useful machines. On a frequency of 50 between 375 and 1 000 revs. per min. there are six numbers of poles available. We might use a ring-winding tapped at various points, but this involves formidable switchgear and is inconvenient from the manufacturing standpoint. There are also difficulties in design. With constant voltage per section we get a constant horse power characteristic which is not what is demanded, and some means must be adopted to increase voltage per section in proportion to speed.

* Abstract of a lecture delivered before The Institution of Electrical Engineers.

A Fundamental Problem.

The problem was only solved gradually. In order to avoid the large number of terminals the method of pole-changing illustrated in Figs. 1 and 2 was adopted. The ring winding in Fig. 1 is divided into 12 sections, each of two turns. The beginning of each section is denoted by a white circle, the end by a smaller block circle. Instantaneous currents are plotted below, (*a*) corresponding to two poles, (*c*) to six. Fig. 2 shows connections for 13 phases. This involves the use of a phase converter which, however, is simple in design and a great improvement on the complex switchgear avoided. However, the number of terminals (30 in the case of six poles) was still too great. Now if two sections which are opposite in phase are mutually reversed and connected in series or aparrallel they can be supplied from a single terminal. Thus in Fig. 1, sections 1 and 7, 2 and 8, etc., may be so treated. Connecting all sections in star 12 terminals are needed to give 2 poles ; connecting opposite sections in series only 6 are needed. But again a difficulty arose. It was found that the simplification in transformation would complicate the switching. However,

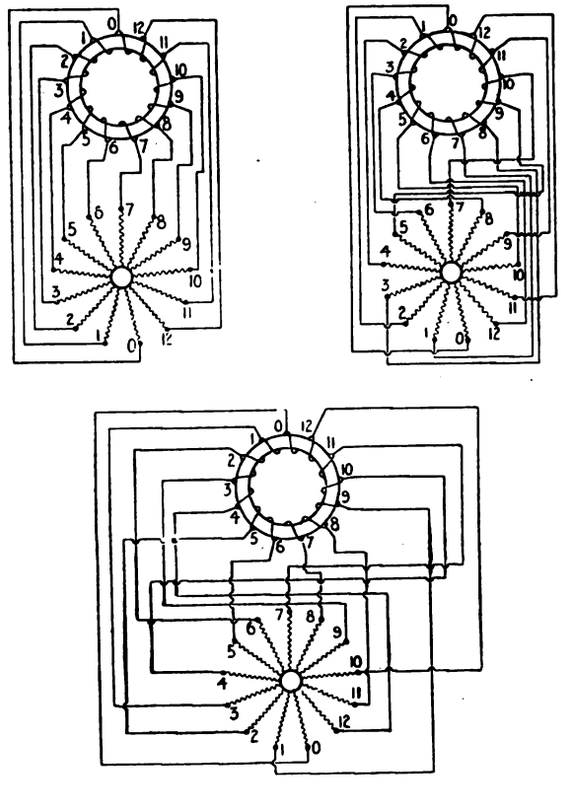

FIG. 2.

the method of reversal and star-mesh method may be combined leading to windings in which the e.m.f. across the section has four times as many phases as that supplied to the terminals. A winding was ultimately found enabling this to be done, not on one number of poles only but on over a large series of numbers covering a speed range of 3 to 1 or more, without reconnecting the winding in any way when changing the poles. Such a winding is shown in Fig. 3, where 18 out of 36 sections are connected in mesh and an equal number in star to the angle of the mesh. Alternate sections in mesh and in star are mutually reversed, the mesh sections alternating with star sections all round the circumference. This winding, containing only 18 terminals, can be used for all numbers of poles from 6 to 16, and, with a slight modification, for further numbers from 20 to 26. Where only odd numbers of poles are required a winding having only 9 terminals and capable of operating on 2, 6, 10 and 14 poles (or on 22 and 26) can be obtained.

The Phase Converter.

The author next describes the phase converter, a device necessary in operating from a supply not having more than three phases but not needed in certain cases (as in ship pro-

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pulsion), when a single motor is operated from a generator which serves no other purpose. Further simplification is possible by limiting the number of phases to multiples of three, and the transformer does not differ externally from a standard three-core type. By using the apparatus as an auto-transformer the whole of the primary windings may be abolished and the copper reduced to half. Moreover the primary and secondary windings flowing in opposite directions in the same windings give a resultant which is materially less than the secondary current alone. A phase transformer transforming from 3 to 9 or 18 phases requires only 30 to 40 per cent. of the rating of a transformer converting the same amount of power from one voltage to another. In fact, owing to certain other circumstances the rating can

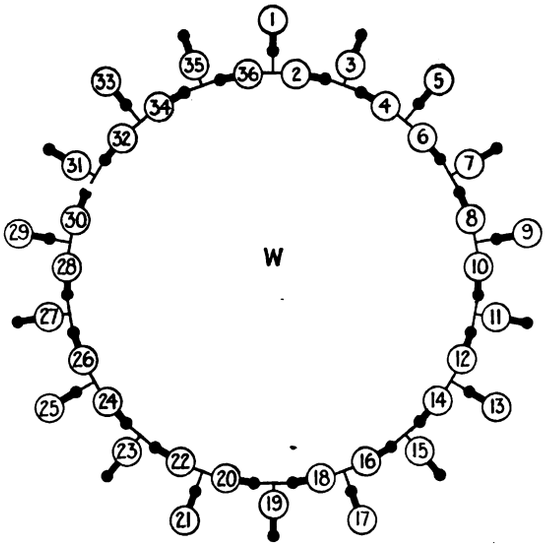

FIG. 3.

be reduced in practice to only 18 to 20 per cent. A diagram illustrating conditions for up-to-date nine-phase and eighteen-phase transformers being made by the Metropolitan-Vickers Co. for use with these machines is given in the original paper.

Controller Features.

Controllers are next described. These naturally vary according to different speed combinations. The following rule applies to three-phase circuits :—" A three-phase multi-speed motor for any number of speeds up to six will require three times as many terminals as there are speeds." Combinations covering practically all that is needed for industrial purposes are available. In Fig. 4 are assembled a series of speed torque curves giving one example of each combination.

Characteristics of the Motors.

The characteristics of the motors are next discussed. Squirrel cage motors of the multi-speed type find a much greater field of utility than when used on a single speed, since the chief drawback, *i.e.*, as regards starting current, is almost completely overcome in the multi-speed form. In squirrel cage motors having a speed range of two to one or more it is always possible to have full load starting torque with not more than twice full-load current, but if switched direct on to the line the larger machines take much greater currents and give correspondingly greater torques. Hence in such cases an auto-transformer is necessary. Current rush on changing speed and rate of acceleration are under strict control by the use of primary resistance in series with the motor. By substituting an auto-transformer for a resistance the maximum surge may be reduced to one half and on high speeds is desirable.

Performance Curves.

A rotor winding for a machine having any number of speeds giving genuine slip-ring control up to one of these speeds may be electrified. Methods of achieving this are described and the operation of starting such motors explained. A series of curves for efficiency, power factor and slip for a 70 H.P. motor, arranged to give all numbers of poles from 8 to 16, are presented. Similar curves for machines fitted with a normal low resistance rotor as commonly used in slip-squirrel-cage machines are also given. Generally speaking the efficiency remains nearly the same at all speeds ; there is a slight reduction at low speeds, but in the larger sizes this will not exceed about 5 per cent. The power factor is more variable, but in the larger machines this will not alter by more than 10 per cent. These machines absorb a constant amount of wattless current at all speeds.

The Cascade Motor.

Cascade machines have been several times described and only need brief reference. They have the great advantage that one can obtain not only two efficient speeds but also resistence control from standstill to the lower and from the lower to the top speed. The method of effecting this is familiar. The final result is a motor having only a single winding for each member, the stator being connected on the one hand to the line as a primary winding and on the other to a starter the resistance of which is gradually cut out in bringing the machine from standstill to cascade speed. On further short circuiting of the resistance across the slip-rings the motor rises from cascade to its maximum speed. Alternatively both sets of slip-rings may be on the one rotor, thus obtaining for a particular combination of numbers of poles a machine with six slip-rings, the same number as are required in the cascade set. Such " internal " cascade machines were until recently limited to the use of a series of 12, 18, 24 . . . poles and to two definite speed ratios, viz., 3-2 and 3-1. These limitations have now been overcome. Machines can be built the lowest speeds of which correspond to any number of poles exceeding six and having, in theory, any desired range of speed. The rule applying to such machines is as follows :—A motor to give top speed corresponding to M poles and bottom speed corresponding to (M+N) poles will have a number of slip-rings equal to (M+N) / (G.C.M. of M. and N).

By combining the cascade method and the pole-changing method machines may be built for three or more speeds. Large low-speed motors having suitable speed-ratios, *e.g.*, 187/150/125 revs. per min., are very advantageous in rolling mills. The principle may be extended to machines of four or more speeds such as 750/500/375/300 revs. per min.

Some Conclusions.

The characteristics of variable speed alternating current motors without commutators are summarised as follows :—

(1) A large variety of combinations is available, giving speeds up to five (or six with a panel-type controller), all capable of control by simple types of drum controller and some of being built economically down to 2 or 3 H.P.

These have the main characteristics of machines with short-circuited secondaries, but will start full-load torque with not more than twice full-load current. The rate of acceleration in changing speed under full load is under exact control by simple means.

(2) A slip-ring type of motor capable of any number of speeds up to six and of accelerating under 2–2½ times full-load torque from standstill to any of such speeds.

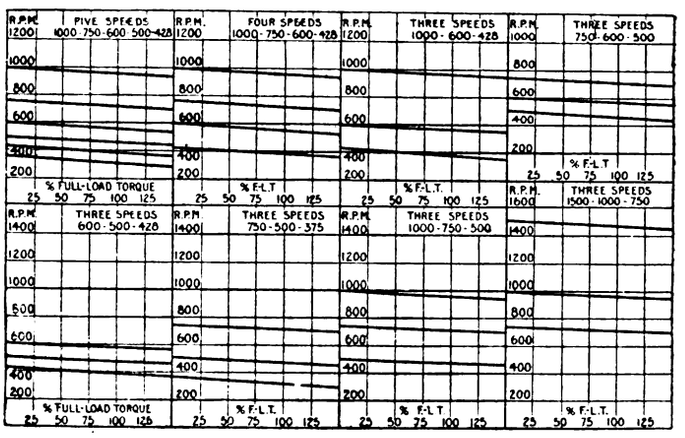

FIG. 4.

(3) The two-speed cascade motor capable of accelerating from standstill to its lowest speed under 2–2½ times full-load torque by resistance control, and then rising from its lower to its higher speed by short-circuiting a resistance connected across the slip-rings. These two speeds may have practically any desired ratio. Speed-change is here effected without opening the stator circuit.

(4) A multi-speed cascade machine capable of starting and accelerating to its lowest speed in the manner described and then of rising from that speed to any one of its other speeds on short-circuiting the slip-rings.

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Some Recent Physical Apparatus.

An Interesting Exhibition at South Kensington.

The thirteenth annual exhibition of physical apparatus was held by the Physical and Optical Societies on Wednesday and Thursday of last week at the Imperial College of Science, South Kensington, and was largely patronised. Exhibits were shown by over fifty firms, and there was therefore a great deal to be seen. On the other hand, as compared with many previous exhibitions, there was not so much of striking novelty.

TWO USEFUL DISCOURSES.

A discourse was given by Prof. E. G. Coker, F.R.S., on "Recent Photo-Elastic Researches on Engineering Problems." These researches, which are familiar to most engineers, are important and throw much new light on complicated stresses. The lantern slides of moving gearing and of cutting tools in use were particularly beautiful. A discourse was also given by Mr. W. Gamble on the "Reproduction of Colour by Photographic Processes."

Fig. 1.—View of Moullin Voltmeter.

CAMBRIDGE AND PAUL INSTRUMENT CO.

Among the many interesting apparatus shown by the Cambridge and Paul Instrument Co. perhaps the high-speed micro-indicator, due to Mr. W. G. Collins, attracted the most attention. The difficulties experienced in taking diagrams of high-speed engines is well known. Even at a speed of 500 revs. per min. care has to be taken to reduce as far as possible the inertia of the moving parts of the indicator. These difficulties become very great at speeds such as 1 000 revs. per min. Consequently optical methods have been adopted in obtaining diagrams of petrol engines running at these and higher speeds. Mr. Collins has sought to overcome this difficulty by reducing the size of the diagram so that it is, say, 3 mm. in length and 2·5 mm. in height. The instrument is still of the cylinder and piston type, but the vertical movement of the piston deflects a strong triangular spring carrying a stylus. At the moment of making a diagram this stylus is brought into contact with a disc of transparent celluloid, producing not a scratch, but an indented line, and the diagram so obtained can be conveniently examined under a microscope which is turned towards any source of light. The instrument is electrically controlled, and the stylus is removed from contact after not more than two revolutions. By means of a ratchet connected to a Bowden wire, the disc can be rotated so that the separate diagrams may be taken in rapid succession. The device was shown in action on a high-speed petrol engine.

The Moullin Voltmeter.

The Moullin voltmeter, which was described in a paper recently read before the Institution of Electrical Engineers, was also shown. It depends for its action on the rectifying properties of a triode valve. Many difficulties are experienced in measuring small voltages at high frequencies by ordinary means. The windings of a dynamometer instrument introduce a prohibitive amount of impedance. On the other hand, an electrostatic instrument, besides being insensitive, possesses a capacity which is comparable with the capacities already in the high-frequency circuits. Thus such instruments disturb considerably the conditions to be observed. The Moullin voltmeter has the advantage that it absorbs no power from the circuit, has a negligible capacity, and is unaffected by changes in frequency. The way in which the voltmeter is used depends upon the particular valve characteristics that are utilised, but these cannot be set out in this article. Under certain conditions the voltmeter is inserted in the anode circuit without any applied anode potential. Under other conditions it is more convenient to use the voltmeter in the anode circuit, which includes the usual high-tension battery. In either case the voltmeter is arranged to indicate voltages directly and the alternating voltage to be measured is applied between the grid and filament. Fig. 1 shows one of these voltmeters for the latter arrangement.

The Galitzen Seismograph.

The Galitzen seismograph appears to be a new departure and is developed so that the records can be obtained at a distance from the instrument. It consists essentially of a pendulum having a vertical or horizontal movement according to the components which have to be observed. The end of the pendulum carries four coils which move between the poles of a pair of permanent magnets. Any movement of the pendulum thus creats an e.m.f. in the coils, and this e.m.f. is observed by a reflecting galvanometer and is recorded on a photographic drum. Fig. 2 shows the construction of the instrument for the vertical component.

THE WESTON ELECTRICAL INSTRUMENT CO.

Among the instruments shown by the Weston Electrical Instrument Co. we noticed a new line of alternating milliammeters from a range of 75 mA and upwards for the full-scale deflection. The resistance for this lowest range is 211 O. A multi-range current transformer was also shown of small size and weighing only 6¼ lb. This has three primary ranges of 10, 20 and 40 A respectively. The secondary has a range of 5 A. The core of the transformer has an opening through which one turn of a primary gives a range of 800 A, two turns 400 A and so on. The transformer is wood-cased and is a handy piece of apparatus.

J. J. GRIFFIN & SONS.

J. J. Griffin and Sons showed a modified Tucker high-tension battery in which the paraffin-wax hitherto used has been replaced by porcelain. This makes a much more satisfactory instrument. This apparatus is supplied in units of 260 cells at the price of £13 10s. They are quite small and can be conveniently put one above another. We also noticed a bomb calorimeter at a reasonable price, and a gyrostat wheel having the frame fitted with vibrating reeds for giving an indication of the speed. The wheel is made slightly out of balance, and the vibrations are picked up by one reed after another as the speed falls. It is an instructive little device for educational purposes.

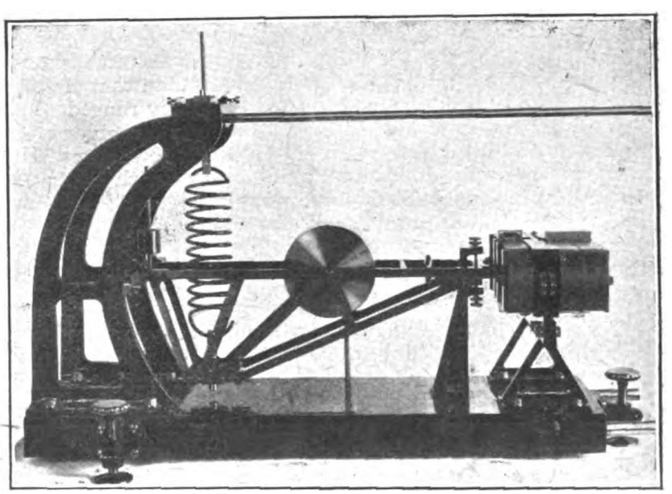

Fig. 2.- The Galitzen Electrical Seismograph.

(To be concluded.)

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Mr. Beauchamp on Electrical Competition.

At the Salesmanship Conference organised by the Electrical Development Association held on Friday last, Mr. J. W. BEAUCHAMP gave a lecture on the "Competition between Electricity and other forms of Heat and Power."

More Support for E.D.A.

Capt. R. S. HILTON, of the Metropolitan-Vickers Electrical Co., who was in the chair, expressed satisfaction that these conferences were being extended into the provinces, and said that in his opinion the work of E.D.A. was only just beginning. It was possible for the industry to give much larger subscriptions to the funds of that body than were now being given. On the selling side of the industry it was necessary to take the big view. In the past, too much had been made of gas *versus* electricity when it came to cooking a leg of mutton, but he thought the electrical industry had too fine a heritage to waste time on details of that kind. The point was to get the consumer dissatisfied with what he had been using hitherto, and in that respect they had a fine thing to dispose of in electricity.

The Salesman's Reply to Customers' Arguments.

Mr. J. W. BEAUCHAMP said that although in the previous conferences a great deal of attention had been given to "Selling the Electric Idea," it might be worth while to devote one evening to discussing how a salesman should reply when challenged by competitors or by prospective consumers, armed with arguments obtained from sellers of gas or fuel. The thing to remember was that in electricity they were offering not a substitute, but an entirely new method, and it was their business to study the best way of presenting the problem to the public from this new point of view.

Some Arguments for Electric Lighting.

In urging the use of electricity for lighting, there was the beauty, the efficiency, the thousand and one special applications of electric light, the use of reflectors, refractors, and the many special illuminating devices to insist upon, all of which arose from the special characteristics of the electric lamp. There was also the absence of flame, smoke, relative coolness, and concentration of light on a small area. In every town in the country they were confronted with statements or leaflets from the gas undertakings showing comparisons in cost, and he would like to give a few points to assist the salesman in answering the arguments usually put forward. It was usually said that gas was so many times cheaper than electric light, and the modern low-pressure incandescent gasfitting was said to give 70 c.p. for a consumption of 2¾ cub. ft. of gas per hour. The average was nearer 50 c.p. for 3 cub. ft., because there was no mention of the by-pass, which might easily add 25 per cent. to the actual gas consumption.

With high-pressure gas lighting practical tests showed the consumption to be 75 per cent. greater than that claimed, but in this branch the competition generally ranged round light distribution, the angle at which the light was given off, or in which it could be re-directed. In all these matters there were much greater difficulties with gas than with electricity. In industrial applications there were the questions of dust and steam and, in the open, the weather. With gas at 5s. per thousand cub. ft. and electricity at 7d. or 8d. per kWh there was nothing to fear.

Electric Power Considerations.

There were also a chain of arguments in favour of electric power which had nothing to do with cost. The great point to remember was that the actual cost of the unit frequently meant little or nothing as regards the total cost of manufacture of any article. As compared with driving by a steam or gas engine, motors enabled a manufacturer to cut out skilled attention, reduce noise, possible complaints from neighbours, risk of fire and accident, smell and bad air, loss of power in transmission, and, last but not least, the worry of producing power himself.

Thermal Efficiency not the Deciding Factor in Heating.

Probably the most interesting application at the present time was the use of electricity for heating. Here, again, it was being manifested that in 80 per cent. of the cases thermal efficiency was not the deciding factor. In industry there was an enormous field for electric heating, in which the incidental advantages which followed were of far greater importance than cost. For instance, in heat treatment processes electricity was telling us more than we ever knew about the influence of heat on metals. There was also the immense advantage due to the ability to measure exactly the facility with which the heat could be localised, or even generated within the object to be heated, and the absence of combustion and need for air, elimination of smoke, ash, etc. The development of industrial heating had not received the attention it deserved.

Electric Heating in the Home.

Great success was attending the use of electric heating for the home, and in some places the electric fire load was even embarrassing in the cold weather. The question for immediate consideration here was to keep closer to the consumer, give more and better advice, and so far as possible prevent him from buying appliances which would not give satisfaction at the current rates in the different districts. The layman had the most "woolly" ideas with regard to heat considered quantitatively. He had no conception of the amount of electricity, coal or gas required to do a certain amount of heating work over a certain period.

There was a large business to be done with the occasional heater, sold on its merits for particular purposes, where it would be a success—for instance, in bath and dressing rooms. For this purpose it was possible to show a customer exactly the amount of comfort he could have for so many pence per day or week.

Starting from the Right Point of View.

For more serious and long hour work, it might be necessary to put forward proposals for a mixture of hot water or fire heating and electricity, and they need not hesitate to do that. To be successful in either direction, however, they must start the customer from the right point of view. It was useless to talk of price per unit and how many units an apparatus took. The point must be brought out that for two half-hours a day he could obtain considerable comfort at a small cost. If it were put in this way, and the cost suggested, say 7d. per week, then it made an impression upon the customer. But they should be perfectly fair in letting the man know that the same apparatus used all day in the living room would be considerably more expensive than coal.

Cooking the Most Interesting Line.

Possibly the most interesting line of domestic work before us at the present time was the introduction of electric cookery. There was an immense business here for the supply undertaking, manufacturer and the contractor. It was necessary in most cases that there should be means for hiring out the cooker and that the rate for electricity should be fairly competitive with gas, although it certainly need not be as cheap as gas. Here again he urged them to study the method of presenting the idea to the public. It must be made clear that they were not endeavouring to do with a piece of red-hot wire what was now done with coal or gas, but that an endeavour was being made to demonstrate a change in the whole practice of kitchen management, that one of the most important operations in the house was being made almost automatic, enabling a widening of the menu without difficulty, and generally altering the whole aspect of preparing food.

Selling Confidence.

The principal thing they had to sell was confidence, because if they sold goods and the customers were not altogether satisfied, they had not sold properly. That was important in the electrical business, because their transactions with the public were never completed. The main idea with regard to apparatus should be—"Will the customer be able to use it year in and year out without finding it too expensive?" That depended upon the article, the amount of use per year and the price per unit. Therefore, it was essential to have regard to the use to which the apparatus was put, the circumstances in which it was used and the price per unit. At previous meetings they had often been asked to use electric stuff themselves. There was no doubt that if they all used as much electrical apparatus as they could in their homes and business premises they would be in a much better position to deal with their customers, because they would know what was wanted and what the results to be obtained were. Having got a more or less electrified house themselves, they should go out and sell to their neighbours right up to that limit. In most districts they would find a market.

The lecture was followed by a short discussion.

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Institution of Electrical Engineers.

A Tribute to Sir John Gavey.

At the meeting of the INSTITUTION OF ELECTRICAL ENGINEERS on Thursday, January 4th, the PRESIDENT referred to the death of Sir John Gavey. He recalled that Sir John had joined the Institution only one year after its foundation in 1872, and having passed from Associate Membership to full Membership, had served on the Council for a number of years and had been President in 1905-6. Sir John Gavey was, said Mr. Gill, a very active member and had read no fewer than five papers before the Institution. When he became engineer-in-chief to the Post Office in 1901, Sir John had previously conducted for the Post Office the great work of valuation of the trunk lines, and was also responsible subsequently for many of the broad decisions which the Post Office took in regard to the final purchase of the National Telephone Company's undertaking. Everybody who knew Sir John Gavey had the greatest regard for his fairness, ability, broad-mindedness and determination. A resolution of condolence had been sent, and he would ask the meeting to confirm that by standing.

MR. GILL then called upon Mr. F. Creedy to read a paper on "Variable-Speed Alternating-Current Motors without Commutators," an abstract of which will be found on p. 35 of this issue.

DISCUSSION.

Mr. L. J. HUNT said it was a remarkable fact that the winding which had made practicable the building of cascade motors was apparently also the best winding for change-pole motors. It gave quite remarkable results when used as a stator winding for change pole motors. These windings would also give a cascade speed corresponding to the number of sides, irrespective of the number of poles for which the stator was wound, and, as Mr. Creedy had shown, an 8-sided winding would operate as an 8-pole cascade motor, or a 20-sided winding as a 20-pole machine, and so on, so greatly increasing the possible speeds for which cascade motors could be wound.

A Great Service to the Industry.

Dr. S. PARKER SMITH remarked that there were many advantages, in addition to the speed changing property, in the motor called by Mr. Creedy the multi-speed motor. The author had shown how, by the application of fundamental principles, it was possible to make the ordinary squirrel cage induction motor run at 2, 3, 4, 5, and even 6 speeds, economically, and so overcome one of its greatest disadvantages. A further advantage of his system was at starting. Whereas with the ordinary squirrel cage motor something like four or five times the full load current was required, only twice the full load current was required with the author's motors. Another advantage of these motors over the shunt motor was that they gave constant torque at all speeds, which was what the user wanted and seldom obtained, even with direct current.

Has the D.C. Motor been Bettered?

Mr. A. JACK said designers admitted that if an a.c. motor could be obtained comparable with the d.c. shunt motor, we should probably get as good a motor as could be wished for. Multi-speed a.c. motors of various types had been introduced in recent years, but the question was whether these really were the equivalent of the d.c. shunt machine. Two, three, or four speeds were not sufficient to meet the requirements for multi-speed motors, and the jumps in the steps were often too great. Even with Mr. Creedy's improvements, it was difficult to see how far all the demands would be met. The introduction of resistance to facilitate the change from one speed to the other was a complication, as was the elaborate controller used by the author; but, even so, the number of speeds available was extremely limited. There were, therefore, greater possibilities in the a.c. commutator motor, either of the series or the shunt type. With these motors there was not the same limitation with regard to speed, and it was possible to obtain a continuous range of speeds.

The Author's Reply.

There was only time for a very brief reply by the AUTHOR, who had nothing to say in regard to the remarks of Mr. Hunt and Dr. Parker Smith, except to express his thanks. As regards Mr. Jack's remarks, Mr. Creedy's answer was that the commutator machine must be of the slow speed type, and that the real field of competition between the two types would be only in the small sizes. There were limitations in the size of the commutator machine, owing to the requirements of commutation, and this, of course, did not apply to the multi-speed motor described in the paper.

The Further Confessions of a Mere Buyer.

The Last of the Little Window.

FROM A CORRESPONDENT.

I was ill-advised to write my confessions. It has created a furore among salesmen. They have clamoured at the door of the office of the editor of THE ELECTRICIAN for my name and address that they may seek my—no, not my blood, but my secret of the little window. Hence it is that the editor demands more confessions. "Confess thyself or stand revealed before all salesmen as one who knows the great secret," saith the editor. The way of confession is hard.

Continuance in Vice.

I shall continue to attend the E.D.A. Conferences. I am hardened to the vice. I shook off that worried look which betrays all buyers, and put on my blandest smile. Great was my achievement when I slipped past the watchful keepers of the door. I hear on good authority that they have had very strict instructions to look out for buyers. I feel some sympathy with the anxiety of the E.D.A. authorities to keep out buyers. It must mean troublous thoughts of a buyer laughing up his sleeve, at the attempts to solve how to get through that little window. I have learned much from Mr. Attwood's last lecture, when he gave some tips to bring off this trick "To sell the buyer," as Mr. Attwood said. I must be on my guard against these Attwood disciples who come to sell me. I must warn our commissionaire not to be seduced by these gentlemen to make bets that he cannot get them a safe passage to my office. I must warn the girl at the little window not to be impressed by gentlemen who call and who puff cigar smoke in her face. These tips, and others (such as eulogising my office boy to his face) I have made a note of, and shall counter them.

Salesmen and Knavish Tricks.

Great care must be exercised in a buyer's office. It is not good for us that a salesman should get in and tell us about his product instead of himself. Such an event causes us much excitement. We know how to deal with the man who, owing to some knavish trick (similar to the Attwood cigar smoke trick) with the girl at the little window, gets through the aforesaid little window, and tells us about everything but the product. Years of experience have taught us how to manœuvre such men; but the man who tells us of his product —no! I cannot write of him.

A Strange and Astonishing Confession.

It is a strange and astonishing confession for a buyer to make, that a few salesmen do get through the little window, but mistakes of this kind will happen in the best regulated offices. When I am worn out with the worries of buying I shall write of the happenings in my office when this mistake occurs. I shall tell of a salesman who called. Now this salesman was sorely stricken. He had to deliver a speech at a meeting of the vestry of his local church, and to fill in time for the evening he had to talk for forty minutes! Now I do not wish to suggest anything unkind, or say anything which a buyer should not say, but after I had bid him God-speed, I realised that he had taken up about forty minutes of my time. Still further, I remembered that when I asked him what service I could render him he remarked that he had not come to *sell me anything*, he had just popped in to see me. Now putting two and two together, as is the way of a buyer, I am presented with this question—Did he "pop in" to practise on me for that forty minutes' speech in the evening? Was he trying it on the dog? When next I attend an E.D.A. Conference I must go among salesmen, and learn this secret.

If by some unhappy chance I am revealed as a buyer (or a dog!), and am removed, I shall come back disguised as an order *maker*. It would be easy for me to do this because slowly but surely, I am cultivating a *flair* for selling. This is the one bad consequence of my having listened to this exposition of the selling art. I want to be a salesman! If I only had the courage I would seek an apprenticeship. Who will have me? Surely all salesmen would know me and find it hard, remembering how they had misled me in the past, to welcome me into their fold. Would they not rend me? Also, how could I look my brother (or late brother) colleagues in the face? Could I deliberately set to inveigle these old friends into making a purchase? Ye Gods! it is hard—the longing to sell is so great. This, then, is the confession of a mere buyer.

[We think the "little window" might now be bricked up.—ED., ELECTRICIAN.]

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Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument

ANTENNA WAVE FRONTS.

To the Editor of THE ELECTRICIAN.

SIR,—A fallacy occurs in Prof. Howe's latest "Notes on Wireless Matters." In the ideal case the wave front of a vertical transmitting antenna at the earth's surface is nevertheless inclined and not vertical.

In the "I.E.E. Journal" for April, 1921, I showed how to allow for radiation resistance. Formula (40), viz. :—

$$e = v_0 \cdot \cosh q\,(h-x) \cdot \sin pt$$

really equivalent to

$$e = v_0 \left[\sinh \frac{2\pi b\,(h-x)}{\lambda} \cdot \sin \left\{ \frac{2\pi a\,(h-x)}{\lambda} + pt \right\} + \epsilon^{\frac{-2\pi b\,(h-x)}{\lambda}} \cdot \cos \frac{2\pi a\,(h-x)}{\lambda} \cdot \sin pt \right]$$

showed that there was a difference of time phase in the potential with respect to ground, at top and bottom of the antenna. On the Huygens principle, therefore, it is evident the wave front must always be inclined. (See also top of page 441, 1 c.) Doubtless Prof. Howe has seen the complete derivation of the symbolic formula properly algebrized. It has been circulating in England.

Later, in the pages of THE ELECTRICIAN, when proving Dr. Fleming's five times rule, I showed that $a \equiv 1{\cdot}27$; $b \equiv {\cdot}786$, from Dr. Eccles' Pacific Coast experiments.—I am, etc.,

A. PRESS.

Rantoul, Ill.,
December 25th, 1922.

"PESSIMISM IN ENGINEERING."

To the Editor of THE ELECTRICIAN.

SIR,—I notice that, under the above heading in your issue of December 29th last, I am classed as a pessimist in engineering, a distinction which, however, I share with Mr. W. M. Selvey. I am sure Mr. Selvey is well able to look after himself, and will therefore leave him to "gang his ain gait" in the matter, but I really do not think you ought to classify me as a pessimist because I have given some facts with regard to steam generation. It is quite true, of course, that such facts are apt to give rise to a rather hopeless feeling, especially when one considers that this country is losing about 20 000 000 tons of coal per annum on steam boiler plants alone, which could all be saved by the adoption of very reasonable methods of design and equipment, and, above all, of the proper control of the working.

It has always seemed to me that the crying need in the wide field of power has been facts, and that whilst many people have been ready to give opinions—which, after all, is an easy matter—very few indeed have stuck to the troublesome and rather thankless task of getting at the facts. For this reason, until quite recently, nearly all engineers have been unaware that matters were so bad as they really are in the field of steam generation, and Bryan Donkin, for example, whilst he may have known in 1896 of the general principles of scientific steam generation, includes in his book "Heat Efficiency of Steam Boilers," a large number of tests which give a quite erroneous impression of the working of steam boiler plants in general. Thus, taking "Lancashire" boilers, a series of 10 tests showed 72 per cent. efficiency for the boilers only, and another group of 107 tests 62·4 per cent., whilst some of the figures are extraordinary, as high as 79·5 per cent. My own experience has been that in 400 tests, mostly on "Lancashire" boilers, the average nett working efficiency of the whole plant is only 58 per cent. boilers, economisers, and superheaters put together. As showing further the practical value of much of the work hitherto regarded as classical, it may be stated that Donkin and Kennedy, in a later series of tests, used coal of 15 560 B.Th.U. and 3 per cent. ash in the dried product, which, of course, has little or no relation to every-day conditions. Engineers, in fact, have been living in a fool's paradise for years with regard to steam generation, and, frankly, even many power station engineers are still in this position to-day.

I should like to guarantee that the average boiler plant efficiency of the power stations of Great Britain does not exceed 67½ per cent., and many plants are much under 65 per cent. There are still scores of power station engineers who are working their boiler plants in the dark, and who never use a combustion recorder or keep a feed-meter in continuous and accurate running. I am glad you have mentioned Dalmarnock because this station, so far as I know, is the only one in the United Kingdom where continuous testing is carried out and each boiler regarded, from this point of view, as a separate unit, as I know from personal inspection, thanks to the kindness of Mr. Mitchell.

I am afraid they are beginning to be much ahead of us in America on these matters, although I do hope you will not regard this opinion as a fresh outburst of pessimism on my part. I have been studying for a long time, through the courtesy of Mr. W. R. Wood, the Managing Director of The Underfeed Stoker Co., the wonderful series of tests that have been carried out for many months at the Lakeside Station at Milwaukee, using the "Lopulco" system of powdered fuel on an installation of 40 000 kW, giving 85-86 per cent. boiler plant efficiency, and it is this spirit of continuous testing and a craving for facts that is needed so badly in the field of steam generation. I can only venture to emphasise again that one of the chief requirements is the adoption of a proper code for boiler plant testing, and I am sure that if my suggestion of a practical International Code was adopted, it would mean a big step forward in boiler plant efficiency, and that THE ELECTRICIAN can play a big part in helping along such ideals.—I am, etc.,

DAVID BROWNLIE.

Manchester, January 4th.

HEARTBREAK VILLA.

To the Editor of THE ELECTRICIAN.

SIR,—The story of "Heartbreak Villa" would indeed be a heartening one if electricity could do all that is credited to it therein. But is not the case somewhat overstated? At least 50 per cent. of household work consists in washing up after meals. Unless electricity can do this, Mrs. Ordinaire is not likely to grow very "plump," or to have much time for shopping.—Yours, etc.

INQUIRER.

["Inquirer" is something of a pessimist. One who is experienced in these matters tells us that washing-up is largely a matter of organisation and having plenty of utensils. It need not then take a great deal of time. Nevertheless, "washing-up" is a problem which will have to be tackled in the "all-electric" house, probably on quite novel lines.—ED. E.]

POWER TRANSFORMER FOR 66 000 V.

To the Editor of THE ELECTRICIAN.

SIR,—With reference to Mr. W. T. Taylor's letter in your issue of this week, the following particulars of e.h.t. power transformers, which we have built or have at present on order, may interest him, and others of your readers.

NEWCASTLE.

Six 4 000 kVA single phase, oil-immersed, forced cooled transformers, working pressure 11 000/66 000 V, connected in delta/star for 12 000 kVA three-phase groups.

Test pressure—133 000 V for one minute between h.t. winding and l.t. winding, and between h.t. winding and frame.

(We have delivered six of these transformers, and have at present a further six on order.)

TASMANIAN HYDRO ELEC. POWER SCHEME.

Two 1 000 kVA three-phase, oil-immersed, self-cooled transformers for outdoor substations, working pressure 88 000/11 000 V star/delta connected. These transformers were tested with 220 000 V for one minute between h.t. winding and l.t. winding, and between h.t. winding and frame.

MANGAHAO, N.Z.

We have in hand the following transformers :—

Four 1 500 kVA single phase, 110 000/11 000 V.

Five 1 500 kVA three phase, 110 000/11 000 V, delta/star connected.

Test pressure—220 000 V for one minute between h.t. windings and l.t .windings, and between h.t. windings and frame.

In addition to the above we have recently built a 2 500 kVA single-phase, 11 000/132 000 V transformer, which was tested with 270 000 V for one minute between h.t. windings and l.t. windings and between h.t. windings and frame.

All the above transformers are designed for the specified test pressure, to be applied from a separate source between the whole of the h.t. windings and the l.t. windings and frame.—We are, etc.,

METROPOLITAN-VICKERS ELECTRICAL CO., LTD.,
A. E. DU PASQUIER.

Trafford Park.
January 8th, 1923.

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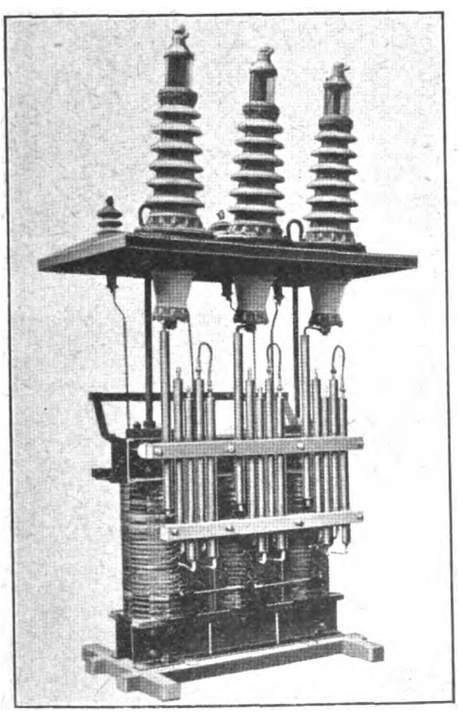
To the Editor of THE ELECTRICIAN.

SIR,—With reference to Mr. W. T. Taylor's letter in the current issue of THE ELECTRICIAN regarding the manufacture of 66 000 V transformers in this country, I have pleasure in attaching herewith a photograph together with a short specification of a 66 000 V power transformer built by my company for an important Colonial hydro-electric scheme. While the high pressure windings are star connected, the line voltage being 66 000 V and consequently the pressure across each phase winding 38 000 V, the provision of a delta winding on the h.t. side to give 66 000 V per phase presents no difficulties whatever. For a transformer supplying power in bulk or for giving a supply to a consumer whose load would be balanced, there is no necessity to provide a delta winding if the transformer is of the three-phase core type of construction, as third harmonic phenomenon is, for all practical purposes, absent. In fact, as Mr. Taylor doubtless appreciates, a delta winding at this high voltage results in a coil which is mechanically not so sound as that for a star connection. The transformer illustrated is typical of British manufacture, and, of course, it by no means represents the pressure limit to which British electrical engineers can attain in the design and manufacture of this class of apparatus. Although Mr. Taylor specifically mentions power transformers, I would point out that my company have manufactured high-pressure testing transformers up to and including 250 000 V, and the factor of electrical pressure is, of course, substantially the same in power transformers.—I am, etc.,

S. AUSTEN STIGANT,
Manager, Transformer Dept.,
Johnson and Phillips, Ltd.

London, S.E.7,
January 6th.



A J & P 66 000 V TRANSFORMER.

The photograph illustrates a three-phase, core type, power transformer, designed for outdoor service and suitable for floor platform mounting. The specification of the transformer is as follows :—

> 100 kVA, 66 000/11 000 V, 50 cycles, the h.t. windings and l.t. windings both being connected in star. The h.t. windings are fitted with minus 3 and 6 per cent. pressure adjusting tappings brought up to oil level only. Both h.t. and l.t. coils are of the cross-over type wound with round wire. The h.t. leading through terminals are of the oil-filled porcelain type, each insulator being fitted with a glass chamber at the top to allow of the expansion of oil which takes place consequent upon increasing temperature. The cover is specially domed and provided with deep, overhanging flanges, so that there is no possibility of water entering the tank under the most severe weather conditions.

The view shown is of the transformer out of its tank, and looking at the h.t. side.

The British Electrical and Allied Industries Research Association.

A Record of Useful Work on Fundamental Electrical Matters.

The second annual report of the BRITISH ELECTRICAL AND ALLIED INDUSTRIES RESEARCH ASSOCIATION, covering the period from October 1st, 1921, to September 30th, 1922, has now been issued. It consists essentially of a record of work done on such matters as fibrous and composite insulating materials, synthetic resins, porcelain, mica, insulating oils, the heating of buried cables, overhead lines, electric control apparatus, corrosion and turbines. Very wisely the Association publish the results of their work as they do it, when they are up-to-date and can be acted upon at once. The policy keeps the work of the Association well before the electrical public and has everything to commend it, except that it detracts a little from the interest of the annual report.

Still a Large Field for Research.

We are not surprised to learn that notwithstanding the further development of the organisation during the year, inquiries and proposals show that there is still a large field in which research is urgently required. Unfortunately, the present state of the industry renders the extension of facilities difficult, and it has been necessary to concentrate on the more profitable work with, we are glad to learn, greater efficiency.

A gratifying feature of the year's work is the increasing extent to which both large manufacturers and specialists have co-operated with the Association. The Association is a help both to large and small manufacturers, and in fact the larger part of the work is placed with manufacturers, the National Physical Laboratory and investigators in the universities and technical colleges. It is preferred to place work with individual members rather than with outside bodies, as in this way they are helped to build up their own establishments and the goodwill is secured to the members if not to the Association.

The Association continues to co-operate with the British Engineering Standards Association and the Committees of the Institution of Electrical Engineers. It is hoped at an early date to bring the electricity supply authorities, power users and others who benefit by the researches into closer working arrangements.

Tests on Porcelain.

A practically complete series of investigations of the electric strength of porcelain under momentary stresses has been made at temperatures from normal to 300° C. Resistivity tests have been made at temperatures from 70° C. to 300° C. Some progress has been made in the preparation of sensitive apparatus for measurements from normal temperature to 70° C. and on the development of an electrical method of determining porosity.

Progress has been made in the development of new methods for the measurement of power factor and permittivity of dielectrics in sheet form, mainly mica; in dielectric loss measurements at high and low voltages and radio and power frequencies, on thermal resistivity and the effect of heat.

Time Switch Development.

At a recent meeting of the Informal Section of THE INSTITUTION OF ELECTRICAL ENGINEERS Mr. E. E. SHARP opened a discussion on "Time Switches."

Mr. SHARP said he did not think time switches were without importance or interest, though it was the first time they had been before the Institution. It was not because of their novelty, they were really very old and well-established. The time switch could naturally be discussed under two main headings, the clock and the switchgear. These headings could be sub-divided again into clocks of short, medium and long run, and switchgears with metallic and mercury contacts, while further intricate sub-divisions were possible.

The periods of the clocks were practically standardised now at 1, 14 and 45 days run. For the one day run a cheap type of clock might be used because small time-keeping errors can be adjusted daily, but a rigid framework and a dust-proof case were essential. For the longer runs the switch had to be put *on* automatically, as well as *off*, and the double operation commonly had to be done twice or more daily. The clock must therefore be a powerful one and so designed as to be unaffected by these powerful operations. With good makers a maximum error of 2½ minutes a week was guaranteed.

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Merchandise to Sell and Profit By.

In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

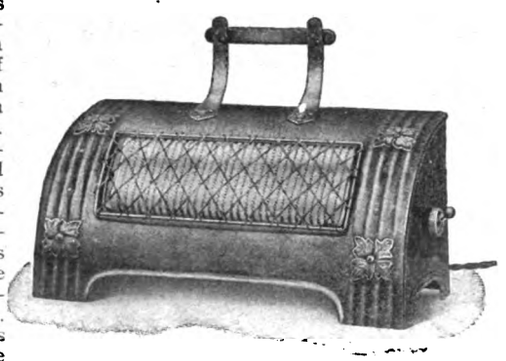
THE IMPERIAL WATER HEATER.

A Contribution to the Hot-Water Problem.

Any contribution which is made to the solution of the domestic hot-water problem must be studied with earnest attention, because it is in this department of activity that development has lagged. That is, the production of a really efficient hot-water producing device, simple to instal at the very minimum of cost, and at an attractive price, has not been so general as it ought to have been. The illustration is of the "Imperial" water heater. The design has been carefully thought out to meet the real needs of this department of the "electrical idea." From the specification we note that the heater has a capacity of 10 galls., and with full heat a hot bath can be obtained in 25 min. A three-heat switch is provided. The cylindrical case is of heavy gauge specially rolled copper. The list price is £18, and the heater is manufactured by the IMPERIAL ENGINEERING CO., stocks being distributed through the usual factors.

A New Line of Electric Fires.

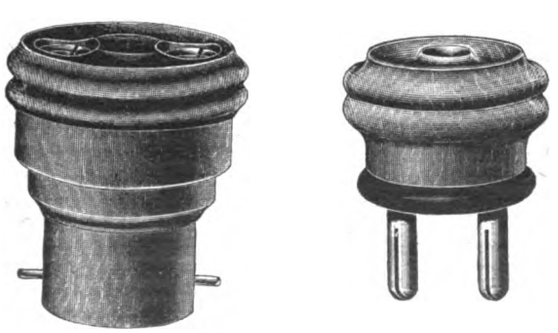
The "Maymore" line of heating and cooking apparatus is comparatively speaking, a "youngster." Nevertheless, the range of apparatus offered is excellent both from the point of view of design and efficiency in the elements. The fire illustrated is listed at 50s., and is of pleasing design. The distinctive note is the shape of the case in hand-beaten metal. The rating is 500 W. The "Maymore" equipment can be obtained through factors or direct from the manufacturers, MAY AND PADMORE.



THE "MAYMORE" FIRE.

Combined Lampholder, Adaptor and Wall Plug.

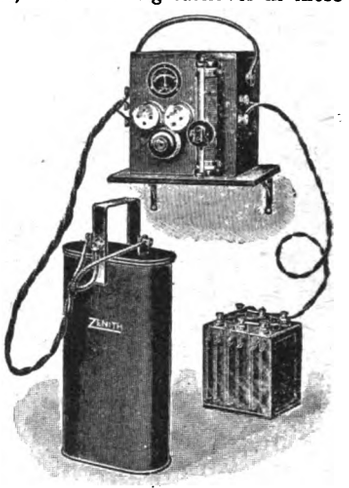
The small device illustrated is one which would reap considerable profit for the retailer if its usefulness were appreciated and demonstrated to the public. The inconvenience caused when a device such as a table standard or kettle, or, in fact, a hundred and one devices, is fitted with an ordinary wall plug, when only a lampholder circuit is available, or *vice versa*, is annoying to say the least, and certainly does not help the "electrical idea." This small device can be sold with every piece of portable apparatus which can be used on a lampholder circuit, and there are dozens, even hundreds, of electrical "domesticians" who will welcome the device. It is but one of many useful devices manufactured by JULIUS SAX AND CO., and marketed through the usual factors.



A "SAX" HELP TO USERS OF ELECTRICAL APPARATUS.

The "Acdic" Battery Charger.

Battery chargers have not appealed to many retailers as a line of merchandise. The fact, however, that much public attention is now absorbed by wireless, and that there is an ever-increasing number of "amateur electricians," means a big turnover in these devices. Considerable care must be made in the selection of the rectifier for the very reason that it will be the victims of much amateur use. The rectifier illustrated is the "Acdic" rectifier manufactured by the ZENITH MANUFACTURING CO. The special feature is a patent form of electrolytic cell, comprising a tank with a cover in separate halves, each of which carries a rectifying electrode of chemically pure aluminium. The complete set includes the regulating unit, as shown in the illustration.

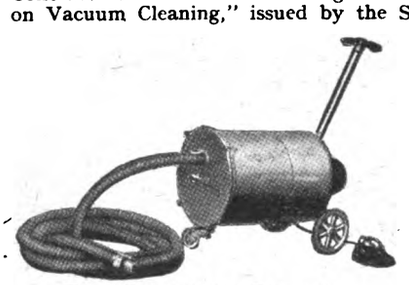


VIEW OF ACDIC BATTERY CHARGER.

Among the many exclusive features which will appeal to the retailer for a merchandising line are the following: (1) It is self starting, and automatic in operation, needing no attention or installation; (2) it does not require constant attention or expert knowledge; (3) it may be worked from any lampholder as the 5A size consumes less current from the mains than the ordinary vacuum lamp; and (4) the amateur can switch on and forget his batteries until his cells are charged.

A Turbine Vacuum Cleaner.

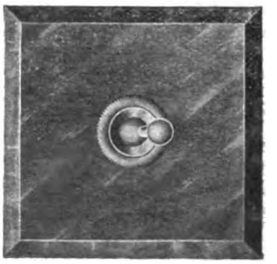
The market for vacuum cleaners is not limited to the domestic field, mainly catered for by the popular small hand machine. Contractors and retailers should give close study to the "Treatise on Vacuum Cleaning," issued by the STURTEVANT ENGINEERING CO., which reveals what can be done in securing a large turnover from the installation of Sturtevant turbine cleaners in large hotels, offices and large mansions. The illustration shows the No. 5 Sturtevant portable turbine cleaner. This is but one of the designs offered by the makers to the contractor to reap "big business" from this field. The Company will readily submit literature and collaborate with contractors with full technical advice and data.



THE STURTEVANT CLEANER.

Artistry in Switch-Plates.

Distinctive switch-plates are hard to find among the large assortment now on the market. CRABTREE AND CO. have many new designs, and one worthy of mention is the "Shelloid." The plate is made of a fireproof and insulating material, which is worked up into a highly-polished surface. It is supplied in various finishes, and one of particular appeal is the tortoiseshell. It can be obtained through factors or direct from the manufacturers.



A DISTINCTIVE SWITCH-PLATE.

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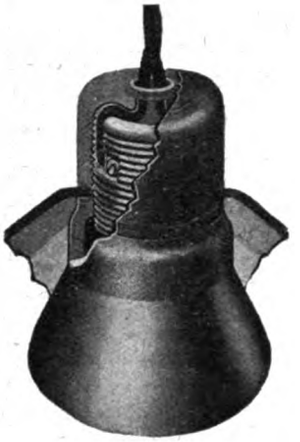
Something New in Lighting Glass.

In but very few fields of development in apparatus has there been such progress made as with lighting glassware. One of the pioneers of this development is the BRITISH THOMSON-HOUSTON CO. and that they are still leading the field is proved by the Leaflet L. 254, just

AN EXAMPLE OF ARTISTIC B.T.H. GLASSWARE.

published. The design illustrated is but one of no less than twenty-seven designs, each one a fine example of the glassmaker's and decorator's art. The "Veluria" shade shown is intended for use in dining-room lighting, and will create a note in lighting quite distinct to the commonplace silk flounce. Samples of every piece of glassware shown in this leaflet should be displayed in retailers' showrooms.



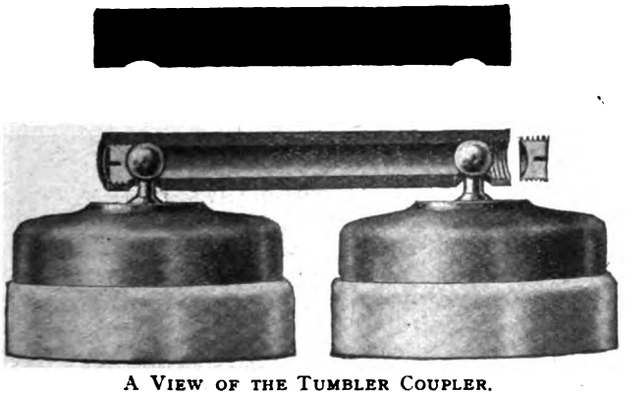
THE LATEST INSULATED LAMP HOLDER.

Insulated H.O. Lampholders.

It is only during the last eighteen months that the manufacturers of lampholders made in a moulded composition have been able to perfect a material to stand up to working conditions. Mr. J. C. WHITE claims to have solved the difficulty. The holder is made in the ordinary B.C. type (as illustrated) and also as a switchholder with a push-bar action.

The "Wilcox" Tumbler Coupler.

EDWARD WILCOX has placed upon the market a simple device which has long been wanted. As will be seen from our illustration it is a fibre coupling bar which enables two or three ordinary s.p. tumbler switches to be coupled up and converted into a d.p. or t.p. switch, as the case may be. Each end of the bar is tapped to receive cupped screws of large diameter which retain the switch



A VIEW OF THE TUMBLER COUPLER.

knobs securely in position against the inner bore. This ensures a vice-like grip. Where the device will prove itself useful is in the fact that stocks of ordinary s.p. tumblers can be utilised and no stocks of d.p. and t.p. coupled switches need be held. The bars are made for 3, 5 and 10 A switches and are listed at 8d., 9d., 1s., each respectively for the double pole type; prices of triple pole are in proportion. Stocks are held and distributed by factors.

A New Dry Cell.

It is claimed for a new dry cell which we have received from Mr. C. PEIRSON that it does not deteriorate under normal conditions, is highly recuperative, has a long life, contains no acid and that its constituent parts are made of vegetable matter. We are trying it out and shall report for the benefit of our readers, but meanwhile merchants might remember its existence.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

The GLOBE ENGINEERING CO. have issued price list No. 4 on standard two and three-phase induction motors.

The GLOBE PNEUMATIC ENGINEERING CO. have issued their 1923 booklet on air compressors and vacuum pumps.

BRUCE PEEBLES AND CO. have issued a new pamphlet No. 18c describing d.c. motors and dynamos of the open type and in large sizes.

A stock list showing over 1 000 a.c. and d.c. motors and dynamos has been issued by the ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI.

The new "Mazda" Calendar for 1923 will brighten many homes and offices this season. It has just been issued broadcast by the BRITISH THOMSON-HOUSTON CO.

The GENERAL ELECTRIC CO. have added another electric cooker to their range of this apparatus. The cooker (cat. No. H.5670), is fully described with several other types in leaflet No. H.2867.

SUPERLAMP, LTD., have sent us a copy of their latest net price list, together with a pocket book, which may usefully be employed for holding treasury notes and other such important pieces of paper.

In the list of publicity matter received which will be of great interest to supply engineers, must be included the descriptive pamphlet on the "F" Multiple Retort Stoker, just issued by the UNDERFEED STOKER CO.

"X-Ray" reflectors are the subject of an attractive folder L247 just issued by the BRITISH THOMSON-HOUSTON CO.; and folder L254 entitled "B.T.-H. Glassware for Decorative Electric Lighting" also deserves mention.

Readers of THE ELECTRICIAN who are interested in mining (particularly in mechanical aids to the mining of coal) will read with interest the latest issue of "M. and C. Machine Mining," published by MAVOR AND COULSON.

From many points of view the announcement of CROMPTON AND CO. of their silent fans for a.c. circuits will be of great interest. Judging from the description given in their new list No. 536 the problem of humming in a.c. fans is solved.

A neat monthly tear-off calendar has been received from KRYN AND LAHY. Each sheet is surmounted by an illustration of one of the processes carried out in their works for the manufacture of high-class steel castings for all purposes or of the finished product.

JOHNSON AND PHILLIPS have just issued a descriptive list describing "J. and P. Oil Switches." Supply engineers should give this list close study. We were particularly interested in the notes on and illustration of the first J. and P. Oil Switch manufactured in 1902.

RADIO INSTRUMENTS, LTD., have issued an artistic showcard illustrating a lady who has evidently just been listening in, and is so satisfied with the results that with uplifted finger she indicates the experience, efficiency and promptitude of the firm and their equipment.

"Everything Electrical" is an ambitious title to apply to a price list. The claim, however, is well substantiated by the GENERAL ELECTRIC CO. in giving this title to a new catalogue just issued. This list is not issued under any pretence that it is a complete catalogue of G.E.C. products, but it does include material in everyday demand. The list measures 5¾ in. by 8¼ in.—a handy size for the pocket.

We have also received from the GENERAL ELECTRIC CO. a copy of a new edition of their catalogue section, dealing with electric lighting sets suitable for country houses, bungalows, etc. This catalogue gives full particulars and prices of both belt driven and direct coupled sets, which can be supplied either as separate units or complete with switchboard panels and accumulators. Fully dimensioned drawings showing the lay-out of typical plants and full instructions for operating the sets are incorporated.

We have received from LESLIE MCMICHAEL, LTD., catalogues dealing with their wireless apparatus. One of these is devoted more particularly to wireless receiving sets of a design which, besides giving scope to the genuine experimenter, will by their reliability, ease of operation and great range, make, it is claimed, a strong appeal to those interested in broadcasting. The second pamphlet is a complete wireless catalogue to whose contents both amateurs and professionals may with confidence be referred.

A complete range of automatic telephones, intercommunication, magneto, central battery, and mining type instruments are illustrated in SIEMENS BROTHERS AND CO.'s new 120-page catalogue of telephones and accessories. Details of high tension telephones for use on wires run on the same poles as high tension power transmission circuits is also given. Siemens, of course, equip exchanges on the magnet, central battery and automatic systems, and illustrated information regarding this equipment is set out in the usual artistic style. Telephones for mines and factories which comply with the Home Office regulations and portable telephones of the kind familiar to those of a military persuasion are also dealt with. The whole should be a useful *vade mecum* of the telephone engineer.

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Patents Expiring in 1923.

The following is a list of patents of interest to electrical engineers which, unless extended by the Privy Council, will expire during 1923. This list does not include any patents granted in 1907 which have since for any reason become void:

No.	Date (1907)	Name of Patentee.	Subject of Patent.
635	Jan. 9	B.T.-H. Co. (G.E. Co., U.S.)	Measuring instruments.
727	Jan. 11	Ditto	Dynamo-electric machines.
887	Jan. 12	Marconi's Wireless Tel. Co.	Receivers for wireless telegraphy.
2381	Jan. 30	Parsons, Wilson and Ford	Turbines and compressors.
2413	Jan. 31	Brown	Electric block signalling system.
2959	Feb. 6	Purves and Sinnott	Insulators for telegraph wires.
3276	Feb. 9	Ransford	Covers of electric furnaces.
3633	Feb. 13	B.T.-H. Co. and Holden	Electric meters.
3935	Feb. 16	Graham	Telephone apparatus.
3938	Feb. 16	Elektrochem. Ind. G.m.b.H.	Tungsten incandescent lamps.
4274	Feb. 21	McKenzie and Holland	Interlocking apparatus.
4292	Feb. 21	Hall and Garner	Switches.
4445	Feb. 22	Ljungström	Gas turbines.
4593	Feb. 25	Marconi's Wireless Tel. Co.	Wireless telegraphy.
4709 4712	Feb. 26	Fessenden	Signalling by electro-magnetic waves.
4710 4713	Feb. 26	Fessenden	Electro-magnetic transmission.
4833	Feb. 27	B.T.-H. Co. and Garton	Regulation of motor generator sets.
4927	Feb. 28	Chaplet	Electric furnaces.
5066	Mar. 2	Hann and Ingle	Earth return connections.
5332	Mar. 4	Dunwoody	Wireless telegraphy.
6203	Mar. 14	Fessenden	Electric signalling.
7180	Mar. 25	B.T.-H. Co. (G.E. Co., U.S.)	Electric resistances.
7563	Mar. 30	Friedheim	Electro deposition on hollow articles.
7757	Apr. 2	Waring and Waring	Connecting and disconnecting sockets.
7833	Apr. 3	Ljungström	Balancing on turbine vane plates.
8025	Apr. 5	Ljungström	Baffling devices for gas turbines.
8359	Apr. 10	Boult (Hoskins, U.S.)	Electric resistance element.
8364	Apr. 10	Ges. für Drahtlose Tel.	Receiver for wireless telegraphy.
9361	Apr. 22	Forsberg and Ljungström	Controlling speed of turbine vane.
10169	May 1	McNeil	Electric fire alarms.
10356	May 3	Schmidt	Electrical commutator machines.
10597	May 7	Taylor	Automatically operated switches.
11086	May 13	Sullivan	Telephone receivers.
11219	May 14	Quiggin	Surface condensers.
11582	May 17	Fleming	Wireless telegraphy.
11808	May 21	Graham	Telephone apparatus.
11854	May 22	Gibbons	Telemotor apparatus.
12353	May 28	Austin	Receivers for wireless telegraphy.
12960	June 4	Marconi's Wireless Tel. Co.	Wireless receiving apparatus.
13129	June 6	Grob	Lighting and heating of vehicles.
13196	June 6	B.T.-H. Co. (G.E. Co., U.S.)	Insulators.
13285	June 8	Ellison	Protection of a.c. induction motors.
15417	June 10	Cumberland	Preventing corrosion.
14059	June 18	Grob	Lighting and heating of vehicles.
14262	June 20	Brown	Telegraph apparatus.
16175	July 13	Morgan Crucible Co. and	Flexible commutator connections.
16530	July 18	B.T.-H. Co. (G.E. Co., U.S.)	Preparation of refractory materials.
16952	July 24	Kjellberg	Electric welding.
18020	Aug. 8	Lundberg	Switches.
18403	Aug. 14	Stokes	Surface traversers.
18842	Aug. 21	Pickard	Wireless reception.
19174	Aug. 26	Burleigh	Dynamo electric machines.
19348	Aug. 28	Flohr	Electric furnaces.
19424	Aug. 29	Mavor and Biles	Electric propulsion of marine vessels.
20119	Sept. 9	Marconi's Wireless Tel. Co.	Transmitters for wireless telegraphy.
20549	Sept. 16	Holt and Rhodes	Fixing guard rails to tram track rails.
20619	Sept. 17	Escare and Damey	Lamp holders.
20676	Sept. 17	Conrad	Electric switching and other devices.
20878	Sept. 20	Parsons and Ball	Electrically controlled clocks.
21971	Sept. 25	Evershed and Vignoles	Measuring electrical resistance.
21299	Sept. 25	Bellini and Tosi	Directed wireless telegraphy.
21588	Sept. 28	Zweigbergk	Electric controllers.
21827	Oct. 3	Latour	Single phase commutator motors.
21938	Oct. 4	Morris and Lister	Electric switches.
22125	Oct. 7	Westinghouse Brake Co.	Automatic fluid pressure brakes.
22405	Oct. 10	B.T.-H. Co. (G.E. Co., U.S.)	Motor control systems.
22735	Oct. 15	Warwick Machinery Co.	Governing mechanism for turbines.
23303	Oct. 22	Major, Stevens and Stevens	Electric lifts.
23352	Oct. 22	Liberty Mfg. Co., U.S.	Rotary motors.
23570	Oct. 25	Thomson (Kelvin)	Compass suspension for use on ships.
23915	Oct. 30	B.T.-H. Co. (G.E. Co., U.S.)	Motor controllers.
24288	Nov. 2	Bosch	Contact breakers for electrical ignition
24502	Nov. 5	Imray (Elliott, U.S.)	Turbines.
26354	Nov. 28	Ryan	Electric welding machines.
26940	Dec. 5	B.T.-H. Co. (G.E. Co., U.S.)	Alloys for resistance conductors.
27232	Dec. 10	Meyerling	Ampere-hour meters.
27830	Dec. 17	Gibbs	Electrolytic cells.

German Meters.

Watford's Problem—To Buy or Not to Buy.

Watford Town Council last week considered the proposal of the Electricity Committee to buy German meters at a saving of 10s. each. Councillor Coates submitted that the German competition was not fair, but due to the depreciated exchange. He proposed that the question be referred back, and that the engineer be asked to obtain prices from the best English companies.

Alderman Blake said it was not a question of buying German meters, but of buying the best meters on the market. Most of the large boroughs and institutions up and down the country were purchasing those so-called German meters, and he himself imported thousands of them ("Shame!"), not because they were German, but because they were the best meters.

Councillor Coates pointed out that the question whether they were best or not did not arise. Any meter passed by the Board of Trade was acceptable to that authority.

On a vote being taken, the amendment was carried.

Electric Lifts.

English and American Practice.

Mr. H. MARRYAT delivered a lecture on electric lifts at a meeting of the National Association of Supervising Electricians on Tuesday evening. The lecture formed a supplement to and brought up to date the information given in a lecture by Mr. Marryat on December 14th, 1915.

Mr. Marryat commenced by saying that there was no book dealing comprehensively with the subject, and one was obliged to refer for information to literature issued by manufacturers. A drawback to that procedure was the fact that standard terms were not used, and he thought it might be of some benefit to engineers if the terms he had suggested in his previous lecture were carried further, with a view to general adoption. Amongst a few interesting papers that had been written on electric lifts a particularly good one was that by Mr. Harrison T. Reed, in the "Journal" of the American Institute of Electrical Engineers. Those papers, however, dealt with American practice, which was impracticable in this country in view of the limitations to the size of buildings. They, in this country, had followed American practice up to a point, but they should now develop a purely British lift for high speed with short travel. In America a drive termed "full way traction" had been developed. In that system the lifting ropes passed from the car over the main traction sheave, round a secondary sheave, back over the main sheave, and on to the counterweight. This doubled the contact area between the rope and the driving sheave, and rendered it unnecessary to groove the traction sheave in "V" form. The ordinary "V" groove was employed with corresponding improvement in the life of the rope. The question of the choice between drum and traction drive had now been nearly answered by the survival of the traction sheave. If the car on counterweight ran into the dead stops the rope would be so slack that the sheave would continue to run inside the ropes and no catastrophe would occur.

The best place for the engine was at the top of the well. Its removal to any other part of the building, instead of removing weight from the top girders substantially increased the strain in nearly every instance. The length of rope was reduced by two-thirds by this method, and the rope always bent in the same direction, which lengthened its life.

Motors, Gears, and Brakes.

Direct current motors for lifts might be intermittently rated for a capacity of 15 to 30 minutes per hour continuous running, according to the nature of the work to be done. For a busy service the heavier rating should be adopted. The commutation and brush gear should be of ample proportions to stand starting currents, and the machine must be reversible, with fixed brush positions. The speed variation was secured by shunt field control. Single speed lift motors were usually compound wound, the compounding consisting of from 10 to 20 per cent. series turns, which winding was cut out when the lift acquired full speed. In transferring from high to full speed the motor acted as a generator and returned current to the line. Variable speed motors had to be larger and more expensive than single speed motors for the same H.P. Motor speeds of 800 to 1 200 revs. per min. were now generally accepted as the most satisfactory for passenger lifts in London. The efficiency varied from 30 to 60 per cent. The efficiency of worm gearing fell off rapidly as the gear ratio increased. His firm had decided to pin its faith to the arrangement in which the worm was above the wheel, as it afforded more solid construction and greater facilities for inspection and cleaning than the reverse arrangement. In addition to the electro-magnetic brake, his firm now added a hand release, which, in the event of failure of current, permitted the lift to be wound to the floor level by hand. High-speed lifts were now also fitted with a dynamic braking device, the armature being short circuited through a resistance and the shunt field disconnected from the line and energised by back e.m.f.

Mr. Marryat then dealt with the calculation of counterweights, the provision of rockers to equalise the strain on the ropes, and other safety gear. He also mentioned his firm's combined system of operator-control during busy hours and push-button control during slack hours, and the controller, patented by his partner, Mr. M. D. Scott, in which the shunt field of the motor was always left connected across the armature, when the main circuit was disconnected, which eliminated a large class of failures due to inductive discharge on breaking the field circuit. A valuable feature was that the controller was double-pole, the main source of supply being switched on and off at both poles at each operation of the lift, which prevented uncontrolled movement of the car in the event of an earth in one or other part of the control system.

Institution Dinner on January 18th.

Arrangements have been made for the members of the Institution of Electrical Engineers to dine together at the Engineers' Club, Coventry Street, W., after the ordinary meeting of the Institution, to be held on January 18th. The charge per cover will be 5s. 6d. Members wishing to be present at the dinner are requested to send their names to the Secretary in advance, either in writing or by telephone. Subject to accommodation being available, additional names will also be received by the Institution attendants from members when the latter sign their names before entering the Lecture Theatre for the meeting, but it is especially preferred that members should send in their names in writing or by telephone.

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Magnetic Separators.

Recovering Unburnt Fuel from Ashes.

The German firm of Fried Krupp have devised a magnetic separator for the purpose of recovering coke and unburnt coal from ashes, says "Engineering." Practically all coals contain iron in the form of pyrites, which has no magnetic properties. The burning of the coal, however, converts the pyrites into oxides, which are magnetic; and as the whole of the iron passes away with the slag, the metal exists there in a very much more concentrated form than in the original coal. These facts are taken advantage of to effect the separation.

The machine employed consists essentially of a magnetic drum over which the furnace refuse is passed. The drum rotates slowly about a horizontal axis, just as in the case of an ordinary magnetic separator. The ashes to be treated are delivered by a bucket-elevator to a vibrating screen which separates them into various sizes. Each size is passed separately on to the circumference of the drum. The slags containing iron are held magnetically to the surface for a portion of the revolution, and then drop off into small wagons or other receptacles as the current exciting the portion of the drum which held them is automatically broken. The coal and coke which may be present do not adhere to the drum but leave its surface directly after contact with it and fall into their own receptacles. It is said that lumps of slag up to 3-in. mesh will adhere to the drum and thus be eliminated from the fuel.

The magnetic separators are built in sizes capable of dealing with quantities of ashes ranging from ½ ton to 2 tons per hour. The fuel recovery by these machines can either be burnt under boilers by means of forced draught or it can be briquetted, both methods being in use. Among the users of magnetic separators may be mentioned the Hungarian State Railways, who treat locomotive ashes by the method described.

Forty Years Ago.

"The Electrician," January 13th, 1882.

ELECTRIC LIGHTING AT THE MINT.—The Royal Mint, which has just been entirely reconstructed, will be lighted by electric light, and telephones will be largely used throughout the building.

SOCIETY OF TELEGRAPH ENGINEERS AND OF ELECTRICIANS.—At the meeting of the society, to be held on Thursday, the 18th inst., at 8 p.m., Mr. Willoughby Smith will deliver his inaugural address, as president, for the ensuing year.

ELECTRIC AND GAS LIGHTING AT SHEFFIELD.—At a meeting of the Electric Lighting Committee of the Sheffield Town Council, held last week, a report was read from Mr. Conrad Cooke, electrical engineer, retained by the corporation to advise as to applying to the Board of Trade for a provisional order under the Electric Lighting Act, in which he recommended that the streets of the town should not be lighted by electricity but by gas.

Aluminium in the Kitchen.

A Coming Demand which should be Encouraged.

Electric cooking and aluminium cooking utensils go hand in hand, and it is therefore gratifying to find the "Hardware Trade Journal" reporting a firmer demand from retailers for aluminium kettles, etc. Our contemporary also notes that "the clean, attractive appearance of domestic utensils of aluminium, the numerous selling points which can be used in connection with this class of goods, and the constantly extending range of manufactures, have prompted many retailers to embark on a campaign for developing business in this section of the hardware field." A similar policy may well be followed by those who are anxious to promote the sale of electric cookers.

Institution Notes.

An examination scheme has been formulated by the INSTITUTE OF INDUSTRIAL ADMINISTRATION, and will shortly be the subject of a special report. This will also deal with additional subjects such as industrial history and economics, industrial and financial organisation and sales management. The proposed scope of the examinations is outlined in the Institute's "Journal" for December, 1922.

At the funeral of Sir John Gavey, on January 5th, the Council of the INSTITUTION OF ELECTRICAL ENGINEERS, of which the deceased was a past-president, was represented by the following: Mr. F. Gill (president); Mr. W. M. Mordey, Sir John Snell, and Mr. C. P. Sparks (past-presidents); Dr. Alexander Russell and Mr. F. Tremain (members of Council); and Mr. P. F. Rowell (secretary). There were also present Messrs. W. W. Cook, J. E. Kingsbury, A. Moir, G. F. Preston, Dane Sinclair, and Major T. F. Purves.

A committee consisting of representatives of the INSTITUTIONS OF MECHANICAL ENGINEERS AND NAVAL ARCHITECTS has been appointed with the objects of carrying out tests on oil engines, and of reporting on the performance of motor-driven vessels. The Engineer-in-Chief of the Fleet has, with the approval of the Admiralty, joined this committee. In scope, the proposed trials will include economy and thermo-dynamic tests ashore and manœuvring tests at sea. Wherever possible the behaviour of the propellers and the hull will be examined. It is intended to test engines of as many representative types as possible. It is anticipated that the first actual testing work will be carried out about April next.

Tasmanian Hydro-Electrics.

Substantial Progress in the Face of Difficulties.

Some idea of the difficulties attending large hydro-electric schemes may be gained from the eighth annual report of Mr. J. H. BUTTERS, chief engineer and general manager of the Tasmanian Hydro-Electric Department. The report covers the period from June, 1921, to October, 1922. So far as construction was concerned, the essential work in connection with the Ouse diversion was completed. When these works were designed, no accurate information was available as to the stream flow and floods at the point of diversion. Mr. BUTTERS therefore decided to have the headworks partly of a temporary nature, so that they might be readily modified when, in the light of observations made, it was possible to say what form they should take.

Great trouble was experienced in securing a proper foundation for the new dam at Miena, excavations disclosing two serious rifts. One of these caused much anxiety and work, bottom being finally obtained at a depth of 53 feet. This excavation, known as the "Glory Hole," was the cause of the whole of the conservation programme being put back by one year. Completion of the dam was anticipated by the end of 1922 at latest. During the period under review, much work was done at the Waddamana power station, where completion of the whole of the work, except painting, etc., was anticipated before the end of 1922. The northern transmission line was put into service in October, 1922. The Risdon sub-station was completed and made ready for the official opening in November. This sub-station is the largest in the Southern Hemisphere, having a continuous capacity of 50 000 H.P. Work on the Arthur's Lake dam was suspended during the year.

Turning to the commercial side, Mr. BUTTERS reports that the bulk supply branch, after meeting all expenses, providing for depreciation, and paying its interest bill in full, made a net profit of £11 651. The Hobart retail branch made a profit of £3 475. Large users of the Department's power during the year included Carbide and Electro Products, Ltd. (formerly the Hydro-Electric Power and Metallurgical Co.), and the Electrolytic Zinc Co.

Charges for domestic electricity during the period have been at the following rates:—5d. per kWh for lighting, 1d. for domestic heating and cooking, and ½d. for continuous hot-water system. Revenues from these sources have greatly increased.

Mr. BUTTERS notes with pleasure that the Electricity Bill has again been introduced into Parliament. He urges that the standard of electrical apparatus and installations be raised, seeing that the system of the future may have a generating capacity of 100 000 H.P., as against small installations of 1 000 H.P. or less. Legislation in the matter is, he states, essential.

Arc Regulation in Electric Furnaces.

United States Bureau of Mines' Practice.

For regulating the working of a 300 lb. single phase furnace of the Heroult type, used for melting iron and steel, forming part of the equipment of the North-West Experimental Station of the United States Bureau of Mines, in the College of Mines Laboratory of the University of Washington, two ordinary 40 W tungsten filament lamps are set upright on a shelf near the meter board and in full view. Each lamp is connected to one electrode. For convenience it is well to have the left-hand lamp connected to the left-hand electrode, and the right-hand lamp to the right-hand electrode. Both lamps have a common connection to the metal bath in the furnace. Usually all that is necessary is to connect them to the shell of the furnace, but if that does not work, a steel bar can be buried in the hearth similar to the bottom electrode of a Girod furnace. In operation the brilliancy of the filament will vary with the drop in potential between the electrode and the bath. A lamp of this type will glow dull red at 15 V and will safely stand surges up to 125 V. When the power is on and no arc has been drawn the lamps will simply be in series across the bus-bars and will glow with equal brilliancy. When current is flowing through the furnace they are lighted equally only when both arcs are exactly the same, that is, have the same length, and, therefore, the same resistance. The slightest change in either arc is quickly and accurately indicated by the lamps. If one electrode should touch the bath its pilot light would instantly go black. These lights, therefore, show the exact position of the electrodes at all times.

Twentieth Century Cookery.

How the B.E.D.A. Helps the Housewife.

The booklet entitled "20th Century Cookery" is, needless to say, issued by the British Electrical Development Association. Further, it is edited by Mrs. A. Mole and claims to be an indispensable handbook (at the price of 1s.), for the housewife or cook. It is prefaced by an account of the advantages and relief electricity can bring to the much harassed housewife, especially when she uses it for cooking. Then a reprint of that useful pamphlet "Commonsense Cookery" is given and neither last, nor least, there are 100 recipe for all sorts of appetising sauces, entrées, fish dishes, sweets and cakes. Then there are some useful cooking hints and finally an interesting thesis on how electricity saves money. We have handed our copy over to the person to whom it most appropriately belongs. We recommend all our readers to purchase copies and do the same, especially as a reduction in price is made on taking a quantity.

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I.E.E. Certificates and Diplomas.

Conditions of their Award by Technical Schools.

Arrangements have been made for the award of the national certificates and diplomas of the Institution of Electrical Engineers in conjunction with Board of Education. The two bodies are prepared to approve schemes submitted by technical schools or colleges for the award, under approved conditions, of the certificates in respect of part-time, and the diplomas in respect of full-time, grouped courses. Part-time courses are classified as "senior" and "advanced." They must be carried on for at least 150 hours in each year and must extend over at least two years. Full time courses are similarly classified and must extend over at least two years.

Before approving a scheme, the Institution and the Board will require to be satisfied as to the equipment, etc., of the school. It will be a condition of approval of a scheme that certificates and diplomas shall be issued only to those candidates who pass the prescribed examination. Students must, as a rule, take the whole of their courses at one school. The Institution will appoint assessors to revise the examination papers set at the end of the final year of the course, and the assessors will have certain options with regard to substituting questions and making questions compulsory.

Schemes for the joint approval of the Institution and the Board must be submitted in the first instance to the Board, whose address is Whitehall, London, S.W. Applications in respect of part-time courses should be submitted on Form 295 T. in duplicate, and those in respect of full-time courses on Form 296 T. in triplicate. Such applications should in no case be made later than September 30th in the school year in which approval of the course is desired to operate. Applications for the approval of courses to commence in the autumn of 1923 should be sent to the Board as early as possible, and in any case not later than November 1st, 1923.

The full conditions are set out in a pamphlet to be obtained from H. M. Stationery Office, price 1d.

Calendars and Diaries.

Further Useful and Informative Productions.

The "Heemaf" Diary for 1923 is issued by the HENGELOSCHE ELECTRISCHE EN MECHANISCHE APPARATEN-FABRIEK. It is a neat little booklet, and is distinguished by the fact that it contains, not the usual technical data but some excellent photographs of the firm's products.

In addition to the pocket diary noted last week, we have also received from the BRITISH THOMSON-HOUSTON Co. the calendar which it is their kindly habit to send us each year. Already this calendar has taken its place on the editorial wall, for it possesses several outstanding virtues which all its users will readily appreciate.

The stream of calendars still continues to flow with undiminished force into this office. The D.P. BATTERY Co.'s production makes us envious of the surroundings in which its employées work. Apart from the calendar proper, it consists of a coloured aero photo of the works and property of the company, including the staff and workmen's cottages and a recreation ground.

The calendar we have received from BROOK HIRST AND Co., is not only a calendar but a guide to the firm's productions. Each card contains an illustration and short explanation of one of the firm's productions, and thus combines utility with instruction. We note with interest that the name of the firm is shortly to be changed to Brookhirst Switchgear, Ltd., but this will be the only change either in policy or personnel.

HOLLINGS AND GUEST have sent us a clear print monthly calendar which is surmounted by a view in one of their erecting shops. The calendar tells us all about the moon, which is useful to those who live in places without street lighting. The calendar issued by W. H. WILLCOX AND Co. is really called a date remembrancer. It is printed in monthly sheets, each of which contains a number of illustrations of the firm's products. It is so arranged that at the end of each month the sheet need not be torn off but may be turned back over the hanger.

Francis Polden & Co.—Annual Staff Dinner.

Members of the indoor and outdoor staffs of Francis Polden and Co. dined together on Saturday last. MR. FRANCIS C. POLDEN, the chairman of the company, presided over a large gathering, including many ladies.

The toast of "The Chairman and Francis Polden and Co., Ltd.," was proposed by MR. W. J. REVELL, and MR. POLDEN, in replying, dealt at some length with the activities, aims and ideals of the company. MR. A. C. HILL wittily proposed the toast of "The Ladies and Visitors," and MR. W. T. SMITH as wittily responded.

MR. POLDEN, in proposing the toast of "The Indoor and Outdoor Staffs," commented upon the growth of the cordial relationship existing between the indoor and outdoor staffs and between both and the management. He urged both staffs to be as efficient as possible, since efficiency tended to produce work, a fact which he demonstrated by giving concrete examples. MR. GILL and MR. PLUMMER briefly responded.

An excellent musical programme was enjoyed and the evening was concluded with the singing of "Auld Lang Syne."

Association of Radio Manufacturers.

New Body for Protection of Trade Interests.

An association has recently been formed under the title of the NATIONAL ASSOCIATION OF RADIO MANUFACTURERS for the purpose of "preventing those chaotic conditions which inevitably arise in a new industry if the solution of all problems is left to individual effort." Prior to the formation of the Broadcasting Co., a preliminary committee of the Association met regularly, and it is hoped that the decisions reached on many matters will prove beneficial to the trade in the near future.

The Association is not a "ring" and does not attempt to control the selling prices of the instruments marketed by its members. Its main objects are to establish at the outset such fair and equitable conditions of trading as are essential to the well-being of a new industry, and to take up from time to time any questions of common interest to the trade upon which united action appears to be desirable. The conditions of membership are simple. An applicant must be a *bona fide* British manufacturer of radio apparatus and must be eligible for membership of the British Broadcasting Co.

The Radio Section of the Ideal Home Exhibition, to be held at Olympia in March, will be under the control of the Association. Intimations have recently been issued to members and potential members inviting applications for stands and stating that the allotments of space will be made by means of a ballot conducted by the Association. The arrangements include the acquisition of a theatre at Olympia capable of seating 1 000 people, in which radio demonstrations will be organised by the Association throughout the period of the Exhibition.

One of the most important functions of the Association will be to maintain the closest co-operation with the British Broadcasting Co. on all matters of importance to the trade. Derbyshire and Co., 4, Southampton Row, London, W.C.1, are acting as secretaries to the newly-formed organisation and will be pleased to furnish further particulars to any duly qualified British manufacturers who would like to consider the question of membership.

Royal Warrant Holders.

Appointments in the Electrical Industry.

The "London Gazette" of January 2nd contained the names of the following firms holding warrants of appointment to members of the Royal Family, with authority to use the appropriate arms. The warrants do not carry the right to fly the Royal Standard or to use the word "Royal."

To H.M. the King, in the Department of the Master of the Household :—
- Edison Swan Electric Co., London, electric lamps.
- Hart Accumulator Co., London, accumulators.
- A. P. Lundberg and Sons, London, electrical accessories.

To H.M. the Queen :—
- Tredegars, Ltd., London, Specialists in Decorations and Lighting.

In the Department of the Master of the Household, "By Appointment to the late King Edward VII." :—
- Belshaw and Co., London, electric contractors.

To H.M. the King in the Ceremonial Department :—
- Burt, Escaré and Denelle, London, electrical fittings and bronze manufacturers.
- Perry and Co., London, electric light fittings manufacturers.

To H.M. the King in the Royal Mews Department :—
- C. A. Vandervell and Co., London, electrical equipment for motor cars.

To H.M. Queen Alexandra :—
- Edison Swan Electric Co., London, electric lamps and fittings.
- Hassel and Tendt, Copenhagen, purveyors of electric light.
- India Rubber, Gutta Percha, and Telegraph Works Co., London, electric cable and wires.

Scottish Electricians' Wages.

Standard Rate Fixed at 1s. 5d. an Hour.

The Electrical Contractors' Association of Scotland and the Electrical Trades Union have now agreed that the standard wage for electricians in Scotland should be fixed at 1s. 5d. per hour, and that that rate should prevail until May 1st. It has further been agreed that the country money allowance should be reduced from £1 1s. to 17s. 6d. per week, and that these alterations should take effect as from January 1st. The previous standard wage was 1s. 7½d. an hour, and the E.C.A. originally put forward proposals for a reduction to 1s. 3⅜d. The Union officials, on the other hand, put in a claim for an increase of ½d. per hour.

THE PRACTICAL ENGINEER ELECTRICAL POCKET BOOK AND DIARY for 1923, which for the first time is published by Henry Frowde, and Hodder and Stoughton, at 2s. 6d., is no less practical and no less useful than in former years. The traction section has been completed by a description of the application of electric power to railways, which it sadly lacked, and the wireless section has been rewritten. The chemical engineering, rectifier and welding section has also been revised. We notice that considerable space is still given to arc lamps, a subject much beloved by the compilers of pocket books, while it is hardly correct to say that the systems employed on the Manchester-Bury line and proposed to be used on the South-Eastern and Chatham Railway are the same. The type would be easier to read if wider margins were provided to the pages.

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Electricity Supply.

Extensions and Developments.

LERWICK Electric Lighting Co. propose to commence the building of a power station as soon as a suitable site has been found.

GLASGOW Electricity Committee proposes to acquire two sites in connection with a projected new sub-station at a cost of £12 000.

CHICHESTER City Council has obtained an order authorising the transfer of the electric light undertaking from the company to the Corporation.

Sufficient progress has now been made with Edinburgh's new generating station at PORTOBELLO to allow of one turbine and two boilers being in operation.

The SHROPSHIRE, WORCESTERSHIRE and STAFFORDSHIRE Electric Power Co. is about to erect a generating station at Stourport. For this purpose the company recently obtained the guarantee of the Treasury to a loan of £700 000 under the provisions of the Trade Facilities Act, and the money has since been raised without a public issue.

DOVER Town Council has decided to seek the advice of an expert appointed by the President of the I.E.E., on two schemes for increasing the facility for the supply of electricity. One involves the addition of a 1 250 kW turbine set at an estimated cost of £37 000, and the other provides for the erection of a new power station at an estimated cost of £90 000. The Electricity Commissioners have intimated that they would sanction the former scheme, subject to Dover linking up its supply with the Folkestone Electricity Works, each town laying the cable half way.

Reductions in Charges, Proposed and Actual.

DARWEN Town Council has announced its third reduction in electricity charges in twelve months.

Power charges at ROTHERHAM have been reduced from 100 per cent. to 75 per cent. above pre-war rates.

The multi-part tariff at WALTHAMSTOW is now 20 per cent. on the rateable value of the house, plus 1½d. per kWh.

Electricity charges at WOLVERHAMPTON have been reduced from 90 per cent. to 75 per cent. over the pre-war rates.

At DERBY the percentage charge for electricity supplied on the rateable value system has been reduced from 15 to 12½ as from January 1st.

TWICKENHAM and TEDDINGTON Electric Supply Co. has informed TWICKENHAM Council that it is hoped soon to make a further revision in charges.

Electricity charges in LLANDUDNO will shortly be reduced, as the Council is now receiving current in bulk at a low rate from the North Wales Power Co.

BRADFORD Corporation is being urged to make a revision of electricity charges to shopkeepers, particularly those in combined house and shop premises.

The CLYDE VALLEY Electrical Power Co. proposes to make considerable reductions in domestic rates. A rental system with a small running charge is to be introduced.

MAIDENHEAD Electricity Committee has been empowered by the Town Council to make reductions in the charge per kWh, and 10 per cent. reduction on contract rates.

SOUTHAMPTON Electricity Committee recommends that lighting charges be reduced from 6d. to 5d. per kWh, and heating and cooking charges from 1½d. to 1¼d. for the two summer quarters, meter charges to remain as at present.

There would appear to be a case for a reduction of charges at CARDIFF, where it is recommended that in future the electricity department should budget for the payment of 1½ per cent. of its capital towards the relief of the local rates.

BIRMINGHAM Electricity Committee recommends a reduced ordinary lighting rate of 5½d. per kWh (under 1 000 kWh a quarter), with other reductions on a pro rata basis. The factory lighting rate recommended is 4½d. and that on prepayment meters 5½d. per kWh.

The Town Clerk of LIVERPOOL has written to Bootle Corporation objecting to the reduction of the charges for supply of electricity below those in operation in Liverpool. A conference has been arranged with a view to effecting a settlement of the question of the charges in Bootle.

Reference to the reduced chages at HULL was made in this column last week. In addition, an optional multi-part tariff will be introduced as from April 1st, those adopting it paying an annual sum of 15 per cent. on the rateable value of their houses plus 1¾d. per kWh for all current used.

Loans Applied for and Sanctioned.

MAIDSTONE is applying to the Electricity Commissioners for sanction to borrow £9 071 for electricity purposes.

MANCHESTER Electricity Committee wishes to borrow £45 760 for the extension of the Dickinson Street sub-station.

CANNOCK Urban Council has received sanction to a loan of £7 978 for electricity extensions at Hednesford and Chadsmoor.

BARROW-IN-FURNESS Town Council has received from the Electricity Commissioners sanction to a loan of £19 000 for electricity purposes.

BELFAST Corporation has applied to the Electricity Commissioner for Northern Ireland for sanction to borrow £132 667 for electricity purposes.

LIVERPOOL City Council last week confirmed the recommendation of the Tramways and Electric Power and Lighting Committee that an application be made to the Electricity Commissioners for sanction to borrow £250 000—£75 000 for the purchase of the undertaking of the Liverpool District and Lighting Co., and £175 000 expenditure on underground mains. The Commissioners have already sanctioned the borrowing of £16 000 for the provision of electric mains and service.

Tapping New Areas.

An order has been confirmed giving the Urban District Council for OGMORE and GARW powers to supply electricity.

Steps are being taken at CLOWNE to form a local company with the object of carrying out an electric light scheme for the town.

WOLVERHAMPTON proposes considerably to extend the area of its supply, taking in country to the North and North-West of its present area.

SWANSEA Electricity Committee proposes to supply Mumbles with electricity. Three hundred applications for current have been received.

WORKINGTON Town Council has requested the Development Committee to report on the proposed installation of electricity for the borough.

MARKET HARBOROUGH Urban District Council is organising a canvas to ascertain the local demand for electricity. A supply from Kettering is offered.

LEWES Town Council has asked the Electric Light Co. to prepare a comprehensive scheme for lighting the streets of the whole town, and to submit a price.

MARCH Urban Council has decided to offer no objection to an application by Sir Charles Bright, Ltd., to the Electricity Commissioners for a special order to supply electricity in March.

Steps are being taken to secure a supply of electricity for BEER and SEATON. A sufficient promise of capital has been made to justify the formation of a company to carry out a scheme.

BLACKBURN Town Council have deferred the question of supplying electricity to Ribchester and Whalley pending the special inquiry, next February, regarding the Mid-Lancashire electricity scheme.

The Electricity Commission has informed the WOKINGHAM Town Council, in conjunction with Sharpe, Pritchard and Co., that there will be no difficulty in the formation of an area of supply for the borough.

ULVERSTON Urban Council, which has had under consideration a proposal to take a supply of electricity in bulk from the Corporation works at Barrow-in-Furness, has appointed Mr. C. H. Wordingham to advise generally on the scheme.

KINGSBRIDGE Rural Council has been notified that Mr. R. Hartree, Salcombe, intends to apply to the Electricity Commissioners for power to supply electric light and power in the rural area. NEWTON ABBOT Council has been similarly notified.

Crompton and Co. have applied to the Electricity Commissioners for a Special Order authorising the supply of electricity in SHERBORNE Urban District. Any objections must be sent to the Secretary, Electricity Commission, Whitehall, London, by January 29th.

PENYBONT Rural Council have applied to the Electricity Commissioners for a Special Order authorising the supply of electricity in the parishes of Kenfig, Pyle and Tythegston Higher, in Penybont Rural District. Objections to the Secretary, Electricity Commission, Whitehall, London, by January 30th.

Miscellaneous Supply Items.

WOLVERHAMPTON Corporation electricity undertaking made a profit of £13 941 last year.

MAIDSTONE Council Electricity Committee has arranged an Electrical Exhibition at the Corn Exchange from February 10th to February 21st.

The full conference of local authorities concerned in the electricity supply in the WEST RIDING (AIRE and CALDER) Electricity District met in Bradford last week, under the chairmanship of Alderman Wilfrid Turner (chairman of the Bradford Electricity Committee). Complete unanimity was reached as to the attitude to be taken in regard to the conclusions of the Electricity Commissioners recently published in regard to the district.

At last week's meeting of the SALFORD Town Council, the Chairman of the Electricity Committee (Councillor Billington) moved a resolution agreeing to the deletion of the variable price clause from the contracts with Metropolitan Vickers Electrical Co. in connection with the supply of certain plant at the new works, in consideration of a reduction of £9 000 in the contract price. Mr. Billington said the committee were making a good bargain, as wages in the engineering trade were about at the lowest limit. The action of the committee was approved.

An order was made on January 2nd RESTORING LETTERS PATENT No. 115 030, of April 19th, 1917, granted to the Benjamin Electric, Ltd., for "Improvements in or relating to electric lighting apparatus."

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Electrical Progress in New Zealand.

Substantial Contracts for British Firms.

In the report of Mr. R. W. Dalton, H.M. Trade Commissioner, on commercial conditions in New Zealand to July, 1922, it is stated that the success of the Lake Coleridge hydro-electric scheme in the South Island led the Government to investigate the water powers of the North Island, with the result that three main works—at Mangahao, Waikaremoana and Arapuni—were decided upon; and the Government also purchased the Hora Hora plant for further development. Contracts have been let for plant for Waikaremoana and Mangahao, practically all to British firms. This is largely due to the determination of the New Zealand Government to purchase all it can in the United Kingdom, and in some cases material preferences have been shown compared with quotations from other countries. Specifications have been prepared for plant for the Arapuni works, which will serve the Auckland district.

As Mr. Dalton remarks, the works proposed at these centres have been described in previous reports, but he thinks it well to remind firms that New Zealand is rapidly becoming a very important hydro-electric country, and will soon be a considerable market for electrical goods. It is probably, he says, within the mark to estimate the cost of the works and reticulation in the North Island alone within the next few years at about 20 million pounds, exclusive of small motors and other apparatus which will be required, apart from the generation and distribution systems. Municipal authorities also (Wellington, Auckland and Dunedin in particular) have recently taken steps to develop their works to meet the increased demand for energy; and the Southland Electric Power Board, who recently raised a loan in London, are about to proceed actively with the equipment of their works.

Imports included £36 554 worth of electricity meters from the United Kingdom in 1921, compared with £19 929 in the previous year, the corresponding figures for similar goods from the U.S.A. being £20 235 and £9 404. British railway and tramway plant, other than cars and trucks and wheels, except for passenger cars, £406 329, against £163 975; United States, £57 663, against £35 834. Telephones and accessories: U.K., £32 573, against £27 705; U.S.A., £48 401, against £8 221. Bare copper wire: U.K., £181 300, against £32 888; U.S.A., £23 981, against £5 421. Electrical machinery: U.K., £867 735, against £504 993; U.S.A., £464 520, against £342 404.

Personal Items.

Sir Alfred Mond has rejoined the Board of Directors of Brnnner Mond and Co.

Extension of leave on account of illness has been granted to Mr. Thomas Roles, electrical engineer to Bradford Corporation.

Oldham Town Council has increased the salary of Mr. F. L. Ogden, Borough Electrical Engineer, from £769 to £900 per annum.

Mr. Hadyn T. Harrison is to advise on illumination problems in connection with the forthcoming British Empire Exhibition at Wembley.

Mr. H. H. Curtis, having severed his connection with the British Thomson-Houston Co., has joined the London office staff of Electromotors, Ltd.

Sir Joseph Larmor contributed a long memorial of the work of Professor H. A. Lopentz to the series of "Scientific Worthies" in last week's "Nature."

Mr. W. Johnstone, executive director of the Brush Electrical Engineering Co., has been appointed by the Board to succeed the late Mr. B. Broadhurst.

Mr. Arthur H. Morse has resigned from the managing directorship of the Marconi Telegraph Co. of Canada, and is in business on his own account in Montreal.

Sir E. Manville, M.P., at Coventry last week, contradicted the statement made in the Press that he intended to resign his seat in order to make way for Sir Arthur Griffith-Boscawen.

The marriage took place at Cliffe Church, Lewes, on December 31st, of Mr. Charles Leslie Brown, a member of the staff of the Lewes Electric Light Co., and Miss Norah Helen Bleach, only daughter of Mr. Frederick Charles Bleach, 140, High Street, Lewes.

Mr. J. T. Potts has been appointed to succeed Mr. S. J. Watson as electrical engineer at Bury. The salary attaching to the post is £750 per annum. Mr. Potts has been works manager at Bury for 12 years. Mr. Watson, who has now taken up his new position at Salford, has been retained by Bury in an advisory capacity for six months.

The "Times" announces that Mr. G. F. Preston, who has been Controller of the London Telephone Service since the National Telephone Co. was purchased by the Government, is retiring at the end of this month. At the time of the transfer of the National Telephone Co. to the Government, Mr. Preston was general manager of the Post Office Telephone Service.

Mr. W. A. Sycamore has been appointed London manager for the Keighley Gas and Oil Engine Co. in succession to Mr. H. S. Aspinall, who has resigned that position. Mr. Sycamore was before the war with the British Westinghouse Electrical and Manufacturing Co. at Trafford Park and London. He served abroad in the London Electrical Engineers, R.E. (T.), and after the armistice joined the selling staff of the Keighley Gas and Oil Engine Co.

Imperial Notes.

It is estimated that the municipal scheme for lighting Grahamstown, South Africa, by electricity will cost £33 000. The installation will be complete by June 30th, 1924.

Colombo (Ceylon) Municipal Council are considering a proposal to adopt electrically-driven street-watering vans. It is proposed to establish a special generating plant for charging the batteries.

In the course of the last few days, says a Reuter telegram, the New Zealand Government has accepted tenders from British manufacturers for hydro-electrical material to a total value of £81 993. Foreign firms competed in each instance.

An electric power scheme for South Australia is contemplated by the Commonwealth Power and General Electric Co., whose representative (Mr. C. M. McLeod) is making inquiries with a view to discovering the most suitable of the State's brown coal deposits for the production of power. It is thought the Moorlands deposits may prove to be the best.

The New South Wales Government have received a report from their Chief Electrical Engineer on the subject of electric power supply in the south-east corner of the State. It is calculated that for a capital expenditure of 1½ million pounds hydro-electric works could be established on the Snowy River capable of supplying 155 000 000 kWh per annum. Cost of production is estimated at less than 0·3d. per kWh.

New Zealand Government Engineers are investigating a request made by the Egmont Power Board for a licence to develop 2 000 h.p. at Taranaki on the west coast of the North Island. The estimated cost of the project is £30 000, and it is claimed that the scheme, which could be extended to 20 000 h.p., would be one of the cheapest in the Dominion. Mr. Birks, Chief Electrical Engineer to the Government, is in charge of the inquiry.

The Victorian Railways Department is completing construction of its first electric locomotive. The engine will consist of two units, which will be capable of exerting a combined tractive force of 37 000 lb., at 15 miles an hour, slightly in excess of the power of the "C" type of locomotive, which is the most powerful at present in use in the State. The new locomotive will be used principally for service in the metropolitan freight yards and for hauling suburban goods trains.

A contract has been ratified between the Quebec Government and the Quebec Development Co. for the construction of a dam at the Grand Discharge of Lake St. John headquarters of the Saguenay River, designed ultimately to develop one million h.p. of electric energy. Work is to be started almost immediately, and within three years the first unit, developing 200 000 h.p., is to be completed at a cost of 12 000 000 dollars. Sir William Price, of Price Brothers, Quebec, and Mr. J. B. Duke, of New York, are interested in the scheme.

Foreign Notes.

The exploitation of Austrian water-power is being considered by the Austrian Government in conjunction with Anglo-American interests.

The Cuban Secretary of Public Works has authorised the construction of an electrical plant at Taguasco, in the province of Santa Clara.

A joint commission appointed two years ago by the Illinois Central Railway and the City of Chicago has recommended that in the electrification of that line the 1 500 V d.c. overhead system should be adopted. According to the agreement, the suburban passenger service is to be operated electrically by 1927 and the entire freight service within the city by 1935.

London, New York and Madrid banking firms have recently formed a company, with a capital of 500 million pesetas, to carry out the long-discussed project for an electric line between Madrid and Valencia. The line will be about 350 kilometres in length and double-tracked. The project includes the development of hydro-electric power necessary for the new line.

A contract has been entered into, says Reuter, between a group of Italian capitalists and the Empresas Eléctricas Asociadas de Lima (Peru) for the entire reorganisation and partial reconstruction of the electric light and street railway systems owned by the company. The additional capital to be found exceeds £1 000 000. A proportion of the new equipment will be purchased in Italy, but foreign contractors are not excluded from tendering.

Work is proceeding rapidly in France, says the "Engineer," with the installation of high-tension mains which are to connect up the whole of the industrial districts in the northern and eastern departments, and will be in inter-communication with all the different generating stations, both steam and hydraulic, and also with plants using blast-furnace gases, so that the supply will not be dependent upon any one source. The State was authorised in August, 1920, to devote 135 million francs to the construction of the feeders, and the first section, with a potential of 120 000 V, has just been completed between Vincey and Valenciennes by way of Nancy, Briey and Longwy. Other feeders of 45 000 V will be completed in about four months' time at Liart, in the Ardennes, and of 65 000 V between Landres and Conflans-Jarry in the Meurthe-et-Moselle. As each section is completed it will be handed over to distributing companies which will be more or less under the control of the State.

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Wireless News.

"Blind Spots" in Broadcasting.

Wireless research workers, says the "Times," are seeking for an explanation of several "FREAK" RESULTS which have been observed since broadcasting began in this country.

One problem is why the London programme should be heard faintly in Yorkshire and strongly in the North of Scotland—more strongly, in fact, than the Newcastle programme; and why Southampton and Portsmouth should hear the Manchester programme with ease and the London programme with difficulty. Furthermore, why should "blind spots" exist where wireless signals cannot be heard at all? Several such places have been discovered in England. Didcot was one, Newbury another.

The same problem has presented itself elsewhere. America has its "blind spots," and the Dutch Army authorities found it impossible to reach a certain area of four square miles by wireless signals. Geological conditions, contour, the presence of water, and atmospheric conditions are all believed to be influencing factors. It is believed that "fading" and "blind spots" are parts of one and the same problem.

"Fading" is a known phenomenon, which is much more pronounced where a short wave-length is employed. This explains why English amateurs can often pick up Paris and The Hague messages with greater ease than British messages. When the wave-length is over six hundred metres there is comparatively little "fading." The average wave-length of the British broadcasting stations is four hundred metres. It has been found that "blind spots" vary and move with the alteration of the wave-length.

Among other "freak" results recently registered was the receipt of the Newcastle programme at Gibraltar and of the London programme on a crystal receiving set at Bridlington.

Mr. Marconi on Amateur Transatlantic Experiments.

Discussing with a Press representative the recent successful experiments in TRANSATLANTIC WIRELESS TELEGRAPHY on a wave-length of only 200 metres, and a maximum power of one kilowatt and a half, carried out by members of the Radio Society of Great Britain, Mr. Marconi said that the tests undoubtedly reflected great credit on the experimenters and were extremely interesting. He did not, however, agree with the suggestion that they had proved that the existing high-power wireless stations for long-distance communication, using wave-lengths up to 30 000 m., and power up to 350 kW, were needlessly large and expensive. Such a suggestion was likely to cause wrong impressions in the minds of the public.

Mr. Marconi recalled experiments in Transatlantic wireless on short wave-lengths of 200 m. and under made over 20 years ago. He found that the short wave-length was not reliable at all times for such long distances. Speaking of power, he said that, in 1902, messages sent from Poldhu on about 4 kW were received in ships off the American coast. In 1903 he sent a message from the American President to King Edward, using only 5 kW.

Wireless Extensions and Developments.

The fitting of WIRELESS INSTALLATIONS TO LIGHTSHIPS AND LIGHTHOUSES is being favourably considered by Trinity House.

The annual meeting of the CARDIFF AND SOUTH WALES WIRELESS SOCIETY was informed last week that broadcasting from Cardiff would commence in a fortnight's time. Commander J. R. Schofield was elected president of the Society and Mr. Norman M. Drysdale chairman.

Three women students at the James Watt Memorial Classes Greenock, have passed the third class RADIO TELEGRAPHISTS' EXAMINATION and been awarded the Postmaster-General's certificate of proficiency as wireless watchers or listeners. They are said to be the first of their sex in Scotland to secure this qualification.

There is every indication of the GROWING POPULARITY OF "WIRELESS" among the inhabitants of the country generally. Lectures that have been given at such widely scattered places as Swansea, Cheltenham, Darwen, Newcastle, Dundee, and Cambridge have attracted average audiences of 2 000 people, and the further north the lecturer went the keener he found his hearers.

The BROADCASTING OF OPERA was successfully inaugurated on Monday night, when excerpts from the performance of "The Magic Flute" at Covent Garden were sent out. "Hansel and Gretel" was broadcasted on Tuesday, and "Pagliacci" on Wednesday. In addition, wireless enthusiasts will note with pleasure the really excellent programmes which London is now providing. A "Times" correspondent has been discussing with Mr. George Grossmith the probable attitude of theatrical managers towards the broadcasting of their productions. Mr. Grossmith does not think that the innovation will materially affect the theatres any more than the cinema has done. At the cinema, he said, one saw without hearing; with a wireless set or electrophone, one heard without seeing. Neither form of entertainment was comparable to that given at the theatre. The "Times" correspondent also states that the company operating the electrophone service is facing the new development optimistically. The electrophone, it is pointed out, allows the subscriber to hear an entertainment of his own choosing. The wireless amateur has to be content with what is given to him.

Electric Traction.

Tram Fares and Receipts.

Tramway undertakings in several parts of the country are finding that reductions in fares are proving disappointing from a revenue point of view. At Liverpool, three months' working under reduced fares has resulted in receipts falling by about £2 000 a week. There has been an increase in the number of passengers carried, but up to the present the increase has not been sufficient to justify the reductions already made, let alone further reductions. At BOURNEMOUTH, drastic reductions in fares came into operation at the New Year. For the first three days, there was a substantial increase in the number of passengers compared with the corresponding period of last year, but the receipts dropped by as much as £200.

Such experiences have possibly influenced other undertakings in considering fare reductions. In any case, DONCASTER Town Council has approved the recommendation of the Electricity and Tramways Committee that no reduction in the fares from Warmsworth to Doncaster can be made at present. A second case is that of the KIDDERMINSTER and STOURPORT Electric Tramway Co. applying for powers to continue in force the Tramway (Increase of Charges) Order, 1920. At a meeting last week of LYTHAM-ST. ANNE'S Council, on the contrary, it was stated that there was every prospect of considerable modifications in the tramway charges before long.

It will be remembered that the question of issuing season tickets or contracts on tramways was recently referred to in this column. It is therefore interesting to note that the following notice of motion came before the MANCHESTER City Council this week: "That this Council is of opinion that the issue of tramway contracts would be of advantage to the city and to the public generally, and instructs the Tramways Committee to consider the question and submit a scheme for consideration by the Council. At NOTTINGHAM, the transfer ticket system, which was in operation before the War, will be re-introduced next week.

Traffic Receipts for 1922.

Such figures of traffic receipts for 1922 as are available show decreases as compared with the previous year. On the tramways controlled by the LONDON "Underground" Group, the totals for 1921 and 1922 were £2 815 869 and £2 447 280 respectively, a decrease of £368 589. At ACCRINGTON receipts are down for the year, though the number of passengers carried was 6 073 497 as compared with 4 098 979 in 1913–14.

READING Corporation tramways traffic returns show that receipts were £53 368 9s. 9½d. for the period April 1st to November 30th, 1922, compared with £55 367 3s. 5d. for the corresponding period of 1921.

Tramway Extensions and Developments.

The huge MANCHESTER tramway system is, it appears, to be further extended. A new line is to be laid through Victoria Park and a new double track is to be put down from Upper Brook Street to Dickenson Road on new foundations. BOLTON Tramways Committee has arranged for the extension of several tramway services, the Government Grants Committee having arranged to contribute 50 per cent. of the interest on the necessary loan for five years.

BLACKPOOL Tramways Committee has considered a proposal for an electricity showroom in premises in Lytham Road, adjoining the market. The matter has been referred to the Chairman, Vice-Chairman, and Electrical Engineer for further consideration and conference with electrical traders in the town. The Corporation has also approved a plan for a combined tram shelter, public conveniences and transformer chamber at the corner of Waterloo Road and Central Drive. BURNLEY Tramways Committee have received three tenders for the supply of 650 tons of rails required in connection with re-laying works. The total distance is 6 309 yards, at an estimated cost of £31 545. Such cost is being defrayed out of the loan of £38 950, sanctioned by the Ministry of Transport.

The Edinburgh Rails Contract.

In spite of the recommendation of the EDINBURGH Tramways Committee, the Town Council has decided to place the contract for rails with a British firm, at a higher price than that quoted by a Belgian company. It will be remembered that the Tramways Committee recommended by eight votes to two, acceptance of the tender of the Compagnie Anglo-Belge d'Importation and Export, Brussels, amounting to £19 375, for 2 500 tons of tramway rails, and £775 for 100 tons of fishplates. At the Town Council meeting an amendment was moved that the Council accept the offer of Dorman Long and Son at £9 9s. per ton. The Middlesbrough offer was between £4 000 and £5 000 more than the Belgian offer. On a division the amendment in favour of the acceptance of the British firm's offer was carried by 33 votes to 23.

Electric Railway Items.

Traffic receipts on the MERSEY Railway amounted in 1922 to £241 168.

The "Shields Daily Gazette" urges that the railway line between SOUTH SHIELDS and NEWCASTLE should be electrified.

LEEDS Corporation have applied to the Minister of Transport for an Order authorising the Corporation to make and use light railways in Hunslet Rural District.

LONDON'S "Underground," including the London General Omnibus Co., earned £11 832 748 in traffic receipts during 1922, as against £12 201 934 in 1921, a decrease of £369 186.

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S. Kruse and D. W. Richardson. The Importance of Higher Voltages in Amateur Spark Communication (*Q.S.T.*, 5, pp. 27-32, May, 1922). R.352.

M. Latour. A New High-Frequency Apparatus (*Beama Journal*, 11, p. 713, November, 1922). R.357.

British Made Radio Receiving Sets (*Electrician*, 89, p. 269, September, 1922). R.360.

F. A. Hill. A Weagant Circuit Receiver (*Q.S.T.*, 5, pp. 13-14, June, 1922). R.360.

G. P. Kendall. The Switching of L. F. Valves (*Wireless World and Radio Review*, 11, p. 233, November 18th, 1922). R.360.

P. D. Lowell. Amplifier Operation from A.C. Supply (*Q.S.T.*, 6, pp. 32-35, October, 1922). R.360.

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S. Russell. Radio and the Christmas Spirit (*Broadcaster*, 1, pp. 268-273, December, 1922).
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L. W. Chubb. Radio Detectors (*Electric Journal*, 19, p. 450, November, 1922). R.364/365.

W. W. Coblentz. Some observations on the transformation of thermal radiant energy into electric current in molybdenite (*Journal of the Washington Academy of Sciences*, 12, pp. 411-412, November 4th, 1922). R.364.

A. K. Phillippi. Crystal Rectifiers (*Electric Journal*, 19, pp. 459-461, November, 1922). R.364.

M. Kennelly. The telephone receiver considered as a motor (*Annales des Postes, Télégraphes et Téléphones*, 11, pp. 721-739 July-August, 1922). R.366.

A. Sharman. Head Gears and Loud Speakers (*Popular Wireless*, 1, pp. 551-552, November 18th, pp. 575-576, November 25th, 1922). R.366.

M. Adam. Recording of Radio Signals (*Radioélectricité*, 3, pp. 435-439, October, 1922) R.367.

F. W. Dunmore. A Relay Recorder for Remote Control Radio (*Journal of the American Institute of Electrical Engineers*, 41, pp. 747-749. October, 1922).
Discussion on paper with above title. R.367.

W. J. Muller. Double grid valves for the operation of relays (*Radio Nieuws*, 5, pp. 106-107, April, 1922). R.367.

W. D. Owen. Automatic Wireless Reception (*Wireless World and Radio Review*, 11, pp. 24-25, October 7th, 1922). R.367.

The Telegraphone (*Elektrotechnische Zeitschrift*, 43, pp. 1 386-1 388, November 16th, 1922). R.367.

Critical Tuning Devices (*Wireless World and Radio Review*, 11, pp. 253-256, November 25th, 1922). R.381.

A. W. Dransfield. A Simple Pancake Coil Winder (*Popular Wireless*, 1, p. 521, November 11th, 1922). R.382.

D. W. Dye. Calculation of a Primary Standard of Mutual Inductance of the Campbell Type, and Comparison of it with the Similar N.P.L. Standard (*Proceedings of the Royal Society*, 101A, pp. 315-332, July, 1922). R.382.

H. Hoffmann. On the design of coils for radio receivers (*Jahrbuch der drahtlosen Telegraphie und Telephonie*, 19, pp. 412-416, May-June, 1922). R.382.

P. R. Coursey. The Construction of a Heterodyne Wavemeter (*Wireless World and Radio Review*, 10, pp. 845-853, September 30th; 11, p. 65, October 14th, 1922). R.384.

E. T. Paris. On Doubly-Resonated Hot-Wire Microphones (*Proceedings of the Royal Society*, 101A, pp. 391-410, August, 1922). R.385.

Piezo Electricity Applied to Sound (*Beama Journal*, 11, p. 714, November, 1922). R.385.

Electric Wave-Filters (*Q.S.T.*, 6, pp. 9-11, October, 1922). R.386.

R.400. RADIO COMMUNICATION SYSTEMS.

C. S. Franklin. Short Wave Directional Wireless Telegraphy (*Journal of the Institution of Electrical Engineers*, 60, pp. 930-938, August, 1922). R.402/512.

E. W. B. Gill and J. H. Morrell. Short Electric Waves Obtained by Valves (*Philosophical Magazine*, 44, pp. 161-178, July, 1922). R.402/133.

The radio telephone stations of France and other countries (*Annales des Postes, Télégraphes et Téléphones*, 11, pp. 1 108-1 115, September-October, 1922). R.412.

H. Abraham and R. Planiol. A new method of operation which doubles the output of high power radio stations (*Annales des Postes, Télégraphes et Téléphones*, 11, pp. 817-826, July-August, 1922). R.420 531.

E. Bitton and A. W. Dransfield. The Eliminator (*Popular Wireless*, 1, pp. 545-547, November 18th, 1922). R.430.

G. Malgorn and J. Brun. Atmospherics; their origin and elimination (*Radioélectricité*, 3, pp. 416-423; October, 1922). R.430.

Tests of high-frequency telephony between Amiens and Boulogne-sur-Mer (*Annales des Postes, Télégraphes et Téléphones*, 11, p. 1 107, September-October, 1922). R.470.

G. Arco. Modern high-speed receivers and transmitters (*Jahrbuch der drahtlosen Telegraphie und Telephonie*, 19, pp. 338-355, May-June, 1922). R.485.

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The Electrician Competition.

Conditions to be Observed.

For the benefit of our readers we re-publish below the conditions of the wiring scheme for our All-Electric House. The complete plans and conditions appeared last week, and can be obtained in pamphlet form on application to this office. Those interested are advised to write in early for copies.

1. Competitors are required to obtain from the Editor of THE ELECTRICIAN plans and elevations of the house illustrated in THE ELECTRICIAN of January 5th, and to submit suggestions for wiring the house so that electricity may be used for domestic purposes in it to the greatest possible extent. The house is assumed to be in Hackney. The plans and elevations should be redrawn to a ¼ in.=1 ft. scale on tracing cloth in black ink.
2. Competitors must give the following information :—
   (*a*) A specification of the materials to be used and the method of fixing.
   (*b*) A schedule of all points, controls, fittings and apparatus to be erected.
   (*c*) A priced bill of quantities.
   (*d*) Plans showing the runs and sizes of all conductors and the position of all materials installed.
   (*e*) Wiring diagrams (if necessary) of any work or connections that cannot be clearly indicated on the wiring plans.
   (*f*) A brief description not exceeding 1 500 words of the methods proposed to be employed, with reasons.
   (*g*) A letter to a prospective client, quoting for the job and describing concisely what is offered in non-technical language.
3. While technical correctness will be the first essential, the judges will take into account literary and artistic presentation in the competitors' work. Financial soundness will also be a very important consideration.
4. Drawings, specifications and typescripts must bear in the top right-hand corner a pseudonym by which the competitor wishes to be known, and must be accompanied by a sealed envelope bearing on the outside the pseudonym and on the inside the full name and address of the competitor, and a certificate (see para. 10).
5. The typescripts, drawings and pseudonym envelope must be sent by registered post to the Editor, THE ELECTRICIAN, 8, Bouverie Street, London, E.C.4, and must reach him not later than first post on Thursday, March 29, 1923.
6. Typescripts, etc., bearing the pseudonyms will be sent to the judges, but the names and addresses of competitors will not be disclosed to them until the awards have been made.
7. The names and addresses of the successful competitors will be published in THE ELECTRICIAN as soon as possible after the close of the competition.
8. The following prizes will be given : First, 25 guineas ; Second, 15 guineas ; Third, £5.
9. The Editor of THE ELECTRICIAN will act *ex officio* as judge, and his decision on all matters relating to the competition is final. He can enter into no correspondence on the competitions.
10. Competitors will be required to submit with their typescripts, etc., a certificate agreeing to abide by the conditions of the competition.
11. The proprietors of THE ELECTRICIAN will not be responsible for the loss of or damage to any typescripts or drawings. Every care of the matter submitted will, however, be taken.
12. Competitors must take their own steps to protect any patentable suggestions in the plans or essays sent in. The Editor reserves the right to publish any matter he receives, and will not be responsible if protective steps have not been taken before publication occurs. Solutions, other than those of the prize winners, if published, will be paid for at £2 2s. each.
13. The Editor will not be responsible for any opinion which may be expressed about apparatus, methods, or systems by the competitors.

Books Received.

"Electricity in Agriculture." By A. H. Allen. (London : Sir Isaac Pitman and Sons.) Pp. x+117. 2s. 6d. net.

"Deutscher Kalender für Elektrotechniker." By F. Uppenborn and G. Dettmar. (Munich : R. Oldenbourg.) Pp. xi+600.

"Internal-Combustion Engines." By J. Okill. (London : Sir Isaac Pitman and Sons.) Pp. x+126. 3s. net.

"The Physical Society of London, Proceedings." Vol. 35, Part 1, December 15th, 1922. (London : Fleetway Press.)

"Who's Who in Engineering." Third Edition, 1923. Edited by John Ed. Sears, jun. (London : The Compendium Publishing Co.) Pp. 1 211. 28s.

"Journal of the Institution of Electrical Engineers." Vol. 61, No. 313, December, 1922. (London : E. and F. N. Spon).

"The Theory of Spectra and Atomic Constitution." Three essays. By Niels Bohr. (Cambridge : University Press.) Pp. x+126. 7s. 6d. net.

"The Law Relating to Electrical Energy in India." By J. W. Meares. Second Edition. (Calcutta : Thacker, Spink.) Pp. 381. Rs. 16.

"The 'Practical Engineer' Electrical Pocket Book and Diary, 1923." (London : Henry Frowde and Hodder and Stoughton.) Pp. cxxiii+636. 2s. 6d. net.

A Useful Year-Book.

Like one of the English kings "THE ELECTRICAL ENGINEER'S YEAR-BOOK," is both the first and the fifteenth of its line. It was first published by S. Davis and Co. in 1909 under the title of "The Electrical Engineer's Diary," and contained sixty pages of technical information on various branches of electrical activity. In the intervening years it has outgrown its original scope and title until with over 500 pages of information it blossoms out with a new title. Needless to say, all this cannot be expected for nothing, and the price is one guinea, post free. We think, however, that it is worth it; for whether we turn to power or domestic applications, to the list of central station showrooms or to details of telephone installations, we find plenty of excellent information well set out and adequately illustrated. We note with pleasure—for it is a detail that is often forgotten—that each section is indexed. It is a book which if not on every engineer's desk should at least be in his bookcase.

English Electric and Siemens Supplies.

Change of Title and Fresh Activities.

English Electric and Siemens Supplies, Ltd., announce that their principal shareholders, Siemens Brothers and Co., and the English Electric Co., have agreed to transfer to them, as from January 1st last, their electric lamp manufactures at Dalston and Preston, and in future the factories will be under their management.

The consent of the Board of Trade has been given to a change of name of the company, and, as from January 1st, the company is to be known as the Siemens and English Electric Lamp Co., with registered office at Caxton House, Westminster.

The Siemens and English Electric Lamp Co. is to control the sale of, as well as the manufacture of, Siemens lamps and, by arrangement, will provide the sales organisation for supplies and material manufactured by Siemens Brothers and Co. and the English Electric Co. These include Siemens wires and cables, Stannos wires and accessories, Zed fuses, wireless apparatus, telephones, instruments, etc. The board consists of the following : Mr. P. J. Pybus, chairman (managing director of the English Electric Co.), Mr. G. Chauvin (managing director, Siemens Brothers and Co.), Mr. W. O. Smith (director of Siemens Brothers and Co.), Mr. V. Watlington (the English Electric Co.), Dr. H. Wright (Siemens Brothers and Co.), with Mr. F. Hird (general manager of Siemens Brothers and Co.) as managing director.

Business Items.

STARKIE AND SPARKES, electrical engineers and contractors, have opened showroom premises at Shaw (Lancs).

The address of the ELECTRICITY SUPPLY COMMERCIAL ASSOCIATION is now 7, Phineas Pett Road, Eltham, London, S.E.9.

A new branch has been opened by VICKERS, LTD., at Principality Buildings, Queen Street, Cardiff, under the charge of Mr. H. Thackeray.

The telegraphic address of the London office of THOS. FIRTH AND SONS, 8, The Sanctuary, S.W.1, has been changed from "Mesmeric, Vic," to "Mesmeric Parl London."

A branch has been opened at 14, St. Peter's Square, Manchester, by the STERLING TELEPHONE AND ELECTRIC CO. Mr. William Blogg is in charge, and daily demonstrations of the firm's radio apparatus will be given. The telephone number is City 7035.

Mr. C. H. WORDINGHAM, consulting engineer, has removed from 11, Mosley Street, to more centrally situated offices at 33, Brazennose Street, Manchester. His telephone number—viz., Central 828 remains as before. Mr. R. W. Willis is his assistant in charge of his Manchester office.

TODMAN, RYALL AND CO. inform us that as a result of extensions to their business they are now able to supply a.c. and d.c. generators from 1 to 1 000 kW, and a.c. and d.c. motors from ¼ to 500 H.P. They can also supply alternators and transformers up to 500 kVA, making larger sizes to order.

ELECTRICAL INSTALLATIONS, LTD., Martin Lane, Cannon Street, London, E.C.4, have acquired the electrical contracting business of Mr. S. D. Brand, Bridge Street, Guildford, and are opening in this town a branch of their business. Extensive alterations are being made to the existing premises.

H.M. Chargé d'Affaires at Santiago suggests that British firms should send catalogues and other trade literature to CHILEAN GOVERNMENT DEPARTMENTS. This practice is extensively followed by American and Continental firms. Catalogues of electrical goods for the telegraph and telephone services should be sent to Señor Jefe, Servicio de Sanalizacion, Telégrafos y Teléfonos, Bandera 620, Santiago, Chile.

At the trials for apparatus for municipal work held at Cardiff by the Institution of Municipal and County Engineers, the electric time switches of the HORSTMANN GEAR CO. were "highly commended" by the judges in their report. The Horstmann Gear Co. inform us that out of 130 entries, only three, including their own, secured this honour. The firm are exhibiting at the British Industries Fair from February 19th to March 3rd, on Stand D.28.

A manufacturers' agent in TORONTO, who claims the representation of United Kingdom manufacturers of wireless apparatus and speaking instruments of various kinds, is now on his way to this country with the view of securing the agency for Ontario, on a commission basis, of United Kingdom manufacturers of electrical lines which will not compete with his existing principals' products. Particulars from the Department of Overseas Trade, quoting reference No. 2.

The late DR. GISBERT KAPP left gross estate valued at £11 210.

The children of the employées of the BIRMINGHAM Electric Supply Department were entertained on December 28th and 29th by an elaborately staged and cleverly acted performance of "Cinderella." The entire cast was composed of children of employées of the Birmingham Tramways Department, under the direction of Conductor J. H. Fletcher. Inspector Peach and Motorman Orton were responsible for the scenic effects. The entertainment was organised by the Works Committee in connection with the Department Whitley Council.

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Companies' Meetings, Reports, etc.

An interim dividend of 2½ per cent., less tax, is announced on the ordinary shares of HEAD, WRIGHTSON AND CO.

The MACKAY COMPANIES announce a dividend of 1¾ per cent. and an extra dividend of 10 per cent. on the common stock.

About half of the issue of £50 000 10 per cent. seven-year notes made by DRAKE AND GORHAM have been drawn for repayment on May 7th.

A meeting of the shareholders of FERRANTI, LTD., is to be held to-day (Friday) to consider reorganisation of the company's capital, which it is proposed to increase from £130 000 to £300 000.

The Stock Exchange Committee have ordered 135 000 £1 fully paid ordinary shares and £125 000 7½ per cent. debenture stock of the LLANELLY AND DISTRICT ELECTRIC LIGHTING AND TRACTION CO., LTD., to be quoted in the Official List.

The ANGLO-AMERICAN TELEGRAPH CO. announces a balance dividend of £1 10s. per cent. on the ordinary consolidated stock, making £3 15s. per cent. for the year. Similar balance dividends are declared on the preferred and deferred stocks.

The directors of SIEMENS BROTHERS announce that they have decided to defer their decision to pay the dividend for the half-year to December 31st last on the preference shares until the completion and audit of the account for the year and the settlement of liability for E.P.D.

A meeting of shareholders in the LANCASHIRE ELECTRIC LIGHT AND POWER CO., was held yesterday (Thursday) in order to pass resolutions for raising the company's capital to £1 100 000 by the creation of 100 000 further 6 per cent. preference, tax free, 112 500 further 7 per cent. participating preference and 97 662 ordinary shares, all of £1 each.

An extraordinary general meeting of the ANGLO-ARGENTINE TRAMWAYS CO. on January 4th, unanimously confirmed the resolutions passed at the extraordinary general meeting of the company on December 19th, with regard to the scheme for dealing with the arrears of dividend on the second preference shares. (See THE ELECTRICIAN, December 15th, page 700.)

The NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO. has sent to the holders of its 7½ per cent. debenture stock an intimation that it is proposed to pay off at 100, the stock outstanding on July 1st next. The price of the stock, which was issued in July, 1921, at £95 per cent., has dropped from 104½ to 100½ as a result. This company has now taken over the undertaking of the North Metropolitan Electric Power Distribution Co., in accordance with the provisions of the North Metropolitan Electric Power Supply Act, 1922, and with the consent of the Electricity Commissioners.

The total net revenue of the PROVINCIAL TRAMWAYS CO. for the year to September 30th, 1922, was £27 666. From this are to be deducted administration expenses, £2 516, income tax £3 812, interest to debenture holders £8 750, preference dividend £6 000, provision for income tax £3 525, and other items, leaving £3 000. No revenue was received from Plymouth after June 30th, when the lines reverted to the Corporation. Cardiff Corporation exercised its powers to run buses, and took over the company's garage. The balance of expenditure on these two undertakings has therefore been written off. The arbitration for the suggested purchase of lines in the borough of Grimsby has not yet taken place. The directors recommend payment of preference dividend up to September 30th, 1922, for which provision has been made in the accounts, but with the sale of the Grimsby line in abeyance and cessation of revenue from Plymouth and Cardiff and the state of trade, future payments are uncertain.

New Companies.

BAMFORD WORKS, LTD.—Private. Reg. Jan. 1st. Cap. £5 000 in £1 shares. Electrical, etc., engineers, contractors and agents for the manufacture, supply and installation of electrical, etc., plant and machinery for steel works, iron foundries, collieries, mines, railways, dockyards, etc. Reg. office: Tickleholme, Bamford, Derbyshire.

ELECTRICAL POWER EQUIPMENT CO., LTD.—Private company Registered December 29th. Capital, £500 in £1 shares. To carry on the business of designers, manufacturers and maintainers of plant, machinery, apparatus and appliances for the generation, accumulation, transmission and supply of electrical power, heat, and light, etc. The first directors are: L. Porritt, Spring Field, Birstall, near Leeds (permanent chairman and governing director), Wm. Porritt and Son, Ltd.); J. Culkin, 52, St. James' Street, Leeds (managing director). Qualification of permanent chairman and governing director, £200; of ordinary director, £100. Registered office: Martin Street Works, Martin Street, Birstall, near Leeds.

WIRELESS AGENCIES, LTD. (186 713.)—Private company. Registered December 28th. Capital, £1,000 in £1 shares. To carry on the business of electricians, manufacturers of generators, accumulators, suppliers and distributors of electricity and electrical energy for lighting, heating, telegraphic and telephonic communication, etc. The permanent directors are: D. Sharp (chairman), no address given; S. Forbes, 134, Oakwood Court, Kensington, W.8, engineer; E. Schaap, 16, Addison Court Gardens, West Kensington, W., merchant; H. P. Sharp, 7, Avonmore Road, Kensington, W.14, electrical engineer. The three last-named are joint managing directors. Solicitors: Kenneth, Brown, Baker, Baker, Lennox House, Norfolk Street, W.C.2.

Tenders Invited and Accepted.

UNITED KINGDOM.

GLASGOW CORPORATION. January 15th.—Electric light wiring of houses comprised in the Pollokshaws housing scheme. Specifications and forms of tender from the Electrical Engineer, 75, Waterloo Street, Glasgow.

TYNE IMPROVEMENT COMMISSION, January 16th.—One 20 H.P. and three 3 H.P. d.c. motors. Specification from the general manager, Mr. R. Aughton.

SALFORD EDUCATION COMMITTEE, January 19th.—Electric light wiring, and heating installation. Particulars from the Secretary, Education Committee, Chapel Street, Salford.

HULL CORPORATION, January 22nd.—Renewal of railway track on Holderness Road and part of Beverley Road. Tender forms, etc., from the City Engineer.

EAST HAM CORPORATION, January 24th.—Reconstruction of tramway and highway in High Street South and Manor Way. Specification from the Borough Engineer.

HALIFAX HOUSING COMMITTEE, January 24th.—Electric wiring and fitting of 54 houses at Stoney Bridge Lane, Boothtown, Halifax. Tender forms, etc., from the Borough Engineer, Crossley Street, Halifax.

GUARDIANS OF ST. GEORGE'S-IN-THE-EAST (London), January 25th.—Installation of electric lighting at the Infirmary. Specification and form of tender from the clerk, Mr. R. M. Lockner, Raine Street, Old Gravel Lane, London, E.1.

BERMONDSEY (London) BOROUGH COUNCIL, January 29th.—Six months' supply of stores and materials, including cable and jointing materials, conduits, meters, demand indicators, main fuses, wiring accessor, joint boxes, meter boards, etc. Forms of tender from the Town Clerk.

SIDMOUTH URBAN COUNCIL, January 29th.—Buildings, oil engine-driven dynamo, motor booster, switchboard, accumulators, mains, house services, etc., in connection with the Council's electricity supply scheme. Specification from Mr. W. M. Harris, Canal Ironworks, Kendal.

COMMISSIONERS OF H.M. WORKS, ETC., January 30th.—Erection of Bank telephone exchange, Liverpool. Specification from H.M. Office of Works, James Street, Liverpool.

AUSTRALIA.

VICTORIAN RAILWAY COMMISSION (Melbourne), January 24th.—Insulated copper wire. January 31st.—Three-position line relays, three-phase motors, starting apparatus impedance bonds, accumulator cells and accessories.

MACKAY (Queensland), January 31st.—Boiler plant, steam driven generating plant, cables, cut-out, insulators, meters, etc. Specifications from Frew and Bridger, Queen Street, Brisbane, or 450, Little Collins Street, Melbourne.

VICTORIAN ELECTRICITY COMMISSION (Melbourne), January 31st.—Back pressure steam turbine and 1 500 kW, 6 600 V, 50 cycle alternator.

POSTMASTER-GENERAL'S DEPARTMENT, SYDNEY, February 22nd.*—Telephone and switchboard parts (Schedule N.S.W. 937). March 1st.*—Telegraph and telephone instruments and switchboard parts (Schedule N.S.W. 944).

MELBOURNE AND METROPOLITAN TRAMWAYS BOARD, February 28th.—Semi-auto control gear and switchboards.

VICTORIAN ELECTRICITY COMMISSION (Morwell Power Scheme), March 15th.—Motor starters and isolating switches (specification 23/7). April 28th.—Transformers and spares (specification 23/9). Specifications and forms of tender from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2.

NEW SOUTH WALES GOVERNMENT TRAMWAYS AND RAILWAYS DEPARTMENT, May 23rd.—Eight water tube boilers, with accessories, for the Power House at White Bay, Sydney.—*Reuter's Trade Service.*

EGYPT.

MINISTRY OF THE INTERIOR, CAIRO, March 15th.—Supply and upkeep of electrical fittings in the Offices of the Ministry of the Interior, for one year, commencing April 1st next.—*Reuter's Trade Service.*

NEW ZEALAND.

SOUTHLAND ELECTRIC POWER BOARD, January 31st.*—Outdoor transformer station equipment for Monowai hydro-electric scheme.

SOUTH AFRICA.

JOHANNESBURG MUNICIPAL COUNCIL, February 8th.*—Tramcar spares (Contract No. 9).

JOHANNESBURG MUNICIPAL COUNCIL. February 15th.*—8 000/10 000 kW turbo alternator.

URUGUAY.

STATE ELECTRICITY WORKS, MONTEVIDEO, February 9th.*—27 750 metres 225 V v.i.n. lead covered cable. February 15th.*—16 000 metres coloured cords for internal wiring.

The tender of Corben and Son has been accepted by MAIDSTONE ELECTRICITY COMMITTEE for extensions to the boiler house at £2 265.

The tender of the Pulsometer Engineering Co. has been accepted by the GREAT WESTERN RAILWAY CO. for four turbine centrifugal pumps, each coupled to a 650 B.H.P. Metropolitan-Vickers motor, to replace the existing hydraulic service plant at the BUTE DOCKS.

* Particulars from the Department of Overseas Trade.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

AUTOLEE MOTOR ENGINEERING CO., LTD., 406–414, High Road, Lee Green, electrical engineers. £15 8s. 8d., November 14th, and £30 5s. 7d., November 22nd.

B.T.T. ELECTRIC LAMP AND ACCESSORIES CO., 5–10, Rangoon Street, E.C., electrical engineers. £11 16s. 10d. November 16th.

HALSON, Mr. B., 29, Mayfield Road, Northfleet, electrical engineer. £14 6s. 8d. November 10th.

HARRISON AND SON, Princes Street, Southend-on-Sea, electrical engineers. £13 11s. 10d. November 15th.

LANE, Mr. E., 6A, Bradford Road, Southsea, electrical contractor. £28 2s. 3d. November 16th.

NORVALL, George (trading as G. NORVALL AND CO.), 242, Goswell Road, E.C., electrical engineer. £37 13s. 1d. November 21st.

THOMAS AND EVANS, Salubrious Place, Swansea, electricians. £15 15s. 3d. November 22nd.

TURNER BROS., 12, Manor Road, N., electricians. £15 10s. 6d. November 18th.

WESTON, E., 8, Southampton Row, W.C., electrical engineer. £14 5s. 2d. November 13th.

Receiverships.

DUNN AND CO., CHELTENHAM, LTD.—L. Vizard, of Clarence Parade, Cheltenham, was appointed receiver on December 27th, 1922, under powers contained in first debenture dated October 13th, 1922.

IMPERIAL UNITED LAMP CO., LTD.—F. W. Kellaway, of Thanet House, 231 and 232, Strand, W.C., was appointed receiver and manager on December 15th, 1922, under powers contained in mortgage, dated January 24th, 1918.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

AMESBURY ELECTRIC LIGHT AND GENERAL SUPPLY CO., LTD.—Registered December 29th. £2 500 debentures. General charge.

MAGUIRE (H.), LTD., Hull, electrical engineers.—Registered December 20th. Trust deed dated December 16th, 1922, securing £350 debenture stock. General charge.

MITCHELL'S ELECTRICAL AND WIRELESS, LTD., London, S.E.—Registered December 23rd. £2 600 debentures. General charge. *£550. November 8th, 1922.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

WILKINSON AND CLARK, LTD., Brigg, Lincolnshire, electrical engineers. The voluntary winding-up of this company was confirmed at the recent statutory meeting of the creditors, when Mr. H. S. Carter, C.A., the liquidator, submitted a statement of affairs which showed ranking liabilities of £1 159. Of that amount £1 093 was due to unsecured creditors, and there was a partly secured creditor for £166 who held securities valued at £100. The assets were estimated to realise £736, from which had to be deducted £60 for preferential claims, leaving net assets of £676, or a deficiency of £483. The liquidator stated that a large number of the debts due to the company were very doubtful, and it was difficult to estimate what they would produce. The plant, stock and machinery were being sold by auction. Owing to insufficient records having been kept, the sundry creditors' claims might be increased, but everything had been included in the liabilities of which he had notice and which appeared in the books.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Bankruptcy Information.

EMBURY, Henry John William, and EMBURY, Kenneth Stuart (trading as H. AND K. EMBURY), 110, Queen Street, and 29, Queen Street, Newton Abbot, Devonshire, electrical and mechanical engineers. First meeting, January 12th, 11 a.m., Office of Official Receiver, Exeter Bank Chambers, 67, High Street, Exeter. Public examination, February 8th, 11 a.m., The Castle, Exeter.

SMITH, Archibald (trading as SMITH AND GILL), 57, Albion Street, Nelson, in the county of Lancaster, electrician. First meeting, January 16th, 10.30 a.m., Official Receiver's Offices, 13, Winckley Street, Preston. Public examination, January 17th, 11 a.m., County Court House, Bankhouse Street, Burnley.

Partnership Dissolved.

SMITH AND CO. (Roland Leo SMITH and Harold SMITH), electrical contractors, 4, Oakeswell Street, Wednesbury, and 165, Walsall Road, Darlaston, both in the county of Stafford, as from December 30th, 1922, by mutual consent. Debts received and paid by R. L. Smith, who will continue the business.

Edinburgh Gazette.

BECK (CHARLES E.) AND CO., LTD.—J. M. Geoghegan, 13, Albany Street, Edinburgh, appointed liquidator. Meeting of creditors at 13, Albany Street, Edinburgh, on January 17th, at 2.30 p.m.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"Soft Furnishings: Continental Taste and American Demand"; "Fabrics in Furnishing and Decoration.—XII. Early Eighteenth Century Work (continued)"; "Furniture in the Railway Classification."

THE CHEMICAL AGE.—"Recent Advances in Metallurgical Chemistry," by Elaine Eustice; "Reviews of Recent Chemical Publications"; "Centenary of the United Alkali Co."

THE EUROPEAN COMMERCIAL.—"Review of the Foreign Exchanges"; "Europe's Industrial Fairs."

THE FRUIT GROWER.—"The Wheel of Prices: Are There Too Many Spokes?"; "Fruit and Poultry Keeping," by E. J. Davey; "Plant Fertilisation from the Air."

THE GAS WORLD.—"Full Report of the Third Sitting of the Therm Committee"; "Coke and Its Merchandising"; "Contractors and the Gas Industry."

THE HARDWARE TRADE JOURNAL.—"Continuous Stocktaking for Hardwaremen"; "The Future of Payment by Results"; "Hardware for Brazil."

Prices of Metals, Chemicals, etc.

TUESDAY, January 9.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£68 0 0	—	—
Electro Wirebars	,,	£72 0 0	—	—
H.C. Wire, basis	per lb.	10 3/16d.	—	—
Sheet	,,	10 1/8d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2 3/16d.	—	—
Brass 60/40—				
Rod, basis	,,	7d.	—	
Sheet, basis	,,	9½d.	—	—
Wire, basis	,,	10⅛d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£4 16 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£18 0 0	—	—
Lead Pig—				
English	,,	£28 10 0	10s.	—
Foreign or Colonial	,,	£26 12 6	5s.	
Tin—				
Ingot	,,	£179 7 6	—	£2 17 6
Wire, basis	per lb.	2s. 4¾d.	¼d.	—
Aluminium Ingots	per ton	£100 0 0	—	—
Spelter	,,	£35 12 6	—	£2
Mercury	per bottle	£11 10 0	—	5s.

Sulphur (Flowers)—Ton £9 *Sodium Chlorate*—Per lb. 3d.
,, (Roll-Brimstone)—,, £8 10s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.— ,, £26 per ton, £7 10s.
Boric Acid (Crystals). ,, £55 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 1¼d.; plantation 1st latex, 1s. 3⅛d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Company.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by Messrs. Mewburn, Ellis and Co., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

163 691 Ges. fur Drahtlose Telegraphie. High-frequency telephone systems. (20/5/20.)
187 644 Brush Electrical Engineering Co., Ltd., Boyce, B. A. M., and Huggings, P. Dynamo-electric machinery applicable for electric welding. (7/5/21.) (Cognate Application, 16 595/21.)
187 646 Round, H. J. Thermionic devices. (18/5/21.)
187 649 Midgley, A. H. Control of dynamo-electric machines. (23/5/21.)
163 709 Mauborgne, J. O., and Hill, G. Electro-magnetic wave-signalling apparatus. (24/5/20.)
165 096 Huth Ges., Dr. E. F. Electric oscillation valves. (18/6/20.)
187 665 Aspden, R. L. Flywheel dynamo-electric machines for internal-combustion engines. (27/6/21.)
187 667 Weekes, W. Construction of electrical heating elements. (29/3/22.)
187 689 Huntsworth, G. H., and Anderson, T. G. Coin mechanism for prepayment telephone call apparatus. (21/7/21.)
187 696 Amos, A. W., Lloyd, W. E., and Lloyd, A. L. Electric alarms. (22/7/21.)
187 707 Wade, H. (Severance, E. P.). Electric signal apparatus. (23/7/21.)
166 898 New Antwerp Telephone and Electrical Works. Adjusting device for electric meters, measuring apparatus and other similar apparatus. (24/7/20.)
187 713 Sullivan, H. W. Duplex and the like telegraphic systems. (25/7/21.)
166 904 Ludi, A. Electrical circuit-breaker for vulcanising apparatus. (25/7/21.) (Convention date not granted.)
187 722 Ever Ready Co. (Great Britain), Ltd. ("Hoka" Elektrotechnischefabrik Ges.). Dry batteries. (26/7/21.)
187 736 Western Electric Co., Ltd., and Deakin, G. Telephone systems. (3/8/21.)
175 236 Dubilier, W. Electric condenser and clamp therefor. (7/2/21.)
187 737 White, A. E. (Sangamo Electric Co.). Mercury motor-meters. (4/8/21.)
187 738 Robinson, J. Directional wireless apparatus. (5/8/21.)
187 739 Harrison, H. Electric heating. (6/8/21.)
187 747 Western Electric Co., Ltd. (Western Electric Co., Inc.). Telephone exchange systems. (10/8/21.)
187 755 Marriott, C. W. Electric radiators. (16/8/21.)
187 767 British Thomson-Houston Co., Ltd., and Halliwell, R. F. Interlocking mechanism, particularly mechanism for electric and like controllers. (24/8/21.)
187 775 Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). Control means for electric motors. (29/8/21.)
187 784 British Thomson-Houston Co., Ltd. (General Electric Co.). Electric motor starters. (30/8/21.)
180 975 Westinghouse Air Brake Co. Automatic electric couplings. (1/6/21.)
187 785 Fairweather, W. (Singer Manufacturing Co.). Electrically-lighted sewing-machine. (2/9/21.)
187 789 British Thomson-Houston Co., Ltd. (General Electric Co.). Electrical plug connectors for use with flexible conductors. (6/9/21.)
187 801 Williams, E. B. Electrical connection and lighting boxes for mines and industrial purposes. (21/9/21.)
187 811 Coates, W. A., and Metropolitan-Vickers Electrical Co., Ltd. Operting mechanisms for electrical switches. (29/9/21.)
187 821 Ellison, G., and Anderson, J. Magnetic blow-out devices for use with electric circuit-controlling apparatus. (5/10/21.) (Cognate Application 5 093/22.)
187 823 Chamberlain and Hookham, Ltd., and James, S. Electric current interrupting devices. (7/10/21.)
170 308 Siemens and Halske Akt.-Ges. Telephone systems. (16/10/20.)
187 837 British Thomson-Houston Co., Ltd. (General Electric Co.). Dynamo-electric machines. (19/10/21.)
172 321 Ges. fur Drahtlose Telegraphie. Calling apparatus for high-frequency telegraphy. (4/12/20.)
187 892 Fullers United Electric Works, Ltd., and Welch, A. P. Galvanic batteries. (20/12/21.)
187 893 British Thomson-Houston Co., Ltd. (General Electric Co.). Electric insulators. (21/12/21.)
174 332 Automatic Telephone Manufacturing Co., Ltd. Telephone systems (21/1/21.)
174 063 Scintilla (Firm of). Electric starters for internal-combustion engines. (15/1/21.) (Addition to 161 588.)
180 977 Joly, G. F. C. Spark-gap devices for internal-combustion engines having electric ignition. (28/5/21.)
187 899 Jones, T. H. S., and Jones, H. S. Electric organ actions. (17/1/22.)
178 803 Sachsenwerk Licht-und Kraft- Akt.-Ges. Oil-switches. (21/4/21.) (Addition to 172 982.)
187 907 Swinton, J. H. Whittaker-. Thermionic tubes and the like. (20/7/21.) (Divided Application on 177 816.)
177 499 Meirowsky and Co. Akt.-Ges. Insulating tubes or guides for high-tension electric conductors. (19/3/21.)
187 909 Rutter, J. E. Double pole for the supporting of telegraph, telephone and electric power wires. (1/3/22.)
178 439 Landis and Gyr Akt.-Ges. Prepayment meters for gas, water, electricity and similar commodities. (12/4/21.)
187 921 Simms, W. H. (Bureau d'Organisation Economique). Cooling of electric transformers and similar apparatus. (18/5/22.) (Convention date not granted.)
183 444 Magerle, E. Automatic electric switching device. (21/7/21.)
184 481 Aktiebolaget Birka Regulator. Electric-current limiting device. (30/9/20.) (Divided Application on 169 696.)
187 928 North, N. E., and Metropolitan-Vickers Electrical Co., Ltd. Control systems for dynamo-electric machines. (27/1/22.) (Divided Application on 183 592.)
187 931 Belling, C. R., and Smith, C. H. Electrical heating elements. (30/7/19.) (Date allowed under Sec. 15 (2).)

APPLICATIONS FOR PATENTS.

December 27, 1922.

35 136 L. B. Turner. Charging accumulators from a.c.
35 143 A. E. J. Ball and I. H. Parsons. Electric impulse clocks.
35 155 J. W. French. Sensitive elements of relays.
35 162 G. M. Dalziel. Wireless telephone installations.
35 179 T. Zweigbergk. Devices for making and breaking circuits.
35 180 Igranic Electric Co. and G. H. Pickering. Motor starters.
35 182 W. Dornig. Electric condensers.
35 189 General Electric Co., Ltd., and G. C. Morris. Telephone repeater circuits.
35 190 General Electric Co., Ltd. (Patent Treuhand Ges. fur Elek. Gluhlampen). Lighting devices operated by high frequency currents.
35 191 British Thomson-Houston Co. Electric switching apparatus. (27/12/21 U.S.)
35 192 British Thomson-Houston Co. Illuminating devices.
35 202 E. C. R. Marks (Locomotive Firebox Co.). Electrolytic method and siphon.
35 208 A. J. Packham, A. A. W. Barran and C. B. Mitcalfe-Dale. Thermionic valves.
35 219 Tingey Wireless, Ltd., and W. R. H. Tingey. Input circuits of multiple electrode tubes.
35 222 Automatic Telephone Manufacturing Co. Impulse transmitters for telephones. (29/12/21 U.S.)
35 223 Automatic Telephone Manufacturing Co. Telephone systems. (24/12/21 Germany.)
35 224 Automatic Telephone Manufacturing Co. Calling devices for automatic telephone systems. (20/12/21 U.S.)

December 28, 1922.

35 249 Western Electric Co. Electric signalling systems.
35 263 G. A. Morley. Transformers.
35 264 G. A. Morley. Wireless inductance coils.
35 298 Igranic Elec. Co. and A. H. Curtis. Inductance coils.
35 300 Cape Asbestos Co. and W. A. Godfrey. Heat-resisting stand for electric irons, etc.
35 329 A. L. W. Williams. Electric fire alarms.
35 337 L. Quattrino. Feeding electric furnaces with current. (29/12/21 Italy.
35 343 O. Kurz. Apparatus for collecting and transmitting current from overhead lines. (7/3/21 Austria.)
35 344 O. Kurz. Overhead supply systems for electric traction. (7/3/21 Austria.
35 345 O. Kurz. Electric conductors. (7/3/21 Austria.)
35 346 Siemens and Halske Akt. Ges. Bank contacts for switches used in telephone systems. (6/1/22 Germany.)

December 29, 1922.

35 375 and 35 376 E. J. Halling. Resistances.
35 378 J. H. Dickson. Valve-holders for wireless telegraph apparatus.
35 396 A. E. McKechnie. Electric circuits.
35 399 B. G. Colver. Wireless apparatus.
35 403 H. V. Higgitt and F. E. Pernot. Electric telegraph systems.
35 409 C. H. Bingham. Incandescent lamps.
35 415 Metropolitan-Vickers Electrical Co. Safety devices for hoisting apparatus.
35 424 N. M. Price and W. J and S. R. Witts. Automatic make and break device.
35 432 C. M. Brown. Time switches.
35 436 British Thomson-Houston Co. Electric switches. (10/4/22 U.S.)
35 437 British Thomson-Houston Co. (General Electric Co.). Control for electrical machines.
35 440 K. Murakoski. Induced current medical instrument.
35 442 Akt. Ges. Brown, Boveri et Cie. Mercury vapour rectifiers. (19/1/22 Germany.)

December 30, 1922.

35 457 W. S. Stephenson and G. W. Walton. Converting or transforming electric currents.
35 460 N. R. and E. Booth. Thermionic valves.
35 461 N. R. and E. Booth. Incandescent lamps.
35 462 W. H. Illingworth. Cores for mercurial cut-outs.
35 464 Brolt, Ltd., and W. Holt. Terminals, etc., for electric conductors.
35 489 Bullers, Ltd., R. J. P. Briggs and H. S. Newman. Insulators for h.t. cables, etc.
35 490 C. F. Elwell, Ltd. and S. P. Wing. Wireless masts, &c.
35 492 E. H. Mills and W. F. Possee. Ignition apparatus.
35 493 British Thomson-Houston Co., A. P. Young and E. G. Parrott. Electric ignition devices.
35 496 Metropolitan-Vickers Electrical Co. and D. R. Davies. Circuit breakers.
35 498 J. Hopkinson and Co. and R. A. Hopkinson. Mine signal apparatus.
35 504 Sir C. A. Parsons and J. Rosen. Electric machines.

Arrangements for the Week.

FRIDAY, JANUARY 12th (To-day).

Institution of Heating and Ventilating Engineers.
7 *p.m.* At the Engineers' Club, Coventry Street, London. Lecture on "Automatic Temperature Control," by Mr. B. R. Wingfield.

Junior Institution of Engineers.
7.30 *p.m.* At 39, Victoria Street, London. Paper on "Transient Phenomena Arising in Transformers from Switching Operations," by Mr. S. A. Stigant.

Institution of Electrical Engineers (Scottish Centre). (Students' Section).
7.30 *p.m.* In Room 149, Royal Technical College, Glasgow. Lecture on "Air Driven Electric Generators," by Mr. W. Stirling.

Edinburgh Electrical Society.
8 *p.m.* At Philosophical Institute, 4, Queen Street, Edinburgh. Lecture entitled "Some Wireless Notes," by Mr. A. Whiteley.

SATURDAY, JANUARY 13th.

Association of Mining Electrical Engineers (Lothians Branch).
At the Heriot-Watt College, Edinburgh. "Questions and Answers."

Institution of Electrical Engineers (Students' Section).
Visit to Messrs. Morgan Crucible Co.'s Works at Battersea.

Birmingham and District Electric Club.
7 *p.m.* At the Grand Hotel, Colmore Row, Birmingham. Presidential Address by Mr. C. G. A. McDonald.

MONDAY, JANUARY 15th.

Institution of Electrical Engineers (Liverpool Sub-Centre).
7 *p.m.* At the Laboratories of Applied Electricity, The University, Brownlow Street, Liverpool. Paper on "The Possibilities of Transmission by Underground Cables at 100 000–150 000 V." by Major A. M. Taylor.

TUESDAY, JANUARY 16th.

Institute of Transport.
5.30 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Lecture on "The Employment of Transport in Relation to Post Office Operations," by Mr. H. C. Gunton.

Institution of Engineers and Shipbuilders in Scotland.
7.30 *p.m.* At the Rankine Hall, Glasgow. Ordinary General Meeting.

Illuminating Engineering Society.
8 *p.m.* At the Royal Society of Arts, John Street, Adelphi, London. Discussion on "The Need for Suitable Training in Illuminating Engineering."

WEDNESDAY, JANUARY 17th.

Industrial League and Council.
7.30 *p.m.* At Caxton Hall, Caxton Street, London, S.W.1. "A Talk about Economics," by Sir Ernest J. P. Benn.

Institution of Electrical Engineers (Sheffield and District Sub-Centre).
7.30 *p.m.* At the Royal Victoria Hotel, Sheffield. Paper on "Power Factor—Its Technical and Commercial Aspects," by Mr. H. E. Yerbury.

THURSDAY, JANUARY 18th.

Institution of Electrical Engineers.
6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London. Ordinary Meeting. Paper entitled "Works Production," by Mr. G. H. Nelson.

FRIDAY, JANUARY 19th.

Institution of Mechanical Engineers.
6 *p.m.* At the Institution, Storey's Gate, London, S.W.1. Symposium of short Papers on "Indicators."

Junior Institution of Engineers.
7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette entitled "Paraffin as Fuel for Marine Motors."

British Electrical Development Association.
7.30 *p.m.* At Caxton Hall, Caxton Street, London, S.W.1. Salesmanship Conferences. Lecture on "Wiring Salesmanship in Relation to Spring Cleaning, Decoration, etc.," by Mr. H. T. Young.

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THE ELECTRICIAN

ESTABLISHED 1861.

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CONTENTS.

Notes of the Week	55	Parsons Turbo-Alternator for U.S.A.	72
International Radio Telephony	57	Electrical Contractors and the Press	72
Transatlantic Radio Telephony. Illustrated	58	Whitworth Society Formed	73
Main-Line Electrification in Germany. Illustrated	60	Automatic Telephony	73
Correspondence	63	An Electric Gauge	73
Review	63	Post Office Transport	73
Some Recent Physical Apparatus	64	Wireless News	74
Electrical Developments at Stoke-on-Trent. Illustrated	66	Legal Intelligence	74
A New System of Feed Water De-Aeration. Illustrated	67	Institution Notes	74
Electricity in the Home	68	Personal Items	74
Railless Trolley Traction	68	Electricity Supply	75
Prices of Bulk Supplies	69	Electrical Progress in Australia	75
The Corrosion of Lead-covered Cables by Electrolytic Action. By S. C. Bartholomew	69	Foreign Notes	76
		Imperial Notes	76
Merchandise to Sell and Profit By. Illustrated	70	Electric Traction	77
Municipal Electricity Accounts	71	Business Items	77
Electrical Imports and Exports	71	Obituary	77
Mid-Lancashire Electricity District	71	Companies' Meetings, Reports, etc.	78
Fifty Years of "Via Eastern"	72	New Companies	78
Profitable Municipal Telephones	72	Tenders Invited and Accepted	78
Accident at General Electric Works	72	Commercial Intelligence	79
Hackney Again	72	Forty Years Ago	79
International Telephony	72	Prices of Metals, Chemicals, etc.	79
Why There is a Dearth of Salesmen	72	Patent Record	80
		Arrangements for the Week	80

"The Electrician" Index.

Copies of the Index to Vol. LXXXIX of "The Electrician," which concluded with the issue of December 29th, 1922, are now available free of charge. Application should be made to the Circulation Manager, 8, Bouverie Street, London, E.C.4.

Notes of the Week.

The "Broader Policy" in Danger.

THOUGH the new Council of the Institution of Electrical Engineers has not been in office more than a few months, it will not be very long before the official nominations for next year's governing body are in the hands of members. We call attention to this for two reasons. One is that this year the number of official nominees will equal, but not exceed, the number of vacancies. Unless, therefore, unofficial nominations are put forward there will be no election. Action is therefore called for; but action is necessary for a more important reason. A reaction has taken place against the "Broader Policy." There are those on the present Council who would prefer a reversion from activity in all matters electrical to the cloistered seclusion of the debating society days. That preference may be exhibited in the new nominations. It will be the duty of that large body of members who support the "broader policy" not only to put forward their own nominees, but to obtain from the Council's nominees a statement as to their attitude on this important question.

Prices of Bulk Supplies.

LIKE Cleopatra, the charges for electricity in this country are distinguished by their infinite variety. And that variety is likely to cause trouble on the fast-approaching day when supply is given by districts rather than by towns. The South Lancashire Electricity Advisory Board is therefore to be congratulated on its enterprise in tackling this important subject, and, on approving principles, which shall govern the charges to be made for reciprocal, stand-by and bulk supplies. The decisions arrived at by the Engineering Advisory Committee are given practically in full elsewhere in this issue. A distinction is made between constant bulk supply, off-peak bulk supply, reciprocal supply, and stand-by supply; and it is laid down as an axiom that in all cases the charge shall be based upon the actual cost of production plus a profit. There is no objection to this. It places the matter upon a business footing, and by removing any suspicion of charity will work to both the economic and technical advantage of the district.

The Cost of Production Defined.

THE cost of production, really the deciding factor in the matter, is defined as a fixed charge per kW of demand plus a variable charge per unit delivered to the feeders. The fixed charge will be ascertained by taking the total cost for the previous financial year of the interest on loans (or share dividends), the contribution to the sinking and reserve funds, the management and establishment charges and the rents, rates and taxes, and dividing it by a number of kilowatts representing the maximum running capacity of the station—i.e., the capacity of the plant installed after deducting a reasonable proportion for reserve. The variable charge will be based on the costs of coal, oil, waste, water, stores, wages, and repairs and maintenance. Though, therefore, it is obvious that the bulk supply charges in an area may vary between themselves, depending on the fixed charges that have been incurred, the proportion allowed for reserve plant, if that is not standardised, and the efficiency of running the basis on which they are allocated will be the same, and the very differences may be turned to advantage by inculcating a species of competition and starting a tendency towards more economic working which will be all to the good.

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Allocating the Charges.

HAVING fixed a basis for charging, the next thing is to allocate it in proper proportion to the various kinds of supply. This has been done as follows: In the case of a "constant" bulk supply, the whole of both the fixed and the variable charge will be paid plus an amount not exceeding 5 per cent. of the total of these two amounts. For "off-peak" supply, that is a supply only available at certain times, 20 per cent. of the fixed charge only will be paid plus the coal costs, plus a sum not exceeding 5 per cent. of the *total* fixed and variable charges. "Reciprocal" supply for a period not exceeding two weeks will be based on 25 per cent. of the fixed charge calculated *pro rata*, the coal costs, and again 5 per cent. of the total fixed and variable charges. The proportion of the fixed charge will be increased to 75 per cent. after the first two weeks. "Stand-by" supply will be charged on the whole of the fixed charge per kW of demand which it is necessary for the vendor to maintain, plus the whole of the variable charge and plus 5 per cent. of the total fixed and variable charges. We do not think much criticism can be found with all this, and we shall look to see the same or a similar basis, we hope the former, adopted elsewhere. It is a first step towards that standardisation of tariffs which is much needed.

Voltage Limits on Cables.

THE question of the possible voltage limits on impregnated paper cable has recently been much to the fore. Comprehensive bibliographies have been published by the American Institute of Electrical Engineers, and various phases of the subject have been discussed in a number of contributions, both to the Institute Journals and to the technical press. One of the most recent of these contributions appears in the "Electrical World" of December 9th, 1922. In it Mr. W. A. DEL MAR summarises the technical problems involved in the progress of underground transmission and shows the directions along which many of them are being attacked with a view to obtaining improvement. He considers that it is the cable maker who is holding up progress and that the entire electrical industry is at the present time asking the reason why.

Difference Between British and American Ideas.

A BRITISH engineer, on reading the article, is struck by several points which emphasise the difference between British and American ideas on high voltage cables. For instance, the limitations of dimensions and heat dissipation imposed by the American practice of employing ducts so widely do not hold in British practice, where laying direct in the ground is becoming more and more popular. The temperatures accepted as reasonable, too, are much higher than we consider desirable, and with their adoption follow troubles due to expansion and contraction only rarely encountered over here. The question of circular *versus* shaped conductors, the British favouring the former and the American the latter, is also referred to as a question requiring careful consideration; but on all these points we feel that the "proof of the pudding is in the eating." Where a difference of opinion exists on the two sides of the Atlantic as to the best practice, we only need to examine results to decide for ourselves which opinion to accept. It has recently been stated that in a large number of the American systems, operating at 15 000 V and upwards, there was about one failure per annum for every four miles of cable. So far as we are aware no such comprehensive analysis has been made in this country, but we do not think that British cable makers would be very proud of such a record.

Power Factor and Current Capacity.

MR. DEL MAR evolves a formula for calculating the effect of dielectric power factor on the current carrying capacity of a cable, and here again we notice a feature frequently met with in American literature on the subject—the high values of dielectric power factors accepted. A curve is deduced based on a 10 per cent. value at 60° C., while a 40 per cent. figure is referred to as not being at all unusual in the cables of twenty years ago While not wishing to be unduly cynical we think British cable makers will be inclined to smile at these figures. Anything as bad as 10 per cent. is very unusual to-day, and we cannot believe that 40 per cent. was ever obtained, even twenty years ago, with careful manufacture. The author of the article is the chief engineer of one of the large American cable manufacturers, and, consequently, his opinions have considerable weight. But, after reading the article in the light of what we know of the development work which our own cable makers are doing, we should not be surprised if the progress referred to by the author as being arrested by American cable manufacturers were shortly helped on by their colleagues in this country.

Broadcasting Opera.

THE Broadcasting Co. are to be congratulated on the programmes they have recently been providing. Last week, special arrangements were made with the National Opera Co., with the result that the performances at the Covent Garden Opera House were broadcasted for the delight of many a hearer in the neighbourhood of London. Listening to opera, even for enthusiasts, is often an uncomfortable and tiring operation, but when the music is brought to the fireside and can be listened to in slippers and accompanied by a pipe, real luxury has been achieved. The Press is supposed to reflect opinion. We are doing that when we say that "listeners-in" generally have been not only entertained but impressed by the "wireless" renderings of the "Magic Flute," "Hansel and Gretel," "Siegfried," and "Faust." In their early pronouncements the Broadcasting Co. promised us good programmes. These they have now provided.

The Price of German Technical Books.

COMPLAINTS are rife in the scientific and technical Press of the prices that are being charged for German books. The subject is important from more than one point of view, not the less because the interchange of information between the two countries has never ceased and because it is essential in the interests of progress that that interchange should be continued with the minimum of friction. The case for one side in this country is that while a book is published in Germany at a price of 110 marks, it cannot be purchased in England for less than 40s., which, having in view the rate of exchange, is ridiculous. On the other hand, publishers in this country point out that if German scientific books are allowed to come into this country at a price commensurate with the rate of exchange it will be an extremely serious thing for them, and that the export duty is in its way a godsend. It is a little difficult to reconcile these two points of view. It has been suggested that to do as the Germans are doing is to contravene the Treaty of Versailles. But that document is not sacrosant, and were it enforced in this case readers would benefit at the expense of the publishers. The proper comparison seems to us to be between the prices at which two books of equal quality, one in English and one in German, can be purchased in this country. If these are nearly equal no injustice is being done.

Collecting Consumers' Accounts.

THERE is one part of a supply undertaking's organisation which differs very much between one undertaking and another: the arrangements for collecting consumers' accounts. In some undertakings the collecting department, whether large or small, is brisk, business-like and reputable. In others it has a general atmosphere of depressed dilapidation. The collectors in the one case bring back the cash, in the other case they return with a doleful list of excuses why consumers prefer paying to-morrow. The consequence is that one undertaking gets in practically the whole of its quarter's revenue well before the next quarter, while the slacker undertaking issues innumerable accounts with

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appended arrears. Speedy realisation of the quarter's revenue is obviously of considerable financial consequence. Moreover—and this is one of the most important considerations—an energetic and prompt collection of accounts saves many a bad debt and reduces what bad debts are made to simply one quarter's amount. The fact is, that in too many undertakings the post of collector is looked on as an odd job that can be given to anyone, and paid accordingly. But in reality a well-paid, energetic collector fully earns his salary, more than fully as compared with an unqualified one. Collecting, like everything else, is an art and demands its particular qualities. But too often it is regarded as a matter that is not worth spending five minutes' thought over.

What are Supply Undertakings For?

WE believe that the object of electricity supply undertakings is to sell electricity. We say we believe because the actions of some of these bodies might raise in the minds of superficial observers that the contrary was the fact. For instance, we heard of a case recently where an undertaking was supplying a shop. Above this shop were a number of flats and the occupant of one of these flats wanted to use electricity. He filled in the usual forms and was told he would be connected if he paid some £10 in service charges. Naturally he refused. He is without electricity and the supply authority have a consumer the less. Which, if either of them, is satisfied? Another case is of a shop which required a supply, the distributor running under the pavement a few feet away. An application for connection called forth a demand for a service charge. A letter from a solicitor led to the withdrawal of the demand and instantaneous connection. We are not concerned with the legality of the episode, but with its bad business. Yet there are some in their innocence who suppose that electricity supply undertakings really want to sell electricity.

"The Electrician" Competitions.

APPLICATIONS for the plans of THE ELECTRICIAN All-Electric House still continue to flow in, but if we may mix the metaphor, the flow has taken on a financial tinge. One applicant has asked the amount of the entrance fee and several have sent in stamped addressed envelopes for reply. We therefore wish to point out that there is no entrance fee. THE ELECTRICIAN is not that sort of paper. The financial obligations are all on our side, and in due course we shall fulfil them willingly and punctually. From competitors we expect ideas, so that a further step towards the golden age of electricity, or whatever else it may be called, may be taken. We would suggest once more to those who have not applied to us or who have not obtained the plans and conditions through the various societies that no time should be lost.

International Radio Telephony.

The experiments, of which we give an account elsewhere, conducted early Monday morning by the American Telephone and Telegraph Co. in conjunction in the United States with the Radio Corporation of America, and in this country with the International Western Electric Co., demonstrated the feasibility of international radio telephony on a commercial scale. It might be thought that this had been done before. For as long ago as 1915 speech was transmitted by wireless means between Arlington in Virginia and Honolulu, and just recently amateurs in this country have picked up both speech and music sent out by the American broadcasting stations. But as electrical engineers of all classes know to their cost, it is a great stride from the experimental stage represented by the Arlington tests, and the more or less inexplicable results of the broadcasting reception, to a service which shall allow, whatever the atmospheric conditions and whatever the season, Government officials and business men in this country and in the States to hold a conversation which can be freely understood and as freely acted upon. The experiments at which we had the pleasure to assist on Monday morning convince us that that step has been taken.

Acquaintances Resumed and Extended.

Having said so much it is in no derogatory spirit that we record that those concerned were favoured by fortune. After the first half hour the atmospherics, never unduly disturbing, became almost non-existent, and it was possible for the fifty or sixty persons present to listen in comfort, either through individual head sets or from the loud speaker, to speeches by Mr. H. B. THAYER, president of the American Telephone and Telegraph Co., to informal talks from Gen. J. J. CARTY, vice-president of the same company, and to cullings from the American Sunday newspapers by Mr. BLACKWELL. From the second of these we were glad to hear that he has been a constant reader of THE ELECTRICIAN since 1879, and we take this opportunity of thanking him for his good wishes for our future and on our part expressing our hope that his company and he himself will long continue to have that profound effect on telephonic progress which has been so great a characteristic of electrical history. We were glad to make "radio" acquaintance with so many distinguished persons whose writings we have admired and profited by.

Commercial Communication Now Possible.

Criticism has been made that tests conducted in the winter and under fortuitously good atmospheric conditions prove nothing. But these tests are only part of a series, which have been in progress for a short time in this country, to obtain definite technical information as to the feasibility of introducing commercial radio telephony. As we show elsewhere certain important factors are being taken into account but short as the time has been it is already evident that communication is possible for fourteen hours out of the twenty-four and that "all day" communication is within the range of practical politics. We draw special attention to the way in which economy in power has been obtained by eliminating the carrier wave and one half of the side-band and we look forward with interest to the publication of information on other technical matters which are still in the experimental stage. Technically a great advance has been made. Commercially the future is still to be determined.

What of the Future?

In this connection the question that immediately arises is: What is likely to be the effect of these experiments on international communication? We cannot but think that the effect will be great. On occasions of importance, whether they be diplomatic or commercial, time is of the essence of the contract. If this system of communication becomes a technical and business fact, as there is every reason to suppose it will, time will be almost annihilated. It is true that the experiments on Monday were only "one way," but to arrange not for conversation but for almost instantaneous reply to a radio telephone message is but a small step further on; and we shall look forward to the time, in the near future, when it will have been accomplished. As one of the speakers truly said, if radio telephony had existed 150 years ago the war between this country and her American colonies might never have taken place, and the history of the world might have been very different. In future radio telephony may well be the greatest preventive of war. Once more we congratulate all those concerned on the success of the experiments and especially Dr. H. W. NICHOLLS and Mr. H. T. FRIIS, to whom most of the detailed work was due. These experiments have required for their success, as Major PURVES said, much skill and preparation. We feel sure that everyone present was delighted to assist at what may well be the beginning of very great things.

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Transatlantic Radio Telephony.

A Record of Successful Experiments—Some Technical Factors in the Problem.

Only a fortnight ago we were deploring the paucity of technical improvements in the electrical world during 1922, while last week, becoming more particular, Prof. Howe remarked that radio-telephony in its more restricted sense had made little headway. Neither of these charges, whether they be well founded or not, can be laid on 1923. For early on Monday morning last a party of British press representatives, Post Office officials and others well known in the wireless world were able to hear a series of radio telephone conversations carried on from the offices of the American Telephone and Telegraph Co. in New York by Mr. H. B. Thayer, president of the company, Mr. J. J. Carty, and Mr. E. H. Gifford, vice-presidents of the company, and Mr. E. H. Colpitts, one of the engineers whose work has made such a demonstration possible.

Early History.

This, of course, is not the first time that information has been received by radio-telephonic means across the Atlantic. Neither is it the longest distance that has been encompassed by such means. In 1915 the American Telephone and Telegraph Co. made use of the United States Navy antenna at Arlington, Virginia, for carrying out a series of radio telephonic tests. Observers were sent to Paris, Honolulu and Darien to listen for speech, and speech was in fact heard at all these points, using a power at Arlington of from 5 to 10 kW. But these tests, though speech was successfully received at Honolulu and less successfully at the Eiffel Tower, were in no sense commercial, and both the volume and reliability of the received signals were entirely unsuited to the business requirements of radio-telephony. In fact it was quite impossible to say whether a message would be received at any particular time, and communication on some days was not possible at all.

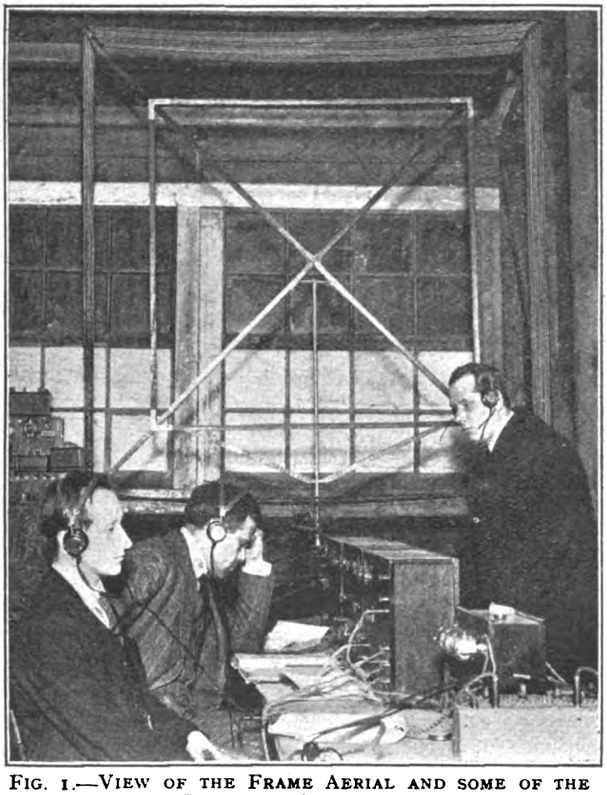

FIG. 1.—VIEW OF THE FRAME AERIAL AND SOME OF THE RECEIVING APPARATUS.

"Freak" Messages.

The same remark may with equal justice be applied to the "freak" messages which have been received recently by wireless amateurs in this country. These tests form the antithesis to the blind spots about which there has been a good deal of publicity. It may in fact be said that at a given spot under different conditions it is possible for the reception to be both super-normal and sub-normal. But neither this super-normality and sub-normality can be considered as factors in a commercial service. We insist upon this point because attempts have been made to minimise the importance of the experiments made last Sunday night on the grounds that what was then done has often been done before.

A Real Advance.

That this is not so, but that a real advance has been made will be evident from a short description of the course of the tests. These took place in this country at the New Southgate works of the Western Electric Co. These works were connected by wireless means with the Rocky Point, Long Island station of the Radio Corporation, and thence by ordinary telephone with the offices of the American Telephone and Telegraph Co. in New York. The total distance covered by wireless was about 3 000 miles of sea and land and about 70 miles by cable. By the courtesy of the Post Office authorities and Mr. S. J. Goddard, of the Western Union Telegraph Co., New Southgate and New York, were connected by a telegraph cable so that test and other messages could be sent in both directions. There were about sixty listeners, each of whom was provided with a head set, an arrangement which required certain modifications in the receiving arrangements, as we shall mention below. After a few preliminary remarks from Mr. Gill, telephone receivers were "assumed" and messages at once began to be heard. These messages consisted first of a list of names of American towns, then of a formal message from Mr. Thayer, which in the course of the tests was repeated more than once, and of formal speeches from Mr. Carty and others. The completion of each speech was confirmed by telegram, which in more than one case was received in the demonstration room about two minutes after the conclusion of the speech.

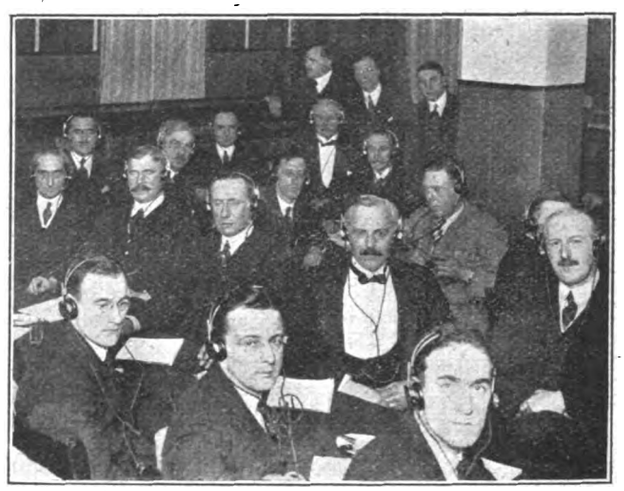

FIG. 2.—SOME OF THE "LISTENERS-IN" INCLUDING MR. MARCONI, MAJOR T. F. PURVES, SIR SHIRLEY BENN AND MR. G. C. ISAACS.

Informal Conversations.

In the meantime messages had been sent telegraphically from New Southgate to New York to tell our American friends who were present and to make suggestions about "speaking up." The result of this was that informality took the place of formality. We heard that it had been snowing and was raining in New York. Mr. Carty told us he had read THE ELECTRICIAN since 1879, hoped to continue reading it, and wished us success in the future, sentiments which we need hardly say we heartily reciprocate. Mr. Thayer's views on Klu Klux Khan were sought and obtained (this is hailed by the "Morning Post" as the first "wireless interview") and many greetings were sent in both directions. At first atmospherics were a little disturbing, but these soon disappeared, and for the rest of the test, which lasted some two hours, the reception well deserved Mr. Gill's encomium of "magnificent." It was possible to hear Mr. Carty cough, and more than one of those present recognised the tones of the speaker's voice before he announced himself. We insist on these seemingly unimportant details to show that the results were no freak effect, but that international radio-telephony has in fact been effected in a way that brings its possibilities

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for commercial communication much nearer than it ever has been before. It is only by some such method that telephony over the ocean is possible, and that possibility has now been raised to the same stage as that of wire telephony over land.

We might add that there has been some criticism of the fact that the tests took place on a winter's night, the time when naturally the best results would be expected. It had been hoped to carry them through in the daytime, but that was not found possible. It may, however, be stated that during the tests now being carried on at New Southgate communication is established and maintained for fourteen hours out of the twenty-four. It should also be mentioned that there was no suspicion of fading any alteration in volume being due to alterations in the amplification.

A Definite Technical Investigation.

Turning now to more technical matters, it may be pointed out that this demonstration was not in the nature of a "stunt." It was conducted as part of an investigation for definite technical information by the American Telephone and Telegraph Co., the object being to determine the feasibility of commercial trans-Atlantic radio telephony. In this connection there is one controlling factor which must always be taken into consideration. This factor is the noise which combines with the received signal and tends to make it unintelligible. If this noise, measured in the usual units of microvolts per m., is nearly equal to or is greater than the received signals communication becomes impossible, no matter what the amplification. That is, it is the signal-disturbance ratio which is important. The first object of these tests is therefore to determine the value of this ratio at all times and at all seasons, and that having been done, it is simple to calculate what power must be used in the transmitter at any moment.

Night and Day Values.

The strength of radio signals, over water, is fairly well known as a function of frequency, distance and power from the Austin formula, which gives the "daylight" values, i.e., it includes the absorption factor. The same formula, with the absorption term equal to unity, represents quite accurately the "night" values of the field under the most favourable circumstances. Unfortunately there is a considerable difference between these extreme values, so that actual measurements must be made. These measurements have been going on for some time in America, and since the beginning of the year the experimental station at New Southgate, used in the demonstration, has been making such field strength determinations. Simultaneously the values of electrical disturbance are measured and separated into the parts due to continuous wave interference and to "static."

When all this information is obtained, which will require a year, it will be possible to determine the cost of a radio circuit of the required excellence and also the way in which the cost varies with the goodness of the circuit, so that definite data will be available for engineering purposes. Fortunately the ratio seems to be constant at the same time on the same day in any year. This applies, no matter what may be the actual type of sending and receiving apparatus employed, as long as it is reasonably efficient and selective.

The Frequency Problem.

Another factor which has to be considered is that the band of frequencies employed should be as narrow as possible to economise the limited number of frequencies available. Intelligible speech requires the use of about 2 000 cycles, and it is important in modulating a carrier to produce signals that a greater range than this is not occupied. The power efficiency of a long distance radio-telephone plant should be high since a large amount of power is required. Because of the difference between the disturbances in summer and winter, the transmitter should be flexible, as to power output, without requiring investment of capital in peak load apparatus which is idle a great deal of the time. Other requirements, such as reliability and cheapness, are obvious.

The Employment of One Side Band.

It is fortunate for radio telephony that all these requirements may be met by one system. The use of the minimum frequency range may be secured by transmitting only one "side band" of the complete modulated wave intead of both side bands and the carrier wave. This method is now in use in the carrier wire telephone system of the American Telephone and Telegraph Co., and its associated companies, and was used on these tests. The greatest power efficiency is also realised by this method of transmission, tests having shown that at most only one third of the power is needed in this system as compared with one in which the complete modulated wave is transmitted. The method can best be carried out by the use of three-element vacuum tubes throughout and since vacuum tubes can be operated in parallel and can be made when needed, a very large peak load can be provided for during part of the year.

In the tests which are now being carried out, the single side band is selected at low power, and is then amplified by means of water cooled power tubes up to about 60 kW. This is radiated from the antenna, and is equivalent to more than 200 kW of the complete modulated wave. At the receiving end, the missing carrier frequency component is introduced by means of a local vacuum tube oscillator and the complete signal is then detected to produce the original speech sounds.

Some Results.

While it is much too early to draw conclusions, engineers may be interested to know that between January 1st, 1923, when the receiving apparatus was installed, and January 15th, 1923, a signal-to-noise ratio of 10 or greater was maintained every test day for 14 hours (between 11 p.m. and 1 p.m. Greenwich) and fairly good telephone speech could be heard *at any time* between these hours, provided near-by stations were not working in the frequency range used, about 56 000 to 59 000 cycles per second. This, however, is the most favourable time of year, and in the summer, when disturbances are much greater, a correspondingly greater amount of power will probably be needed for the same results.

Returning to the question of "freaks," it may be pointed out that the average signal strength in microvolts per m. between Nauen and the United States is 40. On these tests the figure was between 100 to 150 microvolts and on the freak receptions about 1 to 10 microvolts with a wave length of 400 m. Again, on these short wave lengths the variation is extraordinarily high and it is of course only the maximum signal strengths that are received.

Transmitting and Receiving Arrangements.

At the transmitting end the power energy is obtained through a three-phase/six-phase transformer from the supply authority and is amplified in the way we have already described before being sent to the antenna. The antenna itself is 1¼ miles long, the towers being 450 ft. high with cross-arms 150 ft. long. The valves employed were of the type due to Mr. W. G. Houskeeper, of the Western Electric Co. in which the anode consists of a copper tube 1·5 in. in diameter and 7·5 in. long. Water cooling is employed. At New Southgate, a frame aerial about 6 ft. square was used, and additional valves were necessary owing to the large number of receivers in use. This type of aerial was used to obviate the employment of earth resistances, and because it is easy to maintain. Its characteristics are constant, and it minimises the amount of interference.

Future Possibilities.

The extended tests on this side are being carried out under the superintendence of Dr. H. W. Nicholls, who is in charge of radio telephone developments in the laboratories of the American Telephone and Telegraph Companies, and of Mr. H. T. Friis. They as well as all the others concerned are to be congratulated on the results. For it may be said that the connection of wire and radio telephone systems to one another to form a single unit has been developed until all difficulties have been overcome. As we have said, the telephone transmitter on Long Island is connected by wire telephone lines to New York, 70 miles away, and may be connected through ordinary switchboards to any point in the United States. It would therefore be possible for any subscriber in the Bell telephone system to speak to Europe through Rocky Point in exactly the same way as he carries on an ordinary conversation. The tests which are now going on are, of course, entirely one way, since no transmitting apparatus has been installed in England.

All the engineering features involved in the setting up of commercial radio telephone communication between the two countries are not now known, so that no definite statements can be made concerning the prospects for Transatlantic radio telephone service. It is hoped, however, that the tests which are now in progress and which will probably extend over several months, will furnish engineering information leading to a more complete knowledge of the economic and other factors involved in such a service.

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Main-line Electrification in Germany.*

Comparison with Other Countries.

The total route length of the German Federal Railways on April 1st, 1922, was 53 500 km. Of this, 439 km. are already electrified, and 816 km. are being electrified, making 2·4 per cent. of the total.

Table I.—*Comparison of electrified lines in Germany with other countries (including work in progress).*

Country.	Electrified route in km.	Locomotives.	Motor coaches
U.S.A.	2 450	370	1 500
Germany	1 255	288	265
Switzerland ..	743	154	3
Austria	786	82	—
Sweden	438	45	2
Italy..	750	114	51

It is seen that in magnitude main-line electrification in Germany is second to that of the United States only.

Electrified Railways of Germany.

The details of Germany's electric railways are summarised in Table II.

The Wiesental Railway in Baden runs from Bale to Zell at the south of the Black Forest. Power is obtained from a sub-station in Bale, which is fed from the Augst-Wyhlen station on the Rhine.

As yet there are no electrified lines in Wurtemberg, but plans are being worked out for electrifying the sections Ulm-Stuttgart and Ulm-Friedrichshafen.

Coming to the Bavarian Railways, in the south-west is the Mittenwald Railway from Garmisch in Bavaria to Innsbruck in the Austrian Tyrol. This is a mountain line with gradients up to 4 per cent., power being obtained from a hydro-electric station near Innsbruck. In the south-east, the sections the Salzburg-Berchtesgaden and Salzburg-Königsee are electrified, the latter being the only case where direct current is used. The single phase power is obtained from the Saalach power station and the direct current from the Gartenau station. These existing electrifications in a few years will be linked up with electrified lines emanating from Munich to Garmisch, Bayrischzell, Kufstein, Salzburg in the south, and Regensburg in the north—the last section being the first part of the Munich-Berlin line. These works are expected to be completed in 1925, when the hydro-electric stations at Walchensee and on the Middle Isar are working. At the Walchensee station four traction generators totalling 48 000 kW are to be installed, while traction generators giving 51 000 kW are intended for the power stations at Aufkirchen, Eitting and Pfrombach on the Isar.

The electrified network in Central Germany is situated in the lignite coalfield. It is intended to complete the electrification from Leipzig to Magdeburg this year. The railway power station is at Muldenstein, near Bitterfield, the raw brown coal being supplied from neighbouring pits.

The largest electrified system is in Silesia (the Silesian mountain railways). The main line Lauban-Königszelt is on the route from Berlin to Breslau. Power is obtained from the generating station at Mittelsteine, owned by the A.E.G. and S.S.W. The local line Hirschberg-Grüntal will be shortly completed.

System Employed.

The system used throughout on the German electrified main lines is single phase alternating current at 16⅔ cycles with an overhead conductor pressure of 15 kV. The same system has been adopted by Austria, Switzerland and Sweden. Owing to the unsteady character of a traction load, the supply is kept independent of that for general purposes—either separate traction power stations being used, or separate traction generators in mixed stations.

Economies that Justify Electrification.

The following three reasons are given to justify electrification :—

1. When the annual working costs are less than with steam.
2. When valuable minerals—e.g., coal, in the country are conserved.
3. When by introducing electric traction, without increasing the number of tracks, the carrying capacity of the line is considerably increased.

Table II.—*Electrified Railways in Germany (including work under construction).*

Line.	Chief route.	Length in km.	Locomotives.
Wiesental ..	Bale-Zell	49	15
Mittenwald ..	Scharnitz-Griesen ..	38	5
Reichenhall..	Salzburg – Berchtesgaden	41	22
	Schellenberg (c.c.) ..	18	10 motor coaches
Bavaria ..	Munich network ..	595	105
Central Germany ..	Leipzig-Magdeburg	179	62
Silesia ..	Görlitz-Königszelt..	264	77
Hamburg ..	Harbour-Altona (3 000 V.) ..	2	2

As regards the first, comparative figures are not yet available, because the present services are mainly experimental in character in order to try out various modes of construction, etc. As yet, the trials have mainly been made on routes with little traffic—i.e., on the more expensive lines. Further electric locomotives have been costly—even now a single electric locomotive costs 2½ times as much as a steam locomotive of equal weight. The latest quotations, however, show that when ordered in numbers, the cost will be 1·8 times, and for still larger numbers 1·5 times that of steam locomotives. As soon as sufficient electric locomotives for complete services are available, they will be much better utilised than with the present mixed services, and it is estimated that for some services the number of electric locomotives needed will be only 75 to 80 per cent. of the number of steam locomotives. As there are 15 different experimental types in the Breslau and Halle districts, it has not been customary to stock spare parts, though this is being done with the new standard types.

* Compiled mainly from lecture by W. Wechmann, "lektrotechnische, Zeitschrift," vol. 43, p. 805.

Table III.—*The Six Types of Locomotives Required for the German Railways.*

Fig.	Service.	Maximum speed on level. km/hr.	Type.	Total Weight, Tons.	For Bavarian Lines. Hauled Load, Tons.	At km/hr.	on x in 1 000 gradient x	Continuous Rating per Motor. H.P. at r.p.m.	Number of Motors.	Connections of Motors.	Control.
2	Ordinary goods ..	65	1 B B 1	98·0	600	25	16	800 at 325–530	2	Both in parallel ..	Electromagnetic contactors
						35	10				
						55	5				
3	Mountain goods ..	55	C C	110·4	1 200	25	11	500 at 590–982	4	2 motors in series .. 2 groups in parallel	Electromagnetic contactors
						45	5				
5	Local passenger ..	70	1 C 1	81·2	300	40	10	500 at 500	2	Both in series.. ..	Sliding contact switch
						60	5				
4	Mountain passenger	90	2 B B 1	115·6	500	50	10	500 at 590–982	4	2 motors in series .. 2 groups in parallel..	Electromagnetic orelectro-pneumatic contactors
						75	5				
1	Ordinary express ..	110	2 C 2	112·0	—	—	—	1 200	1	—	—
6	Mountain express ..	100	1 A A A A 1	99·6	600	40	15	500 at 550	4	All in parallel.. ..	Sliding contact switch
						55	10				
						80	5				

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Further, repair shops have not yet been built and equipped, so that the railways could not carry out their own repairs. Time and money are also needed to train the personel for the altered conditions, etc.

Operation on the Silesian Mountain Railways.

While the number of locomotives was increased by 22 per cent. in one year, the traffic in ton-kilometres increased 155 per cent. The coal consumption with the power and sub-

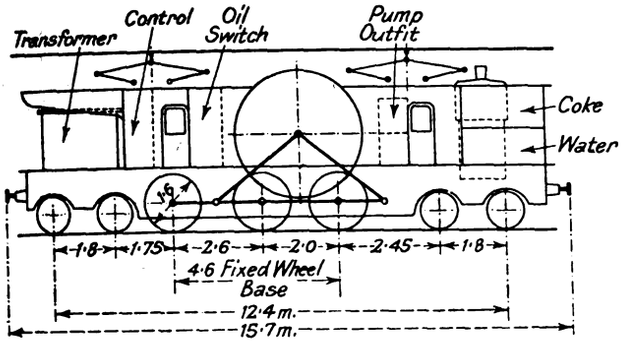

FIG. 1.—SECTION OF LOCOMOTIVE FOR ORDINARY EXPRESS SERVICE.

stations moderately loaded was 60 per cent. of that needed for a similar steam service. Since in well-loaded traction generating stations a still lower consumption can be obtained, greater improvement in coal economy can be expected.

The transmission lines have not proved so satisfactory. In the design too little account was taken of the weather conditions in the Riesengebirge. Violent storms of long duration are common—sheets of ice 18 cm. wide have been seen on the lines. To ensure uninterrupted working there must be two independent transmission lines. Electrically, however, the lines are satisfactory—short-circuits seldom occur, and earth faults are limited in the usual way. Owing to the low frequency, interference with communication circuits is very

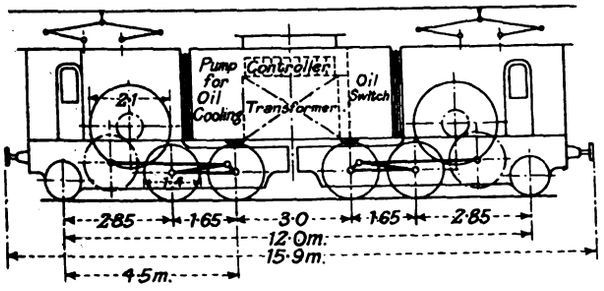

FIG. 2.—SECTION OF "LEVEL SECTION" GOODS LOCOMOTIVE.

small. The 110 kV lines in future will be carried parallel to and about 50 m. away from the track, as a straight line cross-country route from sub-station to sub-station makes maintenance difficult in winter.

The overhead conductors have given good service. At times storms have moved the wires laterally so that the collector bow has come off and broken the line. In consequence the distance between poles or supports will be reduced in future installations. The single catenary suspension is used, and the new designs are arranged so that the view of the signals is not interrupted—a matter not sufficiently attended to in the past. A standard form of construction for the overhead conductor has recently been agreed upon.

Despite prohibitive regulations, fatalities and other accidents have occurred through the personnel climbing on to tenders and carriage roofs. It has now been decided to make the conductors 6·5 m. above the rail level wherever possible. The poles are of reinforced concrete, and require no upkeep.

Details of the Locomotives.

Before the war, the Prussian, Bavarian and Baden railway administrations experimented with some twenty different types of locomotives in order to try out all possibilities. For normal services on the German railways, the six types shown in Table III. are required. Quite recently, in connection with the manufacturing firms, agreement regarding these six types has been reached, use being made of the experience gained in the building, running and repairing of the experimental locomotives.

136 locomotives of these standard types are being ordered.

Motor Design.

It was comparatively simple to settle the motors and transformers. The neutralised series motor is now used almost universally, and the only differences which still exist arise from the practices of different firms. Some manufacturers employ resistance connectors between the armature winding and commutator—others do not. It is too early to demand a standard motor. Certain mechanical difficulties still remain, such as the loss due to brush friction at high speed. Considerable heating of the commutator is caused by brush friction when the current is cut off. It would seem that when working a layer of gas reduces friction between brush and commutator.

Transformer Details.

Two types of transformer are in use—oil-cooled and air-cooled. From the original self-cooling oil type, where the weight of oil was considerable, the circulating-oil type has been developed. A pump circulates the oil through the transformer and an air-cooled cooler. For passenger and express locomotives sufficient air cooling is obtained by

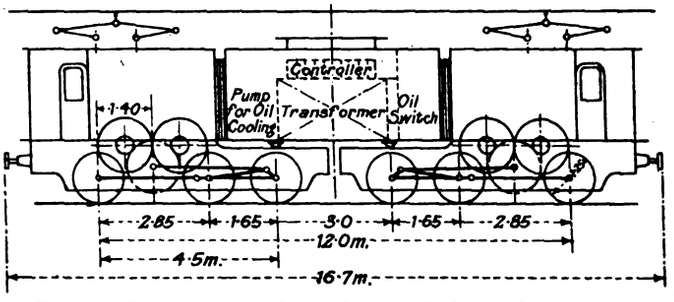

FIG. 3.—SECTION OF "HILLY SECTION" GOODS LOCOMOTIVE.

placing the tubes through which the oil is pumped outside the locomotive. For slow-speed locomotives, a fan blows air on to the cooler. While quite satisfactory, the oil is nevertheless an undesirable additional increase in weight. Although promising air-cooled types, in which moisture and dirt are kept away from the transformer, are available, too little experience is available for a definite conclusion to be reached.

Control Arrangements.

The speed is controlled by varying the voltage at the motor terminals by means of transformer taps. The induction regulator proved to be unsuitable. Two controls worthy of mention are the drum controller of Maffei-Schwartzkopff, and the sliding contact controller of Brown-Boveri. The latter has recently been improved, so that the power can be rapidly switched off in any position without auxiliary apparatus. For the present it has been decided to retain contactor controls

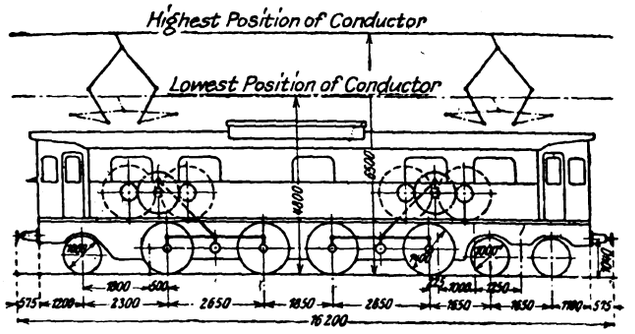

FIG. 4.—DESIGN SKETCH OF LOCOMOTIVE FOR MOUNTAIN PASSENGER SERVICE.

for most of the locomotives, because their design has proved to be successful in switching both on and off. The contactors may be operated electro-magnetically or electro-pneumatically (see Table III.).

The Driving Mechanism.

The driving mechanism is the part of the locomotive that offers the greatest difficulties. The development from the tram-car and motor coach led to the first electric locomotive in

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Germany being equipped in the same way. This successful experiment with geared motors and tram suspension was made in 1907 on the A.E.G. single phase locomotive type A-A+A-A for the Altona railway near Hamburg. The locomotive is still working. Though twelve more with this drive were ordered before the war, circumstances prevented their delivery. With increasing speeds and powers, the shocks on the rails get worse, and it was decided for speeds exceeding 50 km. per hour to instal the motors in the locomotive so that their whole weight was spring-borne.

The other extreme to the tram-suspension drive is that where the power is concentrated in a single motor, which is

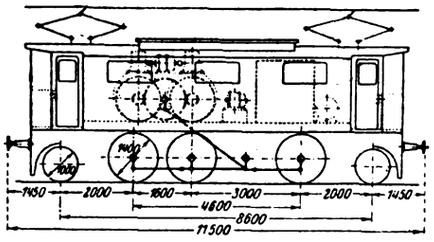

FIG. 5.—SECTION OF LOCOMOTIVE FOR LOCAL PASSENGER SERVICE.

mounted inside the locomotive, and is transmitted to the driving wheels solely through side-rods. The great advantages of this construction are the accessibility of the motor, and the minimum number of bearings. Even with two countershafts (jack axles) there are but six bearings in addition to the driving-axle bearings. On the other hand, such large motors are much more troublesome to handle in the shops than the smaller geared motors.

The Side-rod Drive Adopted.

Owing to the advantages of the pure side-rod drive it has been decided to continue the use of this construction for ordinary express services in the 2-C-2 type shown in Fig. 1. These locomotives, and also the following with side-rod driving mechanisms, are provided with damping springs in the armature. Recent theoretical investigations, particularly by Wichert, and practical experience show that the vibrations which would otherwise be set up are thereby rendered harmless.

Axle Loading Data.

With regard to axle loading, the various German authorities have agreed to permit an axle-load of 16 tons for stationary locomotives, with an increase of 15 per cent. for the effect at the highest speed of the centrifugal force due to unbalanced parts. Since there are no residual centrifugal forces in the perfectly balanced electric locomotive, the permissible axle-loading becomes $16 \times 1{\cdot}15 = 18{\cdot}4$ tons. This is the driving-axle load in all six types here considered.

Since there are no residual centrifugal forces, the speed of rotation can be increased up to the limits permitted by the lubrication and heating of the bearings. Experience fixes the limit at about 400 revs. per min. On the other hand, to utilise the motor fully a peripheral speed of 45 to 55 m. per sec. is necessary. It then follows that for speeds from 110 to 75

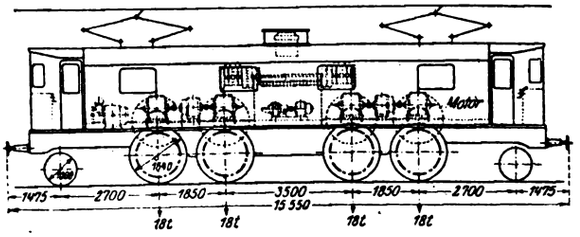

FIG. 6.—SECTION OF LOCOMOTIVE FOR MOUNTAIN EXPRESS SERVICE.

km. per hr. the diameter of the armature must be 1·8 to 2·5 times the diameter of the driving wheels. This explains the large dimensions of the motor. Below 75 km. per hr. it becomes necessary to use motors running at higher speed—that is to say, gearing is essential. This is no disadvantage, since gears can now be made to have high efficiency and long life.

Geared Drives Discussed.

The number of arrangements of geared drives, both possible and in existence, is considerable. A successful construction is that in which the crank pin of the gear wheel is on a level with the axles. The gear wheel can, however, be raised up to 150 mm. without injuriously affecting the action of the drive or the stresses in the rods. In this way a larger gear-ratio is possible than with equal heights of centres. Gears are used in all the remaining five types. The two proposed types of goods locomotives are shown in Figs. 2 and 3. In the ordinary goods (1BB1) locomotive, Fig. 2, there are two coupled bogies with a motor on each bogie, while the bridge joining the two bogies carries the transformer, controller, switches and air pump. Replacing the two pony axles by driving axles and using four motors, the mountain goods locomotive (type CC) in Fig. 3 is obtained. The two pinions of a twin motor drive a common wheel. Several parts of the last two types are interchangeable.

In the 2BB1 passenger locomotive for mountain service in Fig. 4 the double motors are mounted as high as possible to ensure smooth running.

The arrangement of the 1C1 passenger locomotive for local services (Fig. 5) is similar to the last, but only one double motor is required. In the last two types the side rod is connected to a countershaft having its centre on a line with the centres of the driving axles. The two motors of a twin motor are in series, whereby a smaller current is obtained and a reverser for each pair of motors is saved. The motors of the

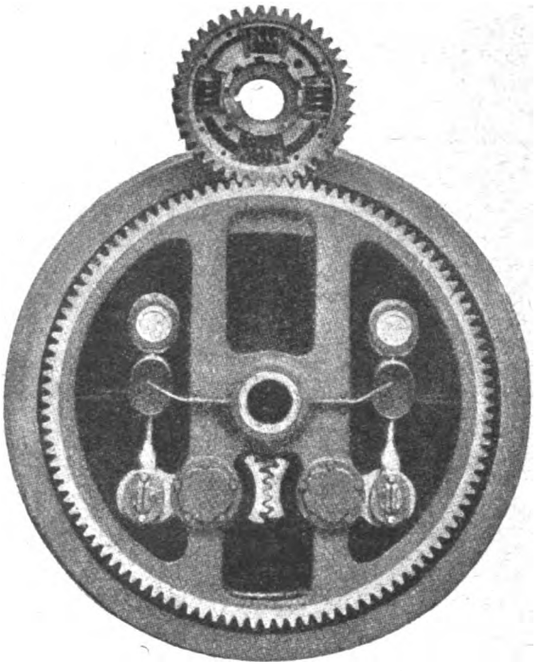

FIG. 7.—BUCHLI DRIVING MECHANISM.

heavy goods and of the two passenger locomotives, just dealt with, have all a continuous rating of 500 H.P., but the design will not be standardised in the present orders.

Express Locomotive Details.

The driving mechanism selected for the express locomotives for mountain service, type 1-A-A-A-A-1, Fig. 6, is the individual-axle drive due to Buchli. The parts of this mechanism are shown in Fig. 7, while successful results with it have been obtained on the Swiss railways. Each driving axle has its own motor mounted above the axle. Both motor and gear wheel are fixed rigidly to the framework, but there is a flexible coupling between gear wheel and axle. Here, again, the motors are rated at 500 H.P. The two axles at each end form a bogie.

Though objection might be taken to splitting up the total power in two or more motors, it has been found that the total weight of the locomotive is not increased hereby, and in some cases is smaller than with a single motor.

The revolving parts of the above constructions do not materially differ from those in steam locomotives. All arrangements of frames, rods, axles and bogies suitable for steam can also be used for electric locomotives. The designer of the latter, however, can make use of the great advantage of distributing the power by arranging the driving axles in separate frames, when this is desirable owing to the length

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of the locomotive and the radii of the curves. With steam locomotives, the long boiler prevents this, and a complex structure, expensive to maintain, results.

The distribution in an electric locomotive can be carried out in one of two ways. Either the locomotive can be articulated, which really consists of coupling 2 or 3 locomotives together; or the splitting up can be confined entirely to the axles with their frames. The latter construction has been adopted by the German railways, because it does not necessitate a division of the electrical equipment, such as the transformer, control gear, switches, etc.

A very robust and simple construction must be used for electric locomotives. Experience shows that well-built electric locomotives are as reliable as steam locomotives—on the Silesian lines, locomotives have covered 60 000 km. before being sent to the shops.

Outputs of Steam and Electric Locomotives.

The power of a steam locomotive is limited by the boiler. If this is not to be forced, only a certain amount of coal in unit time can be burned on the grate. An output above the normal can only be obtained for a few minutes. Consequently the steam locomotive is practically a constant-output machine over the whole speed range. When large drawbar pulls are needed, therefore, as on gradients, the speed must be correspondingly reduced. Since the drawbar pull can only be utilised up to the limit of friction between wheel and rail, at low speeds this fixes the value of the pull and the power over this range rises from zero to the normal value at which it can remain at higher speeds. The time-table can be drawn up so that the steam locomotive is fully utilised as much as possible.

It would be wrong to attempt to build an electric locomotive for the same time-table, to give the same output as the steam locomotive, because the mode of power production is fundamentally different in the two cases. For the electric locomotive there is the whole power available which can be transmitted from the power station, obviously many times what is needed by the train. By operating the controller the driver can transmit any part of this power to the motors. Accordingly the motor determines the limits of the power.

In the lower part of the speed range from standstill to 60 per cent. of the maximum speed, the power is limited by the heating caused by the current. Since the current is a measure of the torque or drawbar pull, this determines the permissible load at the lower speeds, and the output increases in proportion to the speed. At about 60 per cent. of top speed, the power line becomes nearly horizontal, because from here onwards the armature iron losses and brush friction becomes the limiting factors. At the maximum speed, brush friction loss may even entail a decrease in the power. These considerations show that the power curve of an electric locomotive cannot coincide with that of a steam locomotive.

Effect of the Power Curve.

Since the power curve of an electric locomotive bends over at a much higher speed than that of a steam locomotive, it would be irrational to make the rising part of these two curves coincide, because the maximum output of the electric locomotive would then greatly exceed that of the steam locomotive. In such a case, the motors would be too large and only partially utilised. As the power in the rising part of the curve is only needed for short periods, the motor designer takes advantage of the overload capacity of the motor and keeps the continuous rating more or less below the power curve of the steam locomotive. Even in this case the maximum output of the motors will exceed that of the steam locomotive—e.g., if the continuous rating of the electric locomotive in the rising part of the curve is only 80 per cent. of that of the steam locomotive, the maximum power of the former may be 40 per cent. greater than that of the latter.

Since the drawbar pull of the electric locomotive maintains its starting value up to much higher speeds than the steam locomotive, and at high speeds, the drawbar pull is also higher in the former than in the latter case, it follows that where large drawbar pulls are needed, as on gradients, the electric locomotive can maintain a much higher speed than the steam locomotive. The fullest possible use should be made of this in the time table. For example, on the Königszelt-Lauban section on the Berlin-Breslau route, with the same stops and maximum speeds, the travelling time can be reduced by 30 minutes. It is thus seen how an increased amount of traffic can be dealt with by electrification.

Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment, and are requested to keep their communications as short as is consonant with their argument.

POWER TRANSFORMERS AT 66 000 V.

To the Editor of THE ELECTRICIAN.

SIR,—May I thank the readers through your paper for the generous information given.

According to Mr. A. E. du Pasquier, the Metropolitan-Vickers Electrical Co. has credit of the following:—

(*a*) . . . manufacture of a 63 500 V three-phase transformer for the 110 000 V line (Mangahao, N.Z.).

(*b*) . . . manufacture of a 75 000 V single phase transformer for a 132 000 V line.

Will Mr. du Pasquier state where (*b*) transformer is operating and whether power is being supplied at 75 000 V per phase ($\sqrt{3} \times 75\,000 = 132\,000$ V line voltage)?

The information given by Mr. S. A. Stigant of Johnson and Phillips, is quite clear. The writer is in full agreement with the remarks *re* type of transformers and connections on the line side. The transformer-*case complete with the three terminals* is designed for 66 000 V, but *not* the transformer itself, which consists of three 38 000 V single phase units arranged in line and fitted into one transformer-case.

Apparently, the highest voltage power transformer so far manufactured in this country is 75 000 V single phase with two insulated terminals leading from the transformer case.—I am, etc.,

WILLIAM T. TAYLOR.

London, N.10. January 12th, 1923.

Reviews.

The Induction Motor and other Alternating Current Motors. By B. A. BEHREND. (London: Hill Publishing Co.). Second Edition. Pp. xxi+272. 24s.

This book—it is a well-known book in its first edition form—produces two entirely independent impressions upon us. One is that it is a very valuable book dealing with the theory and principles of design of alternating current motors treated graphically, and designed to simplify a complex subject. The other is that it is in the nature of an *apologia* in which the author takes some pains to establish a case for more generous recognition of his own share in the foundation and development of the graphical and inductive treatment of alternating current motors.

The first edition was published in 1901. The present edition deals—in the author's typical manner—with the general A.C. transformer,—poly-phase and single phase induction motor, poly-phase commutation motors—series and shunt, single phase repulsion motors, and a condensed review of single phase commutator motors; while chapters also deal with such subjects as the improvement of power factor, the magnetic pull and other allied subjects.

The author does not claim that the work is encyclopædic but that it is the work of an engineer who, during three decades, has had a part in the development of the machines about which he writes. None will dispute the claim, and all should be grateful for the revelations of the methods which he has followed in the design and construction of alternating current motors. As Mr. Behrend states, the design of electrical machinery is based upon the intelligent comparison of empirical data, and the art of designing cannot be taught without it. The book aims solely at the creation of the means of effecting the necessary comparisons and it is assumed that the fundamentals and principles of operation have been obtained previously by the reader. There are 204 figures in the book and the great majority of these are "diagrams" for the graphical representation of motor quantities. Some of these are on the small side—though it might be argued, with reason, that this is an advantage in that the reader will have to draw them out for himself on a larger scale as he reads the book. There is a tremendous amount of work compressed into the 272 pages—and it is valuable work.

So far as the *apologia* impression is concerned, we could have wished that Mr. Behrend had confined it to one definite section of the book. When one is wrestling with some complicated piece of work it is rather disturbing to have one's thoughts suddenly turned to the consideration of dates and to be asked to adjudicate the rival claims of X and Y.

At the same time Mr. Behrend's bibliography is very complete and of great interest, and he is very generous in his recognition of other workers in his own field.

J. PALEY YORKE.

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Some Recent Physical Apparatus.

An Interesting Exhibition at South Kensington.

(*Continued from page* 37.)

THE RECORD ELECTRICAL CO.

The RECORD ELECTRICAL CO. showed a fine example of a pivoted milli-voltmeter for laboratory work, with a scale length of 3 ft. On the other hand, miniature cirscale instruments were shown, including testing sets having ranges of 5 and 50 A and 5, 50 and 250 V. The overall size of this set is 6 in. by 4 in. by 2½ in. in case and the weight complete is only 1·7 lb.

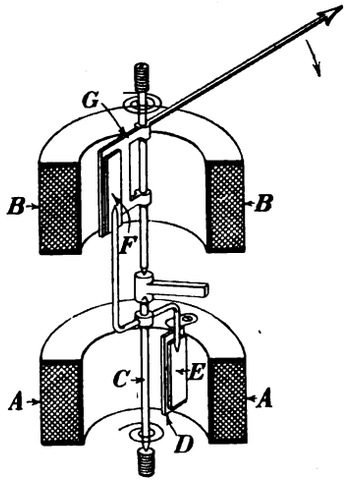

FIG. 3.—RECORD MOVING IRON INSTRUMENT.

The most interesting exhibit, however, was a model of a new moving iron instrument in which a deflection of 250° was obtained. In the ordinary design it is impossible to obtain a deflection of more than about half this value. The method adopted will be seen from Fig. 3. It will be seen that there are two solenoids A and B, and that in continuation of the pointer spindle is another spindle C which is in the axis of the lower solenoid. In this solenoid is a fixed piece of soft iron D and near this is a moving piece of soft iron E, which is carried by an arm on the lower spindle. The second arm of the lower spindle carries another piece of soft iron F situated in the upper solenoid and a piece of soft iron G near is carried by the pointer arm. When the solenoids are energised the soft iron E is repelled by D, being similarly magnetised, and therefore moves round and carries F with it. Not only is G carried round by this movement, but in its turn it is repelled by F and consequently the deflection of the pointer is twice the deflection of the soft iron E. Thus, this large deflection is obtained in a very simple way. By this method the friction is doubled, but as the forces are also doubled this does not introduce any objection.

THE IGRANIC ELECTRICAL CO.

The IGRANIC ELECTRICAL CO. showed on the one hand a selection of their light products, such as inductance coils for wireless telegraphy, and on the other hand an item of heavy engineering in the form of electric valve control, which must have been very interesting to station engineers who visited the exhibition. As is well-known, it is difficult to secure satisfactory operation of valves by ordinary electric gearing controlled at a distance. In the methods hitherto used a direct current series motor, together with a drum controller and a jamb over-load relay, have constituted the electric drive. The motor drove the valve stem through a spur gear reduction. When closing the valve the motor overload resulting as the valve jambs into its seat tripped the jamb overload relay, which in turn tripped the low voltage release of the drum controller and opened the motor circuit. The weakness of this system developed when opening a valve, for a hammer blow was necessary to unseat the valve. This was accomplished by a jamb nut located on the valve stem in such a position that the motor was up to speed before it received the load. The motor, after overcoming this maximum load, however, would race to the open position of the valve, and then come to an abrupt stop with such force as frequently to twist off the valve stem.

The Dean System of Control.

The Dean system of control overcomes these objections. It is a self-contained waterproof unit, incorporating motor reduction gears, limit switch, trip mechanism and an ingenious lost motion device for unseating the valve and eliminating the inertia effects, as seen in Fig. 4. The reduction gear to reduce the speed for gearing directly to the valve stem is of the combination worm and planetary type. The principal feature of the device from an operating standpoint is the instantaneous stop obtained and the elimination of overtravel or drift as affecting the closed position of the valve. The quick stop and the elimination of the effect of inertia are obtained in an ingenious manner. The centre pinion is rotated by the motor through the worm and worm wheel and this turns the planetary pinions and valve driving shaft. The internal gear is free to revolve on a machined surface in the casing, but is restrained from doing so by two plugs which pass through the casing. The outside surface of the internal gear is provided with two peripheral channels, one extending halfway round on one side, and another upon the opposite side. When both plugs are seated in the channels the internal gear is locked. With the centre pinion driven by the motor, the planetary pinions must travel around their own axis, and around the internal gear. This is the running arrangement of the mechanism.

Multipoint Control.

At the limit of travel the motor circuit is opened and the restraining plug is removed at the same instant so that the drift is taken up by rotation of the internal gear. Assume that the valve is closing and the plug is restraining the movement of the internal gear. As soon as the valve is tightly closed, but not jambed, the motor is disconnected, and the closing plug quickly withdrawn from the slot. This allows the internal gear to revolve and absorb the inertia of the driving mechanism. Thus the drift of the motor is provided for. The opening plug in the other channel provides the hammer blow for unseating

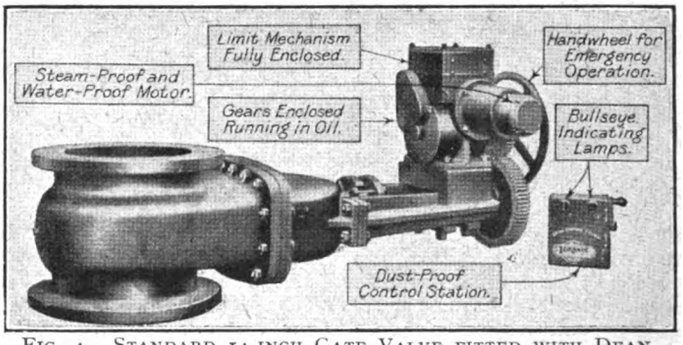

FIG. 4. STANDARD 14-INCH GATE VALVE FITTED WITH DEAN CONTROL.

the valve. The lost motion mechanism is so designed that the motor comes to rest before the internal gear has travelled one-half of a complete revolution. The opening plug does not interfere with this motion, but moves along on its channel. During the opening of the valve the motor is reversed and the internal gear moves nearly one-half a revolution before it is restrained by the opening plug. Thus sufficient time is allowed for accelerating the motor before the valve actually operates, which provides the blow often necessary to open a tightly seated valve. Control may be from any number of points.

H. W. SULLIVAN.

H. W. SULLIVAN showed a great deal of high-class apparatus for wireless telegraphy, some of which was described in our columns quite recently. Apart from this, some interesting telegraphic instruments were on view, including syphon recorders and a special Sullivan galvanometer of very high sensitivity. The resistance of this galvanometer was 8 000 O, the periodic times 24 sec. and the sensitivity was 10 000 mm. per micro-ampere, with the scale at one meter distance. A standard variable air condenser was shown, specially made for the Post Office, and having accurate adjustments. The scale diameter is 45 cm. This scale is provided with a large screening case and a distant-control operating shaft working through a micrometer adjustment gearing, so that the capacity is unaffected by the presence of the observer. Silica quartz is used throughout for the insulation. We also noticed a comprehensive bridge set for the high frequency measurement of resistance, capacity and inductance at wave lengths of 600 metres and upwards with considerable accuracy.

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THE DAMARD LACQUER CO.

A number of examples of Bakelite products were shown by the Damard Lacquer Co. These included laminated insulation, moulded insulation, coils impregnated with varnish, metal objects coated with Bakelite enamel, etc. This material is being used to an increasing extent in the electric industry. Metal tubes were also shown, such as those used in scientific instruments, coated with acid-resisting lacquer of various colours.

HERBERT KENNEDY AND CO.

One of the most interesting exhibits was that shown by HERBERT KENNEDY AND CO., LTD., which attracted a great deal of attention. It is named the "Oscilloscope," and enables machinery to be examined minutely whilst in rapid motion. For this purpose an electric lamp is made to flash up at the same frequency, or nearly the same frequency, as that of the rotating mechanism. Ordinary glow lamps are not suitable for this purpose, but a lamp of the "Osglim" type has been adapted to this use in order to obtain suitable flashes. The lamp is connected to a small induction coil with a spark gap in circuit. A gear-box is provided, consisting of a graduated circular casing, in which two accurately made gear trains are enclosed. Each of these receives its motion from a primary pinion on the central shaft, which is coupled directly to the mechanism to be tested, and each of them drives a contact breaker which may be switched into the lamp circuit. In the case of one gear train, the speed is so arranged that the flashes of the lamp synchronise with the revolutions of the primary pinion, whilst in the standard sets the gear train gives 100 flashes of the lamp to 99 revolutions of the pinion. Either circuit can be brought into operation by means of a switch. For special purposes a hand adjustment may be made, so that one, two or four flashes per revolution are obtained. It will be seen, therefore, that if the primary shaft of the gear box is attached to a rotating piece of mechanism, for which purpose a simple form of adapter is supplied, the mechanism will be seen at rest, if the flashes are synchronised. On the other hand, it will appear to be moving at one hundredth of the actual speed if the second gearing is used. The device was demonstrated at the Exhibition by examining a motor-driven sewing machine, and the results were certainly very interesting. Figs. 5 and 6 show the result obtained in such a case, Fig. 5 being from a photograph of the machine when ordinary illumination is used, and Fig. 6 from a photograph of the same machine when illuminated by the oscilloscope. The actual cyclic moment chosen for the examination is easily varied by means of a simple phase shifting device. The device should prove very useful in the examination of high speed machinery, such as gearing, cams, etc.

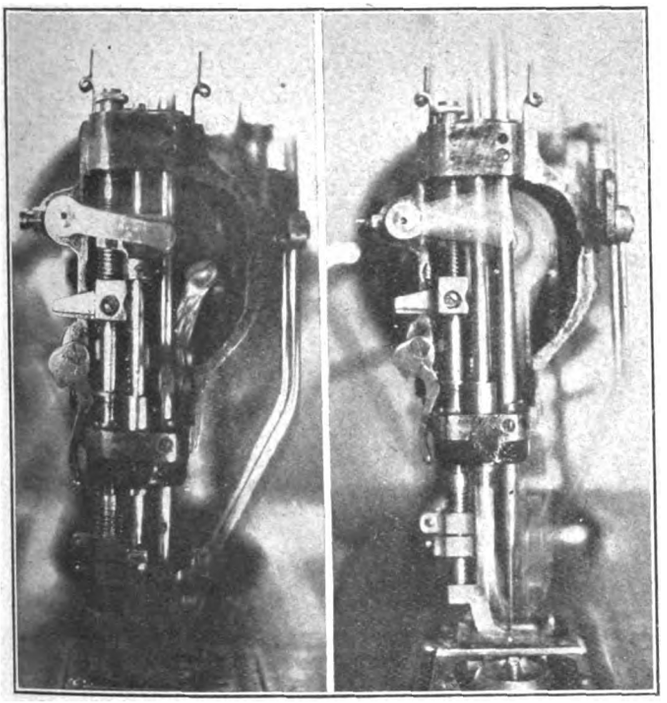

FIG. 6. MACHINE STILL RUNNING PHOTOGRAPHED BY LIGHT FROM OSCILLOSCOPE.

FIG. 5. HEADSTOCK OF SEWING MACHINE RUNNING AT 1,500 R.P.M.

EVERSHED AND VIGNOLES.

A number of interesting instruments were shown by EVERSHED AND VIGNOLES, but most of these have already been described recently in our pages. Attention may, however, be drawn to the recording instruments which have been improved in many details by means of redesign. The construction has been simplified and all parts been made more accessible, while the advantages of the Murday system of rectangular recording have been retained. The improved instruments permits the use of various forms of pen, including the reservoir type, and therefore the instruments may be run for long periods without attention. A wide range of speeds can be obtained from the fraction of an inch per minute to several feet per second. To meet special requirements, in addition to two quantity records, one or more records of another character can be obtained.

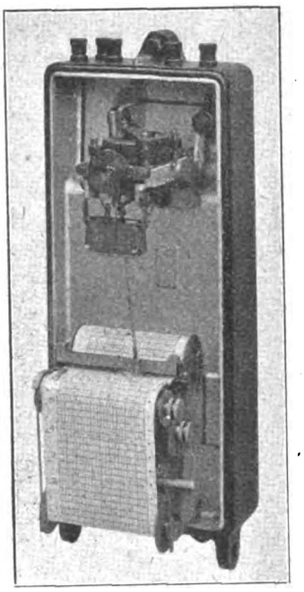

FIG. 7. THREE-PHASE BALANCED LOAD RECORDING WATTMETER, FITTED WITH INK RESERVOIR TO PERMIT CONTINUOUS INKING.

ELLIOTT BROTHERS.

Among the many interesting instruments shown by ELLIOTT BROS. we noticed a form of Millivoltmeter which we understand was only obtainable from Germany before the war. It is a specially sensitive type of the moving coil pattern suitable for test room and laboratory use. It has fixed ranges of 45 mV and 3 V, the resistance in the two cases being 10 Ω and 1 000 Ω respectively. It can be arranged with the usual shunts and multipliers.

A testing set was also shown, consisting of moving-iron instruments. The ammeter gives full scale deflection for 5 A, and can be wound with shunts for d.c. and a.c. measurements. The frequency variation between d.c. and 50 periods a.c. is stated to be of the order of half per cent.

Indicators showing the speed of revolution of the propelling machine on board ship were exhibited. These are coming into use to an increasing extent as they are almost essential for docking and similar purposes. They consist essentially of a magneto generator and a voltmeter calibrated to show speeds. We also noticed a Hamill flow meter, which has been designed for showing the flow of petrol on motor cars. The instrument exhibited indicated a flow up to the rate of two gallons per hour. It had a remarkably uniform and open circular scale, and a small leak was sufficient to cause an indication. The mode of construction was not disclosed.

SIEMENS BROTHERS AND CO.

SIEMENS BROTHERS & Co. also showed a number of pyrometers, among which may be mentioned particularly their portable optical pyrometer. It is a compact instrument and is convenient in use. It is supplied in a case along with a milliammeter and a 4 V accumulator as separate units. The great advantage of the optical pyrometer, provided that the temperature is above 600° C., is that observations can be made at a considerable distance and with the greatest ease. The temperature of an object of 3 in. in diameter can be measured at a distance of 20 ft., while at a yard the temperature of an object of $\frac{1}{8}$-in. diameter can be measured. The maximum current used for the lamp is 0·6 A. Although gas and vapours may cut off the long wave lengths to some extent, this has very little effect on an optical pyrometer.

EVERETT, EDGCUMBE AND CO.

Among the many instruments shown by EVERETT, EDGCUMBE AND CO. we noticed a useful portable current transformer called the "Omnirange," from the fact that it provides an almost unlimited number of ranges, and a dwarf testing set. These were described in our issue of December 2nd, 1922. Another convenient device is a planimeter for obtaining the total value of the quantity recorded on a graph chart. It is only necessary to pass the graph under the planimeter pointer to obtain the desired result.

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Electrical Developments at Stoke-on-Trent.

How Several Systems are Supplied from One Three-Phase Station.

The history of electricity supply in the Potteries will probably be familiar to readers of THE ELECTRICIAN. It began in 1894 at Hanley, when a small single phase alternating system was started. In 1900 a low tension three-wire system was inaugurated at Longton with a pressure of 460 V across the outers, and in 1904 a similar system with 480 V across the outers was started at Stoke-on-Trent. Finally, in 1905, Burslem Corporation inaugurated a three-wire system with 440 V across the outers. This multiplicity of systems caused

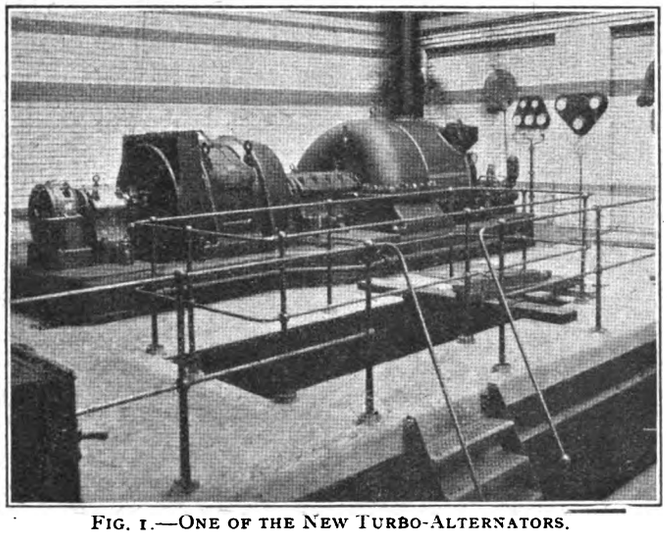

FIG. 1.—ONE OF THE NEW TURBO-ALTERNATORS.

a problem requiring either solution or a compromise when the federation of the five pottery towns became an actual fact in 1910. The problem to be solved was, it will be recognised, the same with which the whole country is now familiar when electricity districts are with a good deal of trouble attempting to achieve being. For there were four undertakings in the one area, undertakings not very dissimilar in size but differing in their electrical systems. These had to be linked up, and additional power had to be provided so that a maximum total economy would result. This was obviously best effected by the concentration of the generating plant in one station and by the use of extra high tension three-phase alternating current at a frequency of 50.

Concentration of Generation.

A station embodying this idea was, therefore, built at Hanley, and was set to work in the summer of 1913. As elsewhere, demands for electrical energy have gone on increasing in the Potteries, and extensions to this station have been necessary, the latest of which was described in THE ELECTRICIAN for April 7th, 1922. The original generating stations, which have been entitled " sub-works," are, however, still being used both for generation and conversion, and have in their turn required extension from time to time. The latest of these was formally opened yesterday, but before describing it we may mention that the original proposals for the provision of converting plant in the sub-works were as follows.

Converting Plant Arrangements.

At Burslem two 600 kW rotary converters were installed for the conversion of the three-phase supply to direct current. At Hanley two 600 kW motor alternators were installed to convert the 6 600 V 50 cycle supply to a 2 000 V single phase 100-cycle supply. At Longton two 300 kW rotaries were installed for the conversion of three-phase to direct current, and at Stoke two 500 kW La Cour motor converters were installed for the same purpose. From the power house at Hanley two e.h.t. three-phase mains were run direct to the Burslem sub-works, one direct to the Longton sub-works and another to the Stoke sub-works, with an inter-connector between Longton and Stoke. This was all in addition to the original generating plant in these sub-works which continued on load.

Replacing Reciprocating Plant by Turbines.

In the spring of 1920 it became evident that the plant in the sub-works would have to be extended. At both Burslem and Stoke the boiler plant was in good working order, and it was, therefore, decided to replace the reciprocating generating plant with an aggregate capacity of 300 kW in each of these works by 1 250 kVA three-phase turbines, one of which was installed at each place. Both these sets were built by the English Electric Co., the one at Burslem being of the impulse and the one at Stoke of the disc and drum type. These sets supply three-phase current at 6 600 V and 51·5 cycles per second. The additions to the converting plant at the Burslem sub-works comprise a 1 000 kW transformer and a rotary converter running at 750 revs. per min., supplied by the Metropolitan Vickers Electrical Co. At the Bagnall Street sub-works is a 1 000 kW La Cour motor converter built by Bruce Peebles and Co. This is directly operated from the 6 600 V three-phase supply. At Hanley it has been necessary to put down a third frequency changer, this being the first addition made in these works since the federation.

Details of the Frequency Changer.

This has some interesting details. A frequency charger bedplate with three pedestal bearings, the centre one being water cooled, carries a 6 600 V three-phase, 51½ cycles per second, slip ring induction motor. This motor, which has its stator frame cast in one piece so as to combine rigidity with sufficient ventilation, is direct-coupled to a 600 kW single phase alternator which delivers current at 2 000 V and 100 cycles. A three-phase frequency of 51½ was chosen for the reason that synchronous motors have a slip on full load of about 3 per cent. The synchronous speed of the motor is 618 revs. per min., so that on full load the set runs at 600 revs. per min. The rotor is in one piece, the core consisting of insulating laminated stampings and the winding being of the barrel type.

A 100-cycle generator is somewhat unusual in these days, and experience has shown many difficulties connected with its design and operation, so that facilities for repair and renewal are important. The alternator stator coils are wound on formers with micanite tube insulation through which the conductor of copper strand covered with cotton braiding, impregnated with insulating varnish, is drawn. The coil ends are protected from injury by sheet steel shields secured to the frame. The alternator rotor consists of oval magnet poles attached to facings on the periphery of a cast steel wheel with a double row of spokes and a " U " section rib. The field coils consist of copper strip wound on edge with adjacent turns insulated by paper; metal flanges at the ends of each coil secure it under pressure. The outside is turned up and

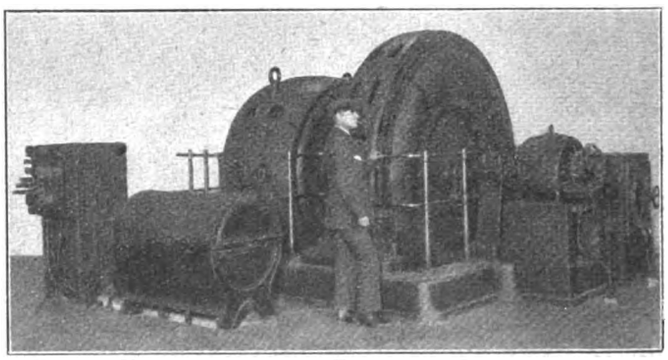

FIG. 2.—VIEW OF ONE OF THE FREQUENCY CHANGERS AT THE HANLEY SUB-WORKS.

polished, giving excellent cooling, and the construction ensures the mechanical strength suitable for high peripheral speeds.

Modernisation of Switchgear Effected.

The electrical remote control switchgear installed in the different sub-works was constructed by Metropolitan-Vickers Electrical Co. Merz-Price protection is gradually being fitted to the older parts of the system and " split conductor " protection has been adopted for several of the new e.h.t. feeders for trunk mains. The increase in the plant capacity has, of course, rendered necessary the reconstruction and modernisation of the switchgear in the sub-works, and at Stoke the old cubicles had to be pulled down and rebuilt to obtain space for the new switchgear and the new motor converter.

The peak load on the whole system in December, 1922, was 6 740 kW, the available plant capacity being 8 000 kW.

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A New System of Feed Water De-Aeration.

One of the difficulties that have to be tackled in the boiler house is the corrosive action that takes place on the iron and steel work owing to the presence of air and oxygen in the feed water. This action can be neutralised by de-aerating the air, and the importance of this can hardly be over-estimated when the cumulative effect on the numerous water tube boilers installed throughout the country is considered. Again, the employment of economisers with steel tubes makes de-aeration desirable, if not absolutely necessary, and the same remark equally applies to the wrought iron feed water piping now generally employed.

A Complete Automatic System.

The details of the "closed feed" system which has been designed by HICK, HARGREAVES AND CO. for the complete de-aeration of boiler feed water will therefore be of interest. This system, as its name implies, allows de-aerated water only to be supplied to the boilers, economisers and their connections, and it is claimed for it by its makers that, as the operation is mechanical and automatic, the usual difficulties of adjustment have been eliminated.

A diagram of the system is reproduced herewith and we give below some details of the arrangements. The condensate is withdrawn from the main condenser A by an extraction pump B, and discharged into the steam sealed feed tank D, from which the lift pump E takes its supply of water and discharges it through a feed heater or house turbine condenser X to the suction of the feed pump F. As it is necessary to provide a head of water at the suction branch of the feed pump, a closed tank Z is placed in an elevated position for this purpose, an overflow from which is taken into the auxiliary tank H. The make-up supply is also taken into this tank and is under the control of a float, which is operated by the rise and fall of the water in the main feed tank D. The water in the auxiliary tank H is passed into the main condenser A by a pipe Y under the control of a float valve, the valve being opened as the float rises. In this way any water which may collect in the auxiliary tank is disposed of and the de-aeration of the make-up supply in the main condenser is ensured.

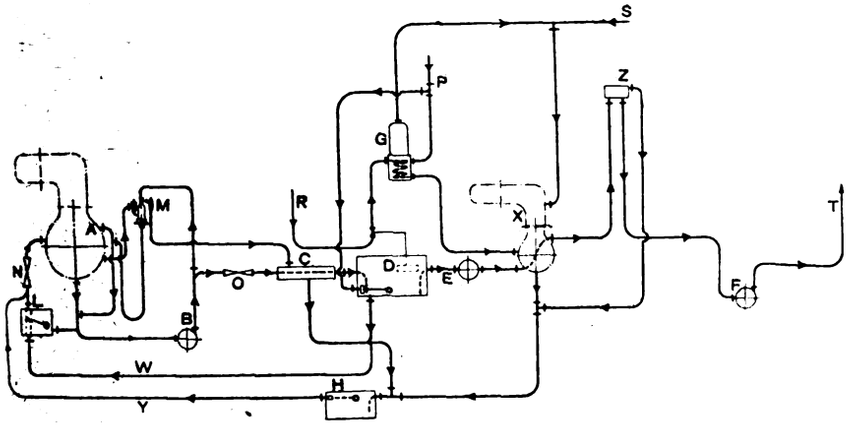

FIG. 1.—DIAGRAM OF HICK, HARGREAVES' CLOSED FEED SYSTEM FOR WATER DE-AERATION.

Heat Conservation.

To ensure the extraction pump B being fully charged with condensate and stabilised under all conditions of load on the main unit, a pipe W is connected from the feed tank D to the main condenser A, the flow along this pipe being controlled by a float which rises and falls in the chamber L in accordance with the rise and fall of the water in the extraction pump suction pipe. To conserve the heat in the drips from the feed heater or house turbine condenser X, a heater may be placed between the latter and the lift pump discharge. By this means the heat in the drips is given up to the boiler feed instead of being lost in the circulating water of the main unit. This arrangement, it is stated, adds to the thermal efficiency of this system and assists in the obtaining of a satisfactory heat balance.

Operation of the System.

The operation of the system is as follows: Assuming that the amount of condensate from the main condenser A is less than the requirements of the boiler house due to the main unit being on light load, the amount of feed required will be provided from the main feed tank D, where there is an ample supply of water for the lift pump E to draw from. Under these conditions the float in chamber L will fall, allowing an increasing supply of water to pass from the tank D along pipe W into the condenser, and thence to the suction of the extraction pump B, thus keeping the latter fully charged and stabilising its operation.

Supplying Excess Demands.

Should the demand in the boiler house continue to be in excess of the amount of condensate discharged from the main condenser, the level of the water in tank D will fall, lowering the float controlling the make-up supply valve and admitting an increased supply of make-up to the system. This passes along pipe Y into the main condenser, where it is de-aerated and afterwards withdrawn by the extraction pump B, thus making up the deficiency due to the extra amount of water withdrawn from the feed tank D.

It may be that the demand in the boiler house is less than the amount of water delivered into the feed tank D by the extraction pump, in which case the excess water will flow down the overflow pipe from tank Z and thence back to the auxiliary tank H, from which it is drawn into the main condenser as before. This will have the further effect of raising the water level in the suction pipe to the extraction pump B, and closing the float valve operating in tank L, diminishing the bye-pass water from the feed tank D to the surface condenser. It will thus be seen that any water, make-up, or otherwise fed to the boilers under varying loads on the main machine is de-aerated and kept from contact with the atmosphere.

House Turbine Economics.

As is well-known, an objection to the use of the house turbine is that, if it is arranged for condensing with ordinary circulating water, there is considerable waste of heat because the latent heat in the exhaust steam is lost in the circulating water. By the use of the closed feed system this loss is obviated as the condensate from the main machines can be passed through the house turbine condenser, the heat of evaporation in the steam condensed in the latter being thus added to the feed water on its way to the boiler feed pumps. This it is claimed gives the maximum thermal efficiency and is more efficient than bleeding the main machines.

When the question of partial load is considered, it is found that whereas the amount of condensate from the main sets decreases approximately in proportion to the load, the auxiliary load is a constant load plus a load in proportion to the number of main sets running, thus at certain loads the amount of water available for condensing the exhaust steam from the auxiliary set is not sufficient, causing the vacuum in the house turbine condenser to be reduced, if not entirely lost.

The system also ensures an ample circulation of water through the house turbine condenser at times of low load on the station, as the supply of condensing water for this purpose is independent of the amount of condensate coming from the main unit. In this way the house turbine can operate under maximum load no matter what the demands in the boiler house may be or what load is being carried by the main machine. This, it will be granted, is a very great advantage.

It may be pointed out in conclusion that no oxidising material for the removal of the oxygen is used, this being accomplished by the air extractor on the main condenser. By the adoption of this method the recharging of vessels with oxidising materials is avoided and special automatic apparatus such as pressure regulating valves is not required.

The Bill promoted by STOKE-ON-TRENT Corporation with the object, among others, of consolidating the electricity undertaking, was rejected by a meeting of Potteries electors last week, a resolution approving the Bill being defeated by an overwhelming majority. The Corporation has, however, decided to proceed with the measure.

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Electricity in the Home.

At the last meeting of the North Western Centre of the Institution of Electrical Engineers Mr. J. W. Beauchamp read a paper on "Electricity in the Home." With regard to the heavy expenses of underground cable laying he urged that the conductors selected should be always reasonably heavy so as to leave a margin of carrying capacity for future increases of load and that in all house wiring an attempt should be made to provide for other uses, in addition to lighting. Slides illustrating overhead distribution showed that such systems need not be unsightly. Several speakers mentioned with regret the opposition, born of prejudice, which had been raised against this practice and argued that the overhead cables might be quite unobtrusive, suggesting even the boon to housewives of house-to-house distribution wires low enough to be used as clothes-lines.

Wiring Systems.

On the subject of wiring, all arguments were in favour of simplicity, and at least one advocate, Mr. Mallinson, was found for wood casing. The general preference, however, was for wiring where it would be under observation and readily accessible. A novel and useful suggestion was that new houses, even in cases where electricity supply was not immediately available should be provided with ducts, say 2 in. in diameter, through interior walls at convenient places for future wiring of any kind.

A "Half-Way" Electric House.

Mr. Beauchamp showed that in cases where a complete electric home was not a convenient or economical proposition at present a "half-way electric house," with one or at most two coal fires, might be an advantageous arrangement. With suitable tariffs this could be operated in any house, and in new property considerable saving would be effected by the reduced constructional work on chimneys. The price at which electricity became an effective competitor with gas for heating purposes used to be given as 1d. per unit for 2s. 6d. per 1 000 cu. ft. Expressed in modern terms 1½d. per unit corresponded to 1s. per therm. With electricity at 1d. per unit cooking for a small family could be done at a cost of about 3s. 9d. per week.

The relatively high price of electrical equipment was a serious problem for supply authorities. A small electric oven, for instance, cost about £20. Such ovens could be installed by supply authorities on the hire-purchase system at a rate of about 10s. per quarter for a period of several years, after which the capital outlay could be considered reasonably recovered. On similar lines rates might be arranged for the cost of wiring installations. In small houses where wiring could be done at about £1 per point a rent of 1d. per point per week would pay off cost in about five years. Another plan which had been tried successfully with larger installations was to charge a rental of 16s. per annum for every £10 of installation cost.

Tariffs.

In the devising of suitable tariffs lay the solution of the difficulty of the consumer. This was one of the points most strongly advocated by the Electrical Development Association, and of possible arrangements a levy on the installation or on the floor area of the house (rather than upon the rateable value) together with a small charge per unit consumed was the best. Some speakers quoted the rates they enjoyed (?) under various local supply undertakings using this principle, the rate per unit varying from ¾d. in the case of fortunate residents in Manchester to 4½d. for some who found their wishes for electrical equipment financially impracticable in the suburbs. One of the essentials of a mixed tariff was, Mr. Beauchamp remarked, simplicity, for the difficulty of explanation to a puzzled consumer was normally considerable. Much amusement was derived from tales of these troubles—of the supply engineer who had ten different tariffs "and there wasn't a customer in the district who could escape one of them," and of the official who, Alderman Walker said, was called the "convincer" and whose duty it was to justify to the dissatisfied consumer the charges made.

Agreement was general on several vital points; the need for reduced expense of distribution so that the cost of connection need not be prohibitive to a householder on account of the length of his garden; the desirability of encouragement of the small consumer in order that he might become a large consumer and the encouragement of installations providing for a steady load by using lighting and house-or-water-heating alternatively on a constant supply; and, finally, the need for flat rate systems of charging for electricity for all domestic applications.

Railless Trolley Traction.

At the meeting of the Institution of Automobile Engineers held on Wednesday in last week, Mr. C. W. J. Taffs read a paper on "Railless Trolley Traction," during which a cinematograph film was exhibited, showing this form of traction in actual operation. Mr. C. W. J. Taffs claimed that before coming to a decision in regard to the adoption of any method of transport, that method would have to prove both its utility and its financial soundness. The latter, he stated, would depend upon a satisfactory compromise between the factors of low first cost and low working expenses. In order to arrive at comparative figures of the three practicable systems—tramways, motor omnibuses and trolley buses, he took commonly accepted figures for material, rolling-stock, power and wages, and from these prepared hypothetical trading accounts. Taking as a supposititious case a housing project involving the construction of six hundred houses on a site about three miles from the centre of a town, tramways would cost £113 000 in capital outlay and for standing charges. Corresponding figures for motor £11 605 omnibuses would be £38 000 and £6 890, and for trolley buses, £53 000 and £6 430. Assuming a total car mileage of 4 620 per week of seven days, petrol at 2s. a gallon, wages of driver and conductor 3s. 6d. per hour, current at 2d. per kWh, and allowing £2 000 per annum as the cost of management, supervision, the total working costs per car mile would be tramway 11·6d., motor omnibus 16d., and trolley bus 12d.

Some Figures from Revenue.

The economic revenue per annum from the tramway system would therefore have to be £21 742, from the motor omnibus £22 890, and from the trolley bus £18 430. The economic fare would require to be: for the tramway 1·72d. per passenger mile, for the motor omnibus 1·84d., and for the trolley bus 1·37d.; the fare for the tramway thus being 25 per cent. and for the motor omnibus 35 per cent. higher than that for the trolley bus. When the conditions were such as to demand very large cars a tramway would become necessary, and that when the traffic was very light and infrequent the motor omnibus would be economically justifiable. The total working expenses of the three systems were 16·92d. per car mile for the tramway, 20·17d. for the motor omnibus, and 13·17d. for the trolley bus.

The trolley bus with 20 ft. poles would have complete freedom of manœuvre on a road 40 ft. in width, so that it could pass or be passed by other traffic with exactly the same facility as the motor omnibus, and could draw up to the pavement to take up or set down passengers, so presenting a very great advantage on the score of safety as compared with the tramway. The trolley bus would also have advantages over the motor omnibus in narrow, steep and tortuous streets, and could be used in conjunction with existing tramway systems by the addition of a return wire to the existing overhead line, while in certain cases by means of a Cross's patent steerer the necessity of even this second wire was obviated.

DISCUSSION.

Opening the discussion, Mr. Dudley Battey said the single motor equipment was not uneconomical in practice. He described a service test lasting some 10 hours, in which the omnibus was loaded to 8½ tons, which was the equivalent of 53 passengers, 46 stops were made, and the route contained a maximum gradient of 1 in 9. The average current consumed was 1¼ kWh per car mile or 150 Wh per ton mile. The price paid for current was 1½d. per kWh.

Mr. H. B. Benny said the comparative figures of costs in the paper seemed to have been arrived at in a very strange way. The author took petrol at 2s. per gallon, and current at 2d. per kWh. The figure of 2d. per kWh was a very fair one, but a 'bus company would not buy No. 1 grade spirit in two-gallon tins at the local garage. He had been through the estimated costs, and suggested that truer figures would be 17·65d. per mile for the petrol, and 19·4d. for the trolley omnibus.

Mr. F. Ayton remarked the tendency was for the cost of liquid fuel to go up, whilst the price of electricity was certainly going to be less in the near future.

The President (Lieut.-Col. D. J. Smith) thought the day was not far distant when public service vehicles such as electric omnibuses would obtain their current from another source than from overhead wires. Although the trolley omnibus possessed a certain flexibility, the flexibility was really only relative because it was absolutely tied to its own track, and was very little less objectionable than the tramway.

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Prices for Bulk Supplies.

Lancashire Leads the Way Towards Standardisation.

A short time ago the South-East Lancashire Electricity Advisory Board instructed its Engineering Advisory Committee, of which Mr. S. L. Pearce is chairman, to investigate the principles which should govern the charges to be made for reciprocal standby and bulk supplies. A report has now been issued which was approved by the Board on Tuesday, January 9th. We give below the essential portions of this document. The sub-headings have been added by us.

Various Types of Bulk Supply.

For convenience the various types of bulk supply are described as follows :—

"Constant bulk supply" means a bulk supply, as defined in the Electric Lighting Acts, which is constantly available and which a vendor is under contract to give and a purchaser is under contract to take.

"Off-peak bulk supply" means a bulk supply, as defined in the Electric Lighting Acts, which is available : (*a*) During the period between 12 noon on Saturday and 6 a.m. on the following Monday ; (*b*) during the period between 6 p.m. on any day and 6 a.m. on the following day ; (*c*) during such other period as may be mutually agreed between a vendor and purchaser ; and which a vendor is under contract to give and a purchaser is under contract to take.

"Reciprocal supply" means a bulk supply, as defined by the Electric Lighting Acts, which two or more undertakers are under contract to give to each other if and so far as they are able so to do.

"Stand-by supply" means a bulk supply, as defined in the Electric Lighting Acts, which is constantly available and which a vendor is under contract to give and a purchaser has the right to take if such supply is required.

Charges to be Based upon Cost plus Profit.

The committee are of opinion that it is essential in the interests of the proper electrical development of the district (particularly having regard to Section 19 c. of the Order) that an undertaker should not be required to furnish bulk supplies at cost price. They therefore recommend that the Board should formally lay down as a principle that the charge for bulk supplies should be based upon actual cost of production as hereinafter defined, plus a profit.

Cost of Production.

Cost of production should include :—

(*a*) A fixed charge per kW of demand to be determined annually by ascertaining the total cost for the previous financial year of the following items in respect of the whole of the generating station :—(1) Interest on loans and/or share dividends (as governed by statutory limitations, if any) ; (2) contribution to sinking or depreciation fund ; (3) contribution to reserve fund to provide for special renewals, obsolescence of plant, etc. ; (4) management and general establishment charges ; (5) rents, rates and taxes ; and dividing such total cost by the number of kW's representing the maximum running capacity of the generating station—*i.e.*, the capacity of the plant installed after deducting a reasonable proportion for reserve.

(*b*) A variable charge per unit delivered to feeders which includes the cost of :—(1) Coal or other fuel delivered to bunkers and removal of ash ; (2) oil, waste, water and stores ; (3) wages and salaries ; (4) repairs and maintenance ; incurred in connection with the supply.

Constant Bulk Supply.

In the case of a constant bulk supply the charge should include :—(*a*) The whole of the fixed charge per kW of demand ; (*b*) the whole of the variable charge ; (*c*) an amount not exceeding 5 per cent. of the total of the fixed and variable charge ; with a proviso that the kW demand should not fall below an agreed minimum, or alternatively, that the fixed charge on such minimum should, in any event, be paid by the purchaser.

Off-Peak Supply.

In the case of an off-peak supply the charge should include :—(*a*) An amount not exceeding 20 per cent. of the fixed charge per kW of demand ; (*b*) the cost of items (*b*) (1) of Clause 2 ; (*c*) an amount not exceeding 5 per cent. of the total cost under paragraphs (*a*) and (*b*) of this clause.

Reciprocal Supply.

In the case of a reciprocal supply furnished for a period not exceeding two weeks the charge should include :—(*a*) An amount not exceeding 25 per cent. of the fixed charge per kW of demand calculated *pro rata* to the period ; (*b*) the cost of items (*b*) (1) of Clause 2 ; (*c*) an amount not exceeding 5 per cent. of the total cost under paragraphs (*a*) and (*b*) of this clause. In the case of a reciprocal supply furnished for a period exceeding two weeks the charge after such two weeks should be on the same basis as during the first two weeks except that 75 per cent. should be substituted for the 25 per cent. payable during the first two weeks. The fixed and variable charge for all reciprocal supplies should be based upon weekly demands and consumption.

Stand-by Supplies.

In the case of stand-by supplies the charge should include :—(*a*) The whole of the fixed charge per kW of demand upon the plant which it is necessary for the vendor to maintain in order to meet the obligation to supply (if so required) to the purchaser ; (*b*) the whole of the variable charge ; (*c*) an amount not exceeding 5 per cent. of the total cost under paragraphs (*a*) and (*b*) of this clause.

Supplies Furnished beyond Vendor's Station.

The foregoing principles should be applicable to the charges for bulk supplies furnished at the busbars of a vendor's station. In cases where the supply is furnished at a point other than the busbars of a vendor's station the charge should include :—(1) Items (*a*) (1), (2), (4) and (5) of the fixed charge so far as such items are in respect of any new main which it is necessary for the vendor to provide for the purpose of furnishing the supply ; (2) the actual cost of the maintenance of such main ; (3) the cost of units lost in transmission from the vendor's station to the station or sub-station at which the supply is metered.

In cases where a supply is to be furnished by means of an existing main the vendor and purchaser should agree upon the charge (if any) to be made under items 1, 2 and 3.

The Corrosion of Lead-covered Cables by Electrolytic Action.*

By S. C. BARTHOLOMEW.

This paper consists largely of a critical survey of reports issued by various committees in this country, in the United States, and on the Continent, from which many quotations are made, the recommendations of the Ministry of Transport being quoted in an appendix. Damage caused by stray currents in America has been considerable, chiefly because the electric railway and tramway systems have not been subject to control as regards the manner in which the earth may be used for the return current. The regulations in this country, judging by results, have been effective.

The nature of electro-chemical corrosion is discussed in detail, and the chief systems of protection adopted in this and other countries are considered. The author prefers those based on limitation of stray currents, rather than those involving special protection of gas and water pipes and telephone or telegraph cables, etc. It is generally believed that a pipe or cable situated 3 ft. or more from a rail should have practically no current in it. The author, however, has met with currents as high as 7 A in such cases, though the conditions may have been exceptional.

Divergence from American Methods.

It is interesting to note the divergence of methods in this country and U.S.A., some devices adopted in one country being taboo in the other. The author's main conclusions are summarised as follows :—

(a) Cables should be kept as far away as reasonably practicable from tramway lines.

(*b*) Pipes should not be laid in contact with tramway standards.

(*c*) Contact with rails, either directly or indirectly connected, should be avoided in the "negative" area. Drainage connections in the "positive" area require very careful study before adoption.

(*d*) Earth plates should be sunk to which cables or pipes should be connected at boxes near the points where current leaves the cables. Cables should not be connected to earth plates which are positive to them.

(*e*) Cables should be kept clear of water in boxes and manholes. Dry conduits are very desirable.

(*f*) Chemical composition of fluid and soil is important. Cables should be liberally coated with petroleum jelly when drawn in.

(*g*) Voltage tests indicate possible danger points.

(*h*) Measurements of current are important, as the chief basis of recognising danger points and forming estimates of liability to injury.

(*i*) Iron pipes should be bonded at boxes and manholes.

(*j*) At junctions of routes cables and pipes should be joined by lead strip soldered to the sheathing.

Of these precautions (d) is taboo in the U.S.A., but is often used. In conclusion, the author can recall no case of damage to a main cable in the city of London, where cables are connected to earthplates at every manhole. Also no case of corrosion has occurred in the lead pneumatic tubes, in some cases a mile or two in length, many of which, laid in iron pipes, were in use for years before the general introduction of electric lighting and traction.

The author furnishes a useful survey of the problem. At one point he confesses to a fear that critics may find his treatment of some aspects of the subject "too skimpy and meagre." As the paper, appendix, and bibliography contain over 50 pages of closely typewritten matter, he need hardly be troubled on this point !

* Abstract of a paper read before the Institution of Post Office Electrical Engineers.

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Merchandise to Sell and Profit By.

In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

A Picturesque Boiling Ring.

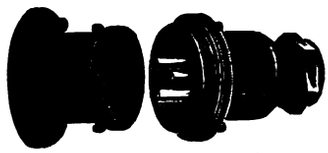
The designer of the "Gipsy" boiling ring has struck a happy combination of utility and the picturesque. The essential feature, however, of a boiling ring must be utility, and this has been achieved with the attractive "Gipsy" ring illustrated. The ring is designed to consume 850 W, and is manufactured in a standard dull black

THE GIPSY BOILING RING.

finish with the flat upper surface nickel-plated. The list price in this standard finish is 25s. 6d., or 27s. 6d. in nickel finish all over. The device is but one of the "Imperial" range of heating and cooking apparatus, manufactured by the IMPERIAL ENGINEERING CO., and distributed through the usual factors.

Plug and Socket for Industrial Use.

Contractors who cater for industrial work are always in difficulty when having to decide what type and make of wall plugs to use. It is an unfortunate fact that wall plugs are one of the many lines which have been made down to a price. A wall plug in industrial work is bought to perform continuous arduous service and therefore



THE NIPHAN PLUG AND SOCKET.

it follows that it must be made up to a standard. The "Niphan" range of wall plugs and sockets is one of the several makes which have been manufactured to this ideal. The illustration is of Cat. No. N. 548A, rated for 15 A. The whole range is a most comprehensive one providing for almost every industrial condition. Those buyers who are seeking devices made up to a standard must index the "Niphan" range on their purchasing cards. It is manufactured by SIMMONDS BROS.

A Useful Switch Adaptor.

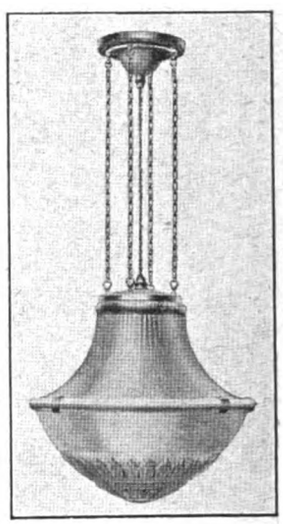
The GENERAL ELECTRIC CO. manufacture the switch-adaptor which we illustrate (catalogue S. 819). It is but one of the many service knick-nacks which this company offer to the retailer to

SOMETHING USEFUL FOR THE HOME.

increase turnover and make profit, because it is a domestic device and consequently a large market is waiting to consume it. It is small and neatly made and the switch controls the light only, so that unless it is desired, it need not be removed from the lampholder. The device is listed at 5s. 9d. each and (to name only one), every purchaser of a small heating device, such as an iron or kettle, is a prospect.

A New Development in the Control of Light.

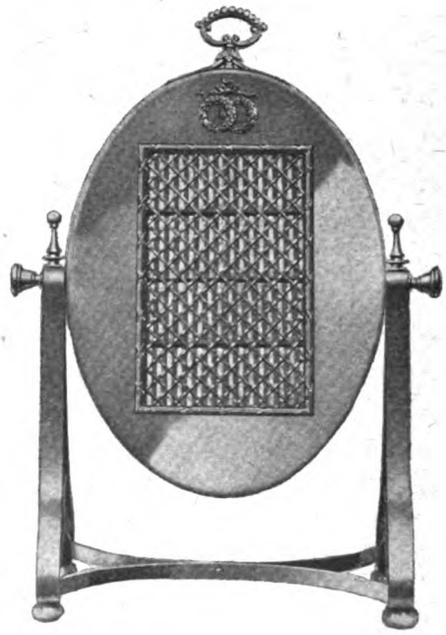
"Holophane" is a household word to retailers, meaning much in the lighting art. The new "Filterlite" fitting recently placed upon the market by the HOLOPHANE CO. will, however, open up new channels of business—business which has been "ungettable," owing to the want of a suitable glass. Popularity has its disadvantages and this is so with the well-known Holophane reflector-bowl. With the "Filterlite" the retailer has something new and distinctive. The accompanying illustration is of the F.12 complete unit. This glassware is made in two diameters, one being 12 in. suitable for 100 to 200 W gasfilled lamps, and the other being 14 in. for 200 W to 300 W lamps. It is a two-piece glass, having plain exterior surfaces with interior prismatic construction. Such construction besides having the advantageof being dust-proof gives a minimum of glare and a wide distribution of light. Stocks are distributed by all authorised Holophane factors.



THE "FILTERLITE" FITTING.

"Cheval Glass" and Electric Fires.

The retailer, in the task of selecting electric fires for a merchandising programme must reflect that the range of distinctive designs is very limited (bearing in mind the qualification distinctive), and it is for this reason that the "Creda" tilting fire, which we show in our



THE "CHEVAL GLASS" FIRE.

illustration will be welcomed. This design is *really distinctive*, and the special tilting arrangement which enables the heat to be thrown in any desired direction is an advantage. The fire is supplied in several finishes, and is listed in antique brass at £6 10s. by the CREDENDA CONDUITS CO.

We understand that the "MEPIC" electric shop window heater, which was described a short time ago in THE ELECTRICIAN, is now being used for warming the ink rollers on printing machines with satisfactory results.

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Municipal Electricity Accounts.

Details for Year ended March 31st, 1922.

Details are given below of the accounts of various municipal electricity undertakings for the year ended March 31st, 1922. In most of the undertakings dealt with there was a small net profit available for carrying forward or transferring to reserve account. The PETERBOROUGH undertaking, however, came on the rates, while at GRAVESEND £2 000 of the profits made by the undertaking was devoted to rate relief. Other accounts will be dealt with in future issues.

£3 000 Net Profit at Keighley.

At KEIGHLEY there was a profit on the year's working of £2 918, compared with a loss of over £6 000 in the previous year. The generation costs were £33 650, against £38 837 in the year 1920-21, and the total working costs were £44 179—a reduction on the previous year of £5 984. The income (£65 559) showed an increase of £4 042. The gross profit amounted to £21 380, out of which were paid: Bank interest, £3 355; sinking fund, £8 429; repayment of capital in excess of borrowing power, £1 574; and other small items, leaving a net profit of £2 918. The total capital charges were £18 462.

Bedford Places £1 700 to Reserve Fund.

The income of the BEDFORD electricity undertaking for the year ended March 31st, 1922, was £72 708 10s. 10d., and the expenditure was £48 236 12s. 6d., making a credit balance of £24 471 18s. 4d. Of this, £8 557 6s. 5d. went to interest on loans, £14 178 9s. 9d. to instalments of principal, and £1 736 2s. 2d., the net surplus for the year, was carried to the reserve fund. On the expenditure side, generation of electricity cost £32 822 12s. 1d., distribution, £5 503 19s. 3d., rent, rates, taxes and insurance, £4 232 3s. 6d., and management expenses, £4 247 0s. 2d. The main items on the income side were sale of current, £61 938 10s., and public lighting and pumping, £8 847.

A Bad Year at Peterborough.

There was a net deficit for the year on the PETERBOROUGH electricity undertaking of £6 870, as against a deficit of £3 580 in the previous year. The deficit, which is the largest there has yet been, was charged to the rates. Revenue amounted to £34 561 and expenditure to £29 344, plus capital and special charges, £12 087. The adverse result is attributed to the following causes: The coal strike during the Spring of 1921, the general trade depression, which retarded the extension of output, and working difficulties during the transiormation of the power stations.

Satisfactory Cardiff Accounts.

The income of the CARDIFF electricity department for the year was £168 369, an increase of £7 473 over 1921. The gross profit was £50 965 18s. 4d., against £51 788 6s. 6d., and the net surplus was £21 516 19s. 5d., a decrease of £2 193 16s. 10d. With the unappropriated balance at March 31st, 1921, the total was £78 872 16s. 9d. From this was deducted expenditure, £21 466 4s. 11d., leaving £57 406 11s. 10d. The depreciation fund is £12 847 and the sinking fund suspense account £22 298 6s. 2d. The amount raised on loan is £351 623 13s. 2d., but after taking into account the funds for the redemption of stock (£117 849 13s. 10d.), instalments paid off and sinking funds in hand (£36 731 12s.), the net liability is £163,643 7s. 3d., or 46·54 per cent. of the total capital of the undertaking.

Gravesend Undertaking Relieves the Rates.

The gross profit on the combined GRAVESEND and NORTHFLEET undertaking for the year was £19 631, 19 per cent. on the capital liability outstanding, or rather more than 10 per cent. on the total capital expenditure. After paying £5 732 interest on capital, repaying £6 429 capital borrowed, carrying forward £1 113 to provide for discounts and bad debts, and crediting £23 interest on investments, there was a net surplus on the year of £6 380. This surplus was allocated as follows: Relief of rates, £2 000; reserve fund, £1 000; and the balance to payment of capital expenditure, for which it is not proposed to take up a loan. Revenue increased from £58 645 to £66 788. The capital expenditure on the combined undertakings at March 31st, 1922, amounted to £175 668, of which £75 314 has been repaid, leaving £100 354 outstanding.

£4 000 Net Surplus at York.

There was a gross surplus for the year at YORK of £24 610 3s. 8d., income being £85 689 and expenditure £61 078 16s. 4d. Details of the income are as follows: Sale of current to private consumers, £75 398 7s.; public lighting, £2 272 8s.; power supplied to the Tramways Committee, £6 693 11s. 11d.; rental of meters and radiators, £1 126 6s. 5d.; miscellaneous, £198 6s. 8d.; total, £85 689. Out of the balance there was expended for interest and sinking fund charges £20 558, leaving a surplus of £4 051 17s. 10d., which was transferred to the reserve and renewals account. There was a credit balance on this account of £3 737 11s. 1d. at April 1st, 1921. The total net expenditure to March 31st, 1922, was £273 454 8s. 10d. The present loan debt is £245 307, and the balance due to treasurer is £28 147 8s. 10d.

Electrical Imports and Exports.

Totals and Comparisons for the Past Twelve Months.

IMPORTS.—The following are official values of electrical machinery, apparatus and material imported into this country (*a*) during December, 1922, and (*b*) the aggregate figures from January 1st to December 31st, with increase or decrease compared with 1921:—

Electrical machinery, (*a*) £58 076 (increase £8 281), (*b*) £1 158 373 (increase £449 292); telegraph and telephone cables, submarine, nil; other than submarine, (*a*) £7 025 (increase £5 679), (*b*) £34 945 (decrease £41 756); telegraph and telephone apparatus, (*a*) £25 210 (increase £13 400), (*b*) £285 039 (decrease £23 684); other electrical wires and cables, rubber insulated, (*a*) £17 038 (increase £14 293), (*b*) £126 622 (increase £83 480); with other insulations, (*a*) £9 299 (increase £7 390), (*b*) £89 533 (decrease £15 676); carbons, (*a*) £8 603 (increase £4 084), (*b*) £46 790 (decrease £47 685); glow lamps, (*a*) £40 239 (decrease £727), (*b*) £212 959 (decrease £67 193); arc lamps and electric searchlights, (*a*) £63 (increase £63), (*b*) £1 197 (decrease £5 271); parts of arc lamps and searchlights (other than carbons), (*a*) £759 (increase £262), (*b*) £12 002 (decrease £3 117); batteries, (*a*) £16 788 (increase £12 052), (*b*) £131 446 (increase £10 959); electrical instruments (commercial and scientific), and electricity meters, (*a*) £6 732 (increase £3 561), (*b*) £68 616 (decrease £66 428); switchboards, (*a*) £255 (decrease £5 861), (*b*) £2 806 (decrease £26 538); other electrical goods and apparatus, (*a*) £72 547 (increase £26 067), (*b*) £541 263 (decrease £174 790). Total of electrical machinery, apparatus and material (other than uninsulated wire), (*a*) £262 634 (increase £88 544), (*b*) £2 711 591 (increase £71 593.)

EXPORTS.—The exports of electrical machinery, apparatus and material (*a*) during December, 1922, and (*b*) from January 1st to December 31st, with increase or decrease compared with 1921, were as follows:—

Electrical machinery, (*a*) £326 949 (increase £14 546), (*b*) £4 151 735 (decrease £587 369); including railway and tramway motors, (*a*) £28 256 (increase £27 161), (*b*) £203 728 (increase £9 212); other generators and motors, (*a*) £136 419 (decrease £11 202), (*b*) £2 080 598 (decrease £572 339); and other electrical machinery, (*a*) £162 274 (decrease £1 413), (*b*) £1 867 409 (decrease £24 242); telegraph and telephone cables, submarine, (*a*) £63 596 (decrease £19 743), (*b*) £403 023 (decrease £1 743 241); other than submarine, (*a*) £35 638 (decrease £49 490), (*b*) £557 391 (decrease £1 061 562); telegraph and telephone apparatus, (*a*) £85 815 (decrease £108 515), (*b*) £1 841 985 (decrease £210 806); other electrical wires and cables, rubber insulated, (*a*) £97 192 (increase £35 581), (*b*) £756 126 (decrease £475 686); with other insulations, (*a*) £88 953 (decrease £18 114), (*b*) £1 040 860 (decrease £1 032 724); carbons, (*a*) £1 106 (decrease £3 146), (*b*) £51 926 (decrease £17 869); glow lamps, (*a*) £21 746 (decrease £3 693), (*b*) £363 622 (decrease £79 559); arc lamps and searchlights, (*a*) £346 (increase £146), (*b*) £5 696 (decrease £7 123); parts of arc lamps and searchlights (other than carbons), (*a*) £44 (decrease £297), (*b*) £6 706 (increase £533); batteries, (*a*) £40 509 (increase £4 353), (*b*) £492 651 (decrease £182 998); electrical measuring instruments (commercial and scientific) and electricity meters, (*a*) £30 591 (decrease £4 673), (*b*) £339 135 (decrease £151 836); switchboards, (*a*) £7 602 (decrease £11 208), (*b*) £209 170 (decrease £30 280); other electrical goods and apparatus, (*a*) £101 222 (increase £2 408), (*b*) £1 239 087 (decrease £740 259). Total of electrical machinery, material and apparatus, other than uninsulated wire, (*a*) £801 309 (decrease £261 845), (*b*) £11 458 313 (decrease £6 320 779).

Mid-Lancashire Electricity District.

Commissioners to hold an Inquiry at Preston.

The Electricity Commissioners are to hold a local inquiry at the Town Hall, Preston, on February 20th and following days, with reference to the area to be included in the proposed Mid-Lancashire Electricity District and the objections and representations which have been made on account of the inclusion in or exclusion from the said District of certain areas. The Commissioners will consider (*a*) a scheme which has been submitted jointly by the Corporations of Blackburn and Preston for effecting an improvement of the existing organisation for the supply of electricity in the District and for the formation of a Joint Electricity Authority, and (*b*) a scheme which has been submitted by the North-East Lancashire Electricity Committee for effecting an improvement of the existing organisation for the supply of electricity in the District and for the formation of an Electricity Board.

Copies of the respective schemes may be obtained from the Town Clerks of Burnley or Preston at a cost of 5s. each. There will also be available prior to the date of the inquiry (*a*) copies of supplementary financial particulars in support of the first-mentioned scheme at a reasonable charge, on application to the Town Clerk, Preston, and (*b*) copies of supplementary particulars in support of the second mentioned scheme at a cost of 5s. each, together with the map and diagram referred to therein at an additional cost of 5s. and 7s. 6d. each respectively, on application to the Town Clerk, Burnley.

Any body or person interested may attend the inquiry, either personally or by counsel, solicitor or agent. Representations or objections should be lodged not later than February 13th.

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Fifty Years of "Via Eastern."

A Record of the Eastern Telegraph Jubilee Celebrations.

Pleasant recollections of the Jubilee celebrations of the Eastern Associated Telegraph Companies last summer come to mind with the receipt of the souvenir volume entitled "Fifty Years of Via Eastern." We recall twinkling lights, dancing, music and flowers and so obtain a breath of summer in the depths of winter. There is a frontispiece of Sir John Denison-Pender. A short foreword gives the history of submarine telegraphy as it is bound up with the history of the companies. Then follow portraits of the directors and principal officials, among whom we notice such well-known faces as Mr. A. R. Hardie (now a director but secretary of the company for nineteen years and in its service for fifty-two years), Mr. F. E. Hesse (who died shortly after the celebrations), Mr. F. Ryan and Mr. W. H. Tweedy. An account is given of the presentation to the chairman at Orleans Park, Twickenham, on July 8th, 1922, of the endowment of the bed at St. Bartholomew's Hospital on July 20th in memory of Lady Denison-Pender, and of the banquet and fete at the Botanic Gardens, Regent's Park, on July 24th. At these last two functions about 3,700 guests were present and the speeches delivered are reported verbatim. The book is excellently and discriminatingly illustrated. Finally, a record of congratulatory telegrams and press cuttings is given.

Profitable Hull Telephones.

The Only Municipal Service in the Kingdom.

Hull Corporation possesses the only municipal telephone service in the Kingdom, and that service is meeting with gratifying success. At a meeting of the Committee last week, Mr. Ombler, the chairman, said that the number of their subscribers was steadily and constantly increasing, and they could look forward to a profit on the year's working of about £11 000. This, at any rate, was the estimate of their manager (Mr. Holme).

Mr. Locking said he hoped that if the estimate of profit proved correct they would reduce the tariff, and not agree to any portion of their surplus going to relieve the rates of the city.

The chairman replied that that question had been discussed with the manager, and it was hoped, sooner or later, to make a reduction in the charges; but he felt that they ought first to bring up their reserves to the point at which they stood when they began to draw upon them. After they had done that he would be pleased to make some reduction in the tariff, or, rather, to arrange some percentage of rebate, which he thought would be the wiser course to adopt. It was said that the more subscribers they obtained the more money they made, but new subscriptions were not all profit.

Turbine Explodes.

Accident at General Electric Works.

An explosion causing injuries to seven persons occurred on January 10th at the works of the General Electric Co., Witton, Birmingham. A turbo-alternator was being tested in a power-house where sixty-seven men were employed. During the operation it suddenly burst, and pieces of broken machinery were thrown about the room in all directions, the force of the explosion being so great that some of the pieces were thrown through the roof of the building. The power-house was set on fire by the electrical discharges, but the flames were speedily got under control by the fire brigade. The men were injured by the falling machinery, and after first-aid had been rendered five were taken to the hospital. Only two, however, were sufficiently injured to justify detention. Their names are Cyril Peake and Sydney Bogue. The former sustained a compound fracture of the scalp and a laceration of the leg, while the latter had injuries of a minor character, and after these had been dressed he was sent home.

Hackney Again.

Mr. and Mrs. Hammer's Electric Supper Party.

The new chairman of the HACKNEY Electricity Committee, Mr. Councillor W. Hammer, and his wife, Mrs. Alderman S. Hammer, have started work by educating their Committee in a very practical manner. Mrs. Hammer is an enthusiastic electrical housewife, leaving no stone unturned in letting others know what Hackney electricity does for her.

The whole of the members of the Electricity Committee were entertained to supper one evening last week. Every dish was cooked electrically, and was enormously appreciated by the guests. Toast and coffee were made on the table, and a pudding was cooked in a "Hotpoint" table oven. The cigars were lighted with electrical cigar lighters, and the room was swept up with a "Premier" cleaner.

The party were taken over the house, greatly appreciating the cleanliness of the kitchen, where a B. and K. "C" type cooker is installed, and the "Nobbs" water-heater in the bathroom. Mrs. Hammer finds that abolishing gas and coal has reduced the cost of housekeeping considerably. Wives of electricity chairmen should note and emulate this excellent propaganda work.

International Telephony.

Mr. Frank Gill on the Question of Control.

Mr. FRANK GILL on January 15th addressed a meeting of the Post Office Telegraph and Telephone Society on "Some Aspects of the Communication Art." After referring to the successful reception of wireless telephone messages from America at New Southgate that morning (dealt with elsewhere in this issue), Mr. Gill said that the public knew nothing of the telephone, and the result was lack of sympathy. The remedy was to educate the public. In America this idea was carried out by means of advertisements in regard to telephone methods in magazines and newspapers, and also news clippings which were sent to the newspapers, visits to exchanges, films, demonstrations and lectures. Mr. Gill showed a number of slides of typical advertisements, giving an idea of the multiplex system, warning the public that a certain number of lines would be moved at a certain time, and showing the extent of the service. The public thus learnt to appreciate the telephone system's work.

Referring to international telephony, Mr. Gill said that at present it was nobody's work to consider the matter. It was hard to get a line through an intermediate country and harder still to get it through two or more. No administration would undertake to deliver a long-distance call in Europe—it would only promise to do its best. He thought that was wrong. Telephone boundaries, as Mr. Thayer had pointed out in a paper, should be on economic and not on political lines. Somebody must have sole control of circuit lay-outs. It could not be done by a lot of different operating companies, and an operator A must be put through successively on a long line to B, C, D, and so on to the actual subscriber. The different nations should appoint one body to consider international telephony for Europe as a whole.

In the short discussion which followed Mr. R. A. DALZIELL said the British Post Office had now everywhere reasonable plant to enable them to tackle the education question.

Why There is a Dearth of Salesmen.

Some American Views.

The discussion which has recently taken place on the dearth of suitable electrical salesmen in this country make it interesting to find the "Electrical World" recounting that the same difficulty is present in the United States. Our contemporary points out that the real reason for this shortage is that salesmen are not paid enough. Salesmen are the ambassadors of the company to the high court of the customer, yet many companies have been paying salaries so small that they do not appeal to men who could truly represent them. To make these jobs attractive to men of the calibre wanted for this work it is necessary to hold out something more than the glory of the business. There must be both recognition and reward. The market offers plenty of opportunity to interest men capable of real achievement and to pay them well out of the profits that their efforts bring.

Parsons Turbo-Alternator for U.S.A.

American Interest in British Development.

We are informed that the Commonwealth Edison Co., of Chicago, in order to gain experience of the latest developments in steam turbine practice in this country, have placed an order with C. A. Parsons & Co., Newcastle-on-Tyne, for a 40 000 kW turbo-alternator. The 25 000 kW turbo-alternator which the Commonwealth Edison Co. ordered from C. A. Parsons & Co. in 1912 for their Fisk Street Station continues to run satisfactorily.

The set which has just been ordered is to be installed in the New Crawford Avenue Power Station, Chicago, of which the designed capacity will be about 500 000 kW, the rest of the plant being probably mainly of American manufacture. The consulting engineers are Sargent & Lundy, Chicago, and Merz & McLellan, London.

Electrical Contractors and the Press.

Formal Opening of a New Home.

On the occasion of the meeting of the Council of the Electrical Contractors' Association, last Tuesday, an opportunity was given to representatives of the electrical Press to inspect the new premises at 15, Savoy Street, London, W.C., and to hear from the President, Mr. H. Marryat, and Mr. W. R. Rawlings, something of the history and the objects of the Association.

The PRESIDENT, in welcoming the visitors, said that the object of the Association was the assistance of its members in the technical and business fields. It was also the negotiating body for its branch of the industry on the wages question, and had had under consideration such matters as discounts of the sale of wireless apparatus. They much appreciated the support the Press had given them, especially of recent years.

Mr. W. R. RAWLINGS said that when the Association was formed twenty years ago, there was discord in the contracting world. Now there was accord. This had been due to the hard work of many of their members, and especially to the yeoman service rendered by their President in editing "The Electrical Contractor." The Press had always done its best to assist the Association.

Mr. A. H. ALLEN ("Electrical Review") briefly replied.

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Whitworth Society Formed.

Dr. Hele-Shaw Elected as President.

A meeting was held on January 12th at the Institution of Mechanical Engineers to consider a proposal to form a society of Whitworth Scholars and Exhibitioners. Dr. H. S. HELE-SHAW, who occupied the chair, and Mr. BUCKLEY, who won his scholarship in 1869 and is believed to be the oldest Whitworth Scholar, expressed their gratitude to the late Sir Joseph Whitworth, and acknowledged that the degree of success which they had attained was primarily due to their Whitworth Scholarships. Other well known men who were unable to attend wrote in similar terms.

The CHAIRMAN stated that Mr. Montgomery, who had acted so far as honorary secretary, and General Mowat had given great assistance in connection with the movement. A resolution was passed that the proposed Society be formed, and Mr. E. R. Dolby was appointed temporary honorary secretary. The following were elected as a provisional committee to act until the first general meeting: Dr. H. S. Hele-Shaw, Sir Henry Fowler, Dr. Arthur Morley, Prof. E. G. Coker, Prof. D. A. Low, Prof. F. C. Lea, Mr. E. R. Dolby, Mr. H. R. J. Burstall, Mr. L. A. Legros, and Dr. W. A. Scoble.

It was resolved that Whitworth Prizemen (a grade which will come into being next year) shall be eligible for membership, that the annual meeting of the Society shall be in the form of, or be associated with, an annual dinner to be held on Sir Joseph Whitworth's birthday, December 21st, and that the committee be asked to arrange if possible for an inaugural dinner within the next two or three months.

Suggestions for the Society.

The CHAIRMAN said further attempts would be made to obtain the addresses of many well known men who would probably be proposed as members of the committee on future occasions. Amongst the numerous letters received from supporters of the movement, he was particularly pleased to associate himself with suggestions from Mr. Sugden who said the Society should try year by year to perpetuate the name of the wonderful man to whose memory it was being formed, and that another important object of the Society should be that the older men should try to help the younger generation of Whitworth Scholars.

It was agreed to ask the committee to approach selected publishers with a view to the production of a record in book form of the work of deceased Whitworth Scholars and Exhibitioners, who, as the Chairman remarked, included such eminent men as John Hopkinson and John Perry.

Dr. Hele-Shaw was elected as the first President of the Society, and Prof. D. A. Low, who proposed his election, remarked upon the fact that the practical examination formerly held in addition to the written examination for Whitworth Scholarships had been dropped and he thought it should be reinstated.

Automatic Telephony.

British Progress and Development.

The criticism is often made that this country is lagging behind in the field of automatic telephony. In an article in the current issue of the "Post Office Electrical Engineer's Journal," Mr. J. Radford gives some figures which will enable those interested to see how far these criticisms are substantiated. On October 31st, 1922, there were 29 automatic exchanges working in this country with a present capacity of 30 260 lines and an ultimate capacity of 51 630 lines. The first of these exchanges is the one at Epsom, which was opened in May, 1912, and the largest is that at Leeds which has a present capacity of 9 600 lines and an ultimate capacity of 15 000 lines. It was opened in May, 1918. One automatic exchange is under construction, that at Southampton, with an initial capacity of 3 200 and an ultimate capacity of 5 500 lines. Orders have been placed for 16 automatic exchanges with an initial capacity of 9 300 and an ultimate capacity of 14 050 lines. Of these the most important are those at Swansea and Dundee. Fifteen exchanges are in the specification stage and these have an initial capacity of 35 890 lines and an ultimate capacity of 54 707 lines. Of these the most important are those at Sheffield and Brighton. Thirty automatic exchanges are still in the pre-specification stage.

In commenting on this development Mr. Radford points out that automatic telephony did not make its appearance in a perfected state, and although the fundamental principles of the various systems remain practically unchanged, numerous improvements in design and circuit arrangements have been effected so that standardisation is being approached though not in such a way as to preclude the possibility of further improvements. Five different systems are at present employed and it has been one of the tasks of the department's engineers to make a thorough study of the claims of each from both the financial and technical points of view. Up to about a year ago proposals for automatic working were investigated on a comparative cost basis to determine whether manual working should be continued or whether it should be substituted by automatic working. The policy has now been adopted of introducing automatic working in all cases where such a course is undoubtedly economical.

An Electric Gauge.

Accurate Testing of Bearing Balls.

In a paper recently read before the Newark Branch of the Institution of Production Engineers, Mr. F. D. HOLISTER said that engineers never neglected or abused other engines as they did electric motors. Motor makers were aware of this fact and usually designed machines accordingly, with a liberal overload factor, so that they could be relied upon to run almost indefinitely under the worst of conditions.

The most common misuse to which a motor was subjected was overload, and this trouble frequently arose as one of the attendant evils of over-standardisation. For instance, it was the practice of some firms to use motors of one size only. These motors had to drive standard lengths of mainshaft, and when the shafts were set up machines were dumped beneath them with a total disregard of the power capacity of the driving unit. Thus a number of heavy milling machines might be driven by a motor of the same size as one driving a similar number of small high-speed automatics. Another very prevalent fault was that little or no attention was paid to ventilation.

An Intelligent Electrical Application.

As an example of the intelligent application of electricity, Mr. Holister cited the gauging of small parts that were made in millions, where individual examination by hand was out of the question. If individual examination must be employed, it was undeniable that far better results would accrue from electrical gauging than from hand work. "Go" and "Not go" gauges could easily be made which would accept or reject work with absolute accuracy if the work was made to form the bridge of an otherwise open circuit. Working upon this principle, a good example was furnished by a machine designed for gauging bearing balls.

This machine was, in effect, a taper gauge, the gauge being formed by two plates, one of which was rigid, and the other movable. The movable plate was made up of a number of segments, these being insulated from the machine and from each other, whilst the plate was pivoted at the top and controlled by an accurately made cam. Directly above the space formed by the two plates and at a definite height was a hopper feeding one ball at a time, and beneath the space was a runway composed of a number of trap doors opening upwards. The spindles upon which these trap doors were mounted were provided with cranks coupled to the armatures of solenoids which were connected to the segments of the movable gauging plate.

In action the hopper would be arranged to release one ball at a time, and this ball would drop a definite distance into the vee formed by the two plates. Thus if the ball were large it would lodge towards the top of the vee, while if it were small it would drop further down, a ball too small dropping straight through, whilst one too large would not drop far enough through to come into contact with the segments. The length of the segments would be such that the extra distance through which a small ball had to travel would compensate for its reduced weight. When the ball was in position it formed a bridge across an otherwise open circuit, the solenoid of which immediately operated and opened one of the trap doors in the runway. The movable plate would then move back and allow the ball to drop, the circuit being meanwhile automatically maintained by the armature being in the up position. Thus the ball in dropping would run down the runway until it came to the opening through which it would drop and be conveyed to a compartment according to its size. Having disposed of the ball, the current would be switched off by a master switch, thus allowing the trap door to close and the plate to move back into the gauging position. The machine would then be ready to receive the next ball.

Post Office Transport.

Electric Lifts and Battery Vehicles.

Lecturing before the INSTITUTE OF TRANSPORT on January 16th on "The Employment of Transport in Relation to Operations of the Post Office," Mr. H. C. Gunton said that for some work the electric lift was often the only solution, especially where space was restricted. The use of electric battery vehicles had gained ground very rapidly during the last few years. Their smooth, quiet running properties, their compactness, and the ease with which they could be controlled in crowded places, combined with their power to negotiate steep gradients, made them eminently suitable for use in railway stations, either as single units or as tractors with trailers.

These vehicles reduced the number of handlings to a minimum, and maintained an unchecked flow of traffic between the desired points. Moreover, their ability to take their loads between the interior of a post office building and a mail van on a train was very valuable.

Unfortunately, however, their employment was often impossible or restricted owing to existing arrangements in the form of lifts and subways being inadequate. In certain stations the weight carrying capacity of the lifts was too small, while the subways and ramps were reserved for passengers. Between the Birmingham Head Post Office and New Street Station, in which the subways and ramps were available for freight handling, a fleet of thirteen electric vehicles was being brought into use by the Post Office.

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Wireless News.

Australia and the Empire Scheme.

Actuated by the recent interview between the Postmaster-General and the Empire Press Union in the matter of Empire Wireless, Sir Joseph Cook, High Commissioner for Australia sends us details of the agreement, signed on March 28th, 1922, between the Commonwealth and Amalgamated Wireless (Australasia), Ltd. Commenting on it, the High Commissioner lays emphasis on the following four benefits which he claims will arise from the new enterprise:—

(1) A direct, speedy, and adequate wireless service available at all hours of the day and night throughout the year between Australia and Great Britain and between Australia and Canada.

(2) A reduction of 33⅓ per cent. on the existing charges for all classes of messages—commercial, Press, and Government.

(3) Expert commercial management and expansion to meet future needs.

(4) Comprehensive provision for service in war-time.

A Danish Government engineer advises the establishment of four WIRELESS STATIONS IN GREENLAND.

A Nottingham taxi-driver has fitted a WIRELESS RECEIVING SET to his cab, and it is stated that his passengers can "listen-in" successfully whether the cab is standing still or in motion.

The BROADCASTING OF OPERA has been successfully continued by the London Station. It is now reported that arrangements have been made to broadcast "The Last Waltz," the Gaiety Theatre musical comedy.

Some 250 radio posts are actually opened or under construction in FRENCH WEST AFRICA, says the "African World," adding that wireless will shortly link French Africa with the Sudanese and Anglo-Egyptian territories.

An Exchange message from VIENNA states that a branch of Marconi's Wireless Telegraph Co. will shortly be set up there with a capital of £133 000, of which £40 000 will be Austrian. The branch will commence to operate in the early autumn.

The first attempt to BROADCAST A COMPLETE CONCERT PROGRAMME from America to Europe will be made by the great Bamberger Station (WOR) of Newark, New Jersey, on or about January 30th, with the co-operation of a score or more of the most important European receiving stations. The concert will take the form of a recital by Miss Edith Bennett, the young American soprano.

On January 12th an application was made to the Manchester Licensing Justices for permission to instal "LISTENING-IN" SETS IN LICENSED PREMISES, to be put into operation when required. The Justices (Alderman Dixon and Dr. Jackson) resolved that inasmuch as the application was a novel one, the whole matter of such licences should be left for consideration by a full meeting of the Licensing Committee. The application would be adjourned for a week.

Wireless telegraph apparatus and broadcasting sets IMPORTED INTO SOUTH AFRICA will be taxed 20 per cent. *ad valorem*, subject to a rebate of 3 per cent. *ad valorem* on the products of the British Empire. Commenting on this decision, the "British and South African Export Gazette" says, "More generous treatment might have been hoped for in view of the Government's enlightened and practical attitude towards wireless telegraphy and telephony generally, but the tax is one which the user will pay in every case, and it is probably not sufficient to check the popularity of wireless either as a service or a hobby."

A group of MEDIUM POWER WIRELESS STATIONS EMPLOYING VALVE TRANSMITTERS has been erected by Marconi's Wireless Telegraph Co., at North Weald, near Ongar, Essex, for the purpose of conducting commercial wireless services with France, Switzerland, and Spain. These stations have been brought to a high state of efficiency, and for some months one of them, although only designed for European communication, has been carrying on a Transatlantic service to Canada. One of the other stations (GLO) which is used for communication with Madrid, a distance of about 720 miles, can be heard at Bandoeng, Java, 7 500 miles distant. The signals were received there with a two-valve set and an aerial only 45 ft. in length and 15 ft. above the earth.

The PRINCE OF WALES will open Rotherham's new super power station on May 30th.

Mr. W. B. Esson will occupy the chair at the DYNAMICABLES' dinner on January 24th, at the Trocadero, London, W. The function is timed for 7.30 p.m.

More than 700 children of employees on the Stafford works of the ENGLISH ELECTRIC Co. were entertained last week-end by the firm for their annual Christmas treat.

All the indications point to a time of DEARER STEEL this year, says the Midlands and Staffordshire correspondent of the "Engineer." He adds that it is some time since steelmasters were making any profits.

The SILVANUS THOMSON MEMORIAL LECTURE, to be delivered at the Technical College, Leonard Street, London, E.C.2, on Thursday, February 1st, at 7.30 p.m., will be on "The Basis of Wireless Communication," the lecturer being Sir Oliver Lodge. Sir Charles Parsons will occupy the chair.

Legal Intelligence.

Technical Case to be Heard by Referee.

An action brought by the Fellows Magneto Co. against Armstrong Siddeley Motors, Ltd., was down for hearing on January 12th in the King's Bench Division by Mr. Justice Roche, but before it was reached counsel representing the parties agreed that as a great deal of detail as to the construction of magnetos would have to be gone into it would be better that the case should be heard by an Official Referee. They therefore asked his lordship to refer it to Sir Edward Pollock, and to this the Judge agreed, observing that he was glad to be relieved of the necessity of pronouncing upon the merits of the magnetos.

The action was accordingly referred as desired.

Institution Notes.

At the weekly meeting arranged by the INDUSTRIAL LEAGUE AND COUNCIL on January 17th at the Caxton Hall, Westminster, S.W., Sir Ernest J. P. Benn gave "A Talk about Economics." Mr. F. S. Button, of the Industrial Court, was in the chair.

Under the auspices of the UNIVERSITY OF LONDON, Prof. Miles Walker will give four lectures on "The Control of the Speed and Power Factor of Induction Motors" at the Institution of Electrical Engineers on February 21st and 26th and March 14th and 21st, at 5.15 p.m.

The ROYAL SCOTTISH SOCIETY OF ARTS has awarded a Mackdougall-Brisbane Medal each to Messrs. Dawson Turner and D. M. R. Crombie for their paper on "An Investigation of the Ionised Atmosphere around Flames by means of an Electrified Pith Ball." The Society has made a grant of £20 to the Edinburgh Radio Society for research investigations connected with the Armstrong super-regenerative wireless receiving circuit.

Automatic regulation in connection with central heating was dealt with by Mr. B. R. Wingfield in an address to the INSTITUTION OF HEATING AND VENTILATING ENGINEERS on January 12th. Various types of regulators were described. Mr. Wingfield averred that overheating would be avoided and that there would be a saving in fuel to the ultimate benefit of the community if temperature regulation was made a regular part of every central heating installation, whether large or small.

Mr. Frank Gill, President of the INSTITUTION OF ELECTRICAL ENGINEERS, gave an address to the North-East Centre in Newcastle on January 8th on "Economics, Annual Charges and Depreciation." He particularly emphasised the important part played by economics in engineering and urged that more attention should devoted to this subject in the training of future engineers. It was always the engineer's problem to find the method of doing what was required at the least possible cost, i.e., with the least possible expenditure of human labour, as money was merely a form of stored labour. The subject of economics was therefore intimately bound up with all engineering considerations and it was essential that its principles should be understood by engineers before they could be in a position to deal with the application of engineering knowledge from the points of view of least possible expenditure, elimination of waste and the reduction of annual charges. These, said Mr. Gill, were rarely properly understood or applied.

Personal Items.

Mr. E. P. PAGE has been appointed sales manager to London Factors and Agents, Ltd.

Mr. JOHN STEPHENS has been appointed works superintendent at Bury, in succession to Mr. J. G. Potts, now electrical engineer.

Mr. W. HOWARD WADMORE has resigned his position with the Metropolitan-Vickers Electrical Co., to take up an appointment with the A.C.E.C.

The appointment of Justice of the Peace for the Royal Borough of Windsor has just been conferred upon Mr. R. G. RAWKINS, manager of the Notting Hill Electric Lighting Co.

Mr. A. H. DARKER, chief electrical engineer to J. Stone and Co., is leaving London to-day (Friday) by the P. and O. steamer "Narkunda" for a business trip round the world.

Mr. H. E. LINCOLN has been appointed general manager of the Wallasey Corporation tramways. There were over 50 applicants for the post. For some years Mr. Lincoln has been connected with the Engineer's Department of the Sheffield Corporation tramways.

Bury Town Council has placed on record its high appreciation of the services rendered during the last 26 years by Mr. S. J. WATSON, who has left to take up his appointment at Salford. The electricity supply to-day is 15 or 16 million kWh, whereas when Mr. Watson came to the town it was about 12 000 kWh.

Mr. J. F. SIMPSON, who is severing his connection with Preston Corporation Tramways to become manager of the town's electricity undertaking, was on Sunday presented with a cheque by the Tramways Department. Councillor J. Wolley, chairman of the Tramways Committee, made the presentation.

A WHIST DRIVE is due to be held to-night (Friday) by the members of the Osram and Robertson Club.

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Electricity Supply.

Extensions and Developments.

Extensions are to be carried out in the engine room of the ABERDEEN generating station at Ferryhill at a cost of £8 593. Tenders will shortly be invited for the work. The Electricity Committee has recommended the Town Council to become members of the E.D.A.

CARDIFF City Council has referred back to the Electricity Committee for further consideration all the projects to extend the installations of electrical power in the city. These projects have reference to extensions of plant to the areas recently brought within the city boundaries and to the electrical equipment at the docks.

WOLVERHAMPTON has decided to apply for a special order to extend the area of the Corporation's supply, so as to include certain parishes and portions of parishes to the north and north-west of the present area. The Deputy-Mayor said there was no disagreement with Walsall or Cannock, but in addition to what was agreed, extensions were proposed to Brewood and Codsall.

Reductions in Charges, Proposed and Actual.

WEST HARTLEPOOL Electricity Committee is to report on the present charges with a view to a reduction.

Mr. A. C. Cramb, electrical engineer, has expressed the hope that a reduction in charges will be possible at CROYDON in a few months' time.

Reductions have been made at EALING as follows: Lighting from 8d. to 7d. per kWh; power, from 2½d. to 2¼d. No reduction is made in heating and cooking charges.

DEWSBURY Town Council has reduced the charge for electricity for lighting from 7½d. to 7d. per kWh, and for power on the maximum demand system from 100 per cent. to 80 per cent. over pre-war rates.

The STAFFORDSHIRE, WORCESTERSHIRE AND SHROPSHIRE Electricity Supply Co. has reduced the charge for electricity for lighting to 6½d. per kWh, and for power to 2½d. for the first 2 000 kWh per quarter and 2¼d. for the next 8 000.

GODALMING Chamber of Trade has again taken up the question of the prices charged for electricity in the borough, and in a letter to the Town Council asked that body to do their utmost to see that the charges are brought down at the earliest possible moment.

BURY ST. EDMUND'S Town Council has adopted the following resolution of the Electricity Committee: That the charges for lighting be reduced from 9½d. to 8d. per kWh, that the discount of ½d. for prompt payment still be allowed, and that a reduction of 15 per cent. be made on the present charges for power.

Loans Applied for and Sanctioned.

LOWESTOFT is applying to the Electricity Commissioners for sanction to borrow £5 000 for electricity purposes.

PORTSMOUTH Town Council has applied to the Electricity Commissioners for a loan of £16 000 for mains, transformers, services, etc.

BIRKENHEAD Corporation intends to apply to the Electricity Commissioners for sanction to borrow a further sum of £20 000 for the purchase and laying down of main and service cables.

CARLISLE Town Council has applied to the Electricity Commissioners for a loan of £2 900 for mains extensions in order to supply electricity to houses about to be erected at Blackhall.

HAMMERSMITH Borough Council has mortgaged to the Royal Liver Friendly Society the revenues of the electricity undertaking and the general rate to secure the sum of £87 205 for electricity purposes.

Tapping New Areas.

The MERSEY Power Co. has extended its system into Overton. Further extensions are to be carried out.

A supply of electricity for the island is to be considered by the present session of the States of JERSEY.

MATLOCK Urban Council has invited the Derby and Notts Power Co. to submit proposals for a supply of electricity to the district.

The Town Clerk of WITHERNSEA has been instructed to make inquiries as to an electric lighting scheme. The question of a supply from HULL is being considered.

ANDOVER Town Council has decided to approach the War Office with a view to ascertaining if they would extend the cables from the Andover Aerodrome to the Borough, and upon what terms.

TORRINGTON Town Council after discussing an electric light scheme with a representative of Crompton and Co. has decided in favour of a joint scheme with Bideford, instead of a separate scheme.

The directors of Wolsingham Steelworks have offered to the Weardale District Council a supply of electricity for the public lighting of WOLSINGHAM, on the understanding that not less than 10 000 kWh per year are taken.

The NORTH WALES Power Co., which has been granted powers to supply current in bulk to a wide area in North Wales, has now definitely selected the site for their transmitting station at Rhuddlan and the point of delivery to Rhyl. The company is still in negotiation with the Prestatyn and Abergele Urban Councils as to lighting those districts by electricity.

BARROW Corporation has nearly completed a scheme for supplying the suburbs of Rampside and Roa Island with electricity. A scheme is also on foot to supply Ulverston, ten miles away. The plant at Barrow is now working at its full capacity, and negotiations were entered into some time ago with Vickers, Ltd., for the taking over of their power station by the Corporation, but so far nothing definite has been arranged in this respect. Failing such an arrangement the Corporation will be under the necessity of extending the existing works.

Miscellaneous Supply Items.

MANCHESTER Electricity Committee are offering special cheap rates for shop-window illumination after closing hours.

Opposition is being offered by WATFORD Tradesmen's Association to the suggested hiring out of electrical appliances by the Town Council.

A report just presented to HEYWOOD Town Council shows that the consumption of electricity for lighting and power in the borough during November last amounted to 203 460 kWh, as against 155 947 in November, 1921, an increase of over 30 per cent.

PORT TALBOT Corporation have applied to the Electricity Commissioners for an Order to supply electricity in the Borough of Port Talbot. Any objections must be sent to the Secretary, Electricity Commission, Whitehall, London, by February 9th.

PLYMOUTH Corporation is seeking powers to provide electricity showrooms and offices, and to exhibit specimens of installations and give demonstrations of the uses to which electrical energy might be put. The proposal does not, however, empower the Corporation to sell fittings or wire premises.

The S.E. LANCASHIRE ADVISORY Board has approved a contract for reciprocal bulk supplies between the Wigan Corporation and the Lancashire Electric Power Co.; also contracts for bulk supplies between the Manchester and Salford Corporations and the Rochdale Corporation and the Milnrow Urban District Council.

HORWICH District Council has applied for an order, desiring to receive a supply of electricity in bulk from Bolton Corporation. The Lancashire Electric Power Co. has also applied for an order to become the authorised agents for this locality. The S.E. Lancashire Advisory Board has recommended the former application.

The interim balance sheet of the GLASGOW electricity undertaking for the six months ended December 30th shows that the position is relatively better than at the same period last year by £17 000, in spite of a reduction of rates to the consumer equivalent to £92 000. This improvement, however, does not indicate any further reduction of rates.

The BRENTWOOD DISTRICT ELECTRIC Co. have applied to the Electricity Commissioners to amend the draft of a Special Order for which the company have applied by substituting the following maximum charges for energy: 1s. per unit, with a minimum of 15s. per quarter in the March and December quarters, and a minimum of 10s. per quarter in the June and September quarters. Any objections to the application must be sent to the Secretary, Electricity Commission, Whitehall, London, by January 26th.

Electrical Progress in Australia.

An Increasing Market for British Machinery.

Mr. S. W. B. McGrigor, H.M. Senior Trade Commissioner in Australia, has prepared a report on the Economic and Financial Situation in Australia.

Referring to the fact that Australia has become the second-best customer of the United Kingdom, Mr. McGrigor remarks that the United Kingdom's present share in the Australian market will not be retained without severe competition from the United States and possibly other countries. The best goods, sales methods and visiting representatives are not too good for this market with its future possibilities.

Dealing with new subsidiary steel industries at Newcastle (N.S.W.) the report states that the Commonwealth Steel Products Co., which has a nominal capital of £250 000, is turning out castings up to five tons, forgings up to three tons, railway axles and tyres of steel made by an electrical process. Their ten-ton electric furnace produces an average of 600 tons monthly. Metal Manufacturers, Ltd., of Port Kembla (N.S.W.), can handle more than the Commonwealth's requirements of copper wire, cables, aluminium, steel-cored cable, etc., and during the current year the company will commence the manufacture of covered telephone cables.

It is stated that Australia offers an increasing market for electrical machinery, but, as the imports of such machinery dropped from £1 681 713 in 1920–21 to £1 350 821 in 1921–22, the additional demand has, apparently, been met so far by the large Australian works, which, it is stated, have been established. Imports of electrical switchgear and apparatus rose from £215 098 to £348 999, and imports of electrical appliances, not elsewhere included, but including incandescent lamps, were £807 870 in 1920–21, the 1921–22 figures not being given. Imports of insulated wire and cable amounted to £1 233 091 in 1920–21 and dropped to £887 174 in 1921–22.

With regard to hydro-electric development it is remarked that since the last report little or no progress has been made in any of the States except Tasmania.

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Foreign Notes.

China.

According to the bulletin of the Bureau of Economic Information, the Foochow Electricity Co. are making estimates for the ERECTION of a HYDRO-ELECTRIC PLANT at the waterfalls between Shipping and Lungting, in the Kutien district, Fukien. An engineer has been sent to conduct surveys.

Cuba.

A report by Mr. G. E. Haggard, H.M. Consul General at Havana, on ECONOMIC CONDITIONS IN CUBA in the year ended September last states that the demand for electric elevators is worth cultivating. Machinery is imported in ever increasing quantities from the United States, which country has an advantage in the form of a reciprocity treaty.

Czecho-Slovakia.

With the help of the State and the province of Bohemia, a company has been formed in Prague which will be able to provide the town with the electric power necessary for its rapid development. The company has a capital of 180 000 000 crowns, and is styled the CENTRAL ELECTRICITY WORKS. A power station is to be erected near the Edwige lignite field at Ervenice not far from Most (North West Bohemia). Its production at first will amount to 45 000 kW. The current will be conveyed to Prague at a tension of 100 000 V. Preparatory work has already commenced.—*Reuter's Trade Service.*

Denmark.

According to the "Danish Foreign Office Journal," a technical committee which has been considering the practicability and profit of GENERATING ELECTRICITY WITH PEAT AS A FUEL, has presented a report in which, on the strength of results attained at a temporary plant erected in the so-called Wildbog ("Vildmosen") in Jutland, it expresses the view that with the cost of labour now prevailing, and with the use of peat from normal bogs at electricity stations equipped with turbines, it would be possible to compete with stations using coal as fuel, even if the price of coal went down to 25 kroner per ton. The committee regards the technical difficulties as having been overcome, and recommends that State support should be granted to aid private initiative in the establishment of a permanent generating station equipped for the consumption of peat.

Germany.

The Cartel of GERMAN ELECTRICAL EQUIPMENT MANUFACTURERS has decreed a further increase in the price of all accessories made of brass, iron or lead, prices being 6 000 per cent. over 1918 prices. The Insulated Wire Control Board has instructed its members to apply increases of from 450 per cent. to 750 per cent. on tariff No. 12 prices, an average increase of 50 per cent. on previous prices. Finally, the works manufacturing porcelain insulators have decreed another increase of 3 800 per cent. on all their products.

Japan.

Greater interest, says Reuter, is being taken in ELECTRICAL MACHINERY in Japan. Although Japan manufactures and exports large quantities of electrical goods, particularly to China, there is little doubt that for the higher class of manufactures she is dependent upon Western nations, and British goods are very favourably received.

Sweden.

Swedish newspapers, says Reuter, show great interest in the new TWO-STROKE CRUDE OIL ENGINE invented by the engineer M. Wennerby, of Halmstad. The engine is able to perform a maximum of 1 800 r.p.m. All kinds of oil fuel may be employed, and the uses to which the engine may be put are numerous.

Switzerland.

With a view to relieving the great amount of unemployment in the Swiss machine and electrical industries, the General Management of the Federal Railways is about to lay a proposal before Parliament for the ACCELERATION OF THE ELECTRIFICATION OF THE RAILWAYS. According to the new programme 75 to 80 million francs will be laid out annually instead of 50 000 000 as hitherto.

U.S.A.

The ALABAMA TRACTION LIGHT AND POWER CO. report that the Mitchell Dam has been completed. Work is going forward on the installation of the first unit, and it is hoped that 30 000 H.P. will be generated by March 1st. The dam will have an initial capacity of 72 000 H.P. with provision for increase to 120 000 H.P. when required. When the new plant is ready for operation the load carried by the present steam plants will be transferred to the dam, with, it is predicted, resulting economies in costs. Upon completion of the plant 77 per cent. of the installed generating capacity of the company's system will be hydro-electric.

A novel method of minimising fire risk with large OIL-COOLED TRANSFORMERS is being introduced by the Westinghouse Electric and Manufacturing Co., of East Pittsburg, Pa., U.S.A., and has found its first application in connection with a 25 000 kVA bank of transformers which the Westinghouse Co. has supplied to the Middle West Power Co. to the order of Sargent and Lundy, consulting engineers, of Chicago. The method consists in filling the transformer case, above the oil level, with nitrogen, which is supplied by an automatic generator fixed to the transformer case. It is also suggested that the layer of nitrogen above the oil acts as a cushion or buffer, helping to absorb shocks due to sudden pressures generated by arcs under the oil level, in case of breakdown.

A recent issue of the "Electrical World" gives an account of successful tests in carrier current telephony carried out by the PENNSYLVANIA WATER AND POWER CO. over a 40 mile power line working at 70 000 V on the three-phase system. A 220 V storage battery is used to operate a motor generator developing direct current at 1 000 V. This is then passed through a 50 W pliotron which gives an alternating current of about 5 000 V and 15 000 cycles. This current passes to the transmission line through a capacity coupler, a second 50 W tube being used as a modulator to superimpose the voice on the higher frequency circuit.

The Byllesby Engineering and Management Corporation announces a new electric, water and steam power construction and development programme for MINNEAPOLIS and ST. PAUL, involving an estimated expenditure of 80 000 000 dollars. The new construction, which will extend over a period of about ten years, will increase by about 306 000 H.P. the electric generating capacity of the Northern States Power Co., a concern serving 350 cities and towns in Minnesota, the Dakotas, Wisconsin, Illinois and Iowa.

Imperial Notes.

Australia.

The BURRINJUCK (N.S.W.) HYDRO-ELECTRIC SCHEME appears to be making progress. Tenders for turbines and generators were received in Australia two months ago, six firms submitting offers for both turbines and generators, and the prices ranged from £24 127 to £48 254. These prices are considerably lower than figures quoted in 1920. No tender, however, will be accepted until details are available from the Agent-General of the offers received by him in London.

It is stated that over 1 200 people are awaiting connection to the MELBOURNE (VICTORIA) CENTRAL TELEPHONE EXCHANGE. About 550 lines were recently transferred from the central to the new Collingwood automatic exchange, and will be replaced by 550 of the new applicants shortly. The remainder of the 1 200 will probably have to wait until the new North Melbourne exchange is erected. In the meantime "extra" clerks have been detailed to communicate with people on the waiting list and ascertain "how many still require telephones."

British Columbia.

It is announced that the British Columbia Electric Railway Co. will spend 172 000 dollars on NEW HIGH TENSION WIRES between Lake Buntzen and Vancouver during the spring, says Reuter.

A Reuter message from Anyox, British Columbia, states that contracts have been signed for the installation of a 5 000 H.P. addition to the existing HYDRO-ELECTRIC FACILITIES of the Granby Consolidated Mining and Smelting Co. The addition will cost about 200 000 dollars.

The British Columbia Electric Co., in addition to improvements in its power plant on the Stave River, is planning the CONSTRUCTION OF A NEW POWER HOUSE further down the river, to cost 10 000 000 dollars. It is estimated that the new plant will develop 100 000 H.P.

Canada.

The development of 50 000 H.P. of ELECTRICAL ENERGY on the Rivière des Prairies by the damming of the river just below Visitation Island will be started by October next, according to an Order-in-Council which has been passed by the Provincial Government granting a 60-year lease on the river rights to the Back River Power Co. The scheme is estimated to cost between six and seven million dollars.—*Reuter.*

India.

The capital of the KARACHI ELECTRIC SUPPLY CORPORATION is being increased and the plant doubled, for the third time since its inception in 1914.

The opening of an ELECTRIC POWER STATION in Rutlam, a tiny yet progressive Native State, having an area of no more than 871 square miles, is typical of the modern spirit which is enveloping India. The new plant is small, consisting only of three 55 kW sets, coupled to crude oil engines.

A number of WIRELESS TELEPHONE SETS have been installed in the Moplah tracts of Malabar, South India. It will be recalled that during the Moplah disturbances last year the rebels systematically cut the telephone and telegraph wires, and thus rendered communication practically impossible.

Reuter intimates that the Itarsi (India) Industrial Corporation, which has an authorised capital of Rs.100 000 and for which the agents are R. R. Chowbey Laxminarayan and Co., Itarsi, will require PLANT TO GENERATE ELECTRICITY for the town of Itarsi (G.I.P. Railway) and for driving saws.

The project for WIRELESS TELEGRAPHIC COMMUNICATION BETWEEN INDIA AND THE UNITED KINGDOM is receiving non-official support in India, particularly from commercial bodies, and a number of resolutions on the subject have been tabled for discussion at the forthcoming session of the Indian Legislature. These resolutions include one by Mr. Sethna (Bombay) urging the Government to proceed forthwith in the matter independently, with a view to entering into agreement with a private enterprise, incorporated in India, "for the erection and maintenance of an efficient service providing an adequate link in the proposed Imperial scheme, and the running of reciprocity stations in the United Kingdom."

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Electric Traction.

Fostering Public Interest in Tramway Systems.

Members of the public are generally all too ready to criticise municipal undertakings, and tramways come in for their fair share of adverse comment. More often than not this is based on ignorance of the true service which the system renders and the difficulties under which it is run. The right remedy is to give the public every opportunity of gaining an insight into the working of the system. The good results likely to accrue from such a course have been fully realised at EDINBURGH, where Mr. R. S. Pilcher, manager of the Corporation Tramways, recently gave some details of the new system to a meeting of the local Rotary Club. He pointed out that the conversion of the tramway system from cable to electric had introduced many difficulties unknown to the public, but so far the problems had all been successfully faced, and the new system would be completed with an addition of £600 000 to the tramways capital expenditure, or £187 000 less than the original estimate. They were now saving approximately £120 000 with the new system. Several questions were asked, and satisfactorily dealt with by Mr. Pilcher.

The same excellent idea has been put into practice at HASTINGS, where Mr. Vincent Edwards, the tramways managing engineer, recently addressed a meeting of the Ratepayers' Association on the system and service. Other municipalities may well do the same.

Tramway Extensions and Developments.

The reduced fares on the EDINBURGH Corporation trams will come into force on Sunday next, January 21st, on which day also further portions of the system will be electrified.

PLYMOUTH Corporation is seeking powers to double certain of its tramway lines at an estimated cost of £39 516. Similar work has also been decided upon at SWANSEA, with a view to providing work for the unemployed.

SUNDERLAND Town Council has decided to purchase 1 400 sq. yd. of land near the Seaside Lane tram terminus at the price of 5s. per sq. yd., for the purpose of making a siding to cope with the exceptionally heavy traffic to Seaside Lane in summer time. A considerable road improvement will result from this development.

New lines are in prospect of construction by GLASGOW Corporation at Milngavie, and the scheme for a DEARNE VALLEY tramway system to connect up the townships of Wath-on-Dearne, Wombwell, Bolton-on-Dearne and Thurnscoe, put forward by the urban councils of those districts, has now reached the stage when the contracts for the construction of the tramways are to be let. The linking up of the BRADFORD and KEIGHLEY systems cannot be proceeded with until the new bridge at Stockbridge has been completed.

The Hull Rails Contract.

HULL City Council has not followed the example of Edinburgh in refusing to buy its rails abroad, as advised by the Tramways Committee, and the tender of the Anglo-Belgian Improvements Corporation, at £9 236, has been finally accepted. The Sheffield Chamber of Commerce wrote urging that the contract should be placed in Sheffield, but an amendment to place the contract with Steel, Peach and Tozer, Sheffield, was defeated. The chairman of the Tramways Committee stated that four months ago, when the matter was first discussed, the lowest English tender was £11 15s. per ton by a Sheffield firm. This firm had now raised the price by £2 per ton. The effect was that the Corporation would have to pay £5 000 more to keep the order in England. This the Tramways Committee felt they would not be justified in doing.

A Glasgow "Safety First" Campaign.

A leading part has been taken by the Tramways Department in the "Safety First" campaign which has been in progress at GLASGOW during the current week. A similar campaign was undertaken in 1914 almost entirely by the Tramways Department, but the present scheme is on more ambitious lines. Each evening a specially illuminated and decorated tramcar has been travelling along a number of principal streets in the city, and there has been a nightly exhibition of cinematograph films on a screen outside the offices of the Tramways Department in Bath Street. The films have been interspersed with pictures giving hints on the avoidance of accidents and the successful conduct of city traffic.

Register of Electric Vehicle Charging Stations.

The "Register of Charging Stations for Electric Vehicles," compiled by the Electric Vehicle Section of the Society of Motor Manufacturers and Traders, is likely to be of considerable use to the owner and driver of electric vehicles. Over 230 towns in Great Britain and Ireland are mentioned in the Register as having charging stations, and the total number of stations of which details are given exceeds three hundred. A large-scale map shows graphically the relative positions of the various stations. The driver of an electric vehicle will thus be able to extend his range of action very considerably.

Electric Railway Items.

Rumours that the EAST LONDON RAILWAY was to be absorbed into one of the great groups have been officially denied.

The cars on the DISTRICT RAILWAY are now being overhauled, and as they come into the repair shops for this purpose many improvements are being carried out. The seats are being re-upholstered throughout, and the poles from floor to roof are being taken out and replaced again by straps.

The "Yorkshire Post" states that there is considerable uncertainty as to the proposals for the ELECTRIFICATION OF THE RAILWAY line between Manchester, Oldham, Middleton, Royton and Shaw, which has been mentioned in connection with the part of the London, Midland, and Scottish system in the scheme for providing employment. Officials of the London and North-Western Co., interviewed by our contemporary's representative, expressed their astonishment at the inclusion of this particular work in any plan for coping with unemployment.

The CITY AND SOUTH LONDON RAILWAY is seeking power from Parliament to construct an extension of its system for a distance of over six miles from the present Clapham Common terminus, passing thence under the Balham High Road, through Merton to Morden, where it will form a junction with the Wimbledon and Sutton Railway authorised in 1910. The time sought within which to construct this extension is five years from the passing of the Act, and upon its completion running powers are sought to be exercised over the whole of the Wimbledon and Sutton Railway.

Business Items.

Premises at 152, Market Street, Preston, have been opened by the CARWIN ELECTRIC CO.

Mr. J. C. White has now moved into his NEW PREMISES at 49, Bridge Street, Deansgate, Manchester.

GUEST, KEEN AND NETTLEFOLDS are making large alterations at their Dowlais Works. A contract for new electrical plant has already been placed.

A manufacturerers' agent in Sydney desires the REPRESENTATION OF UNITED KINGDOM MANUFACTURERS of electrical supplies, particularly tumbler switches and ceiling switches. The agent has been established for a considerable time in Australia and represents various motor-car interests in the Commonwealth. Particulars from the Department of Overseas Trade, quoting reference number 26.

The new Birmingham Showrooms and sales depot of the METROPOLITAN-VICKERS ELECTRICAL CO. are situated at Daimler House, 33-34, Paradise Street. Mr. Collard is in charge. From the

THE NEW METROPOLITAN-VICKERS BIRMINGHAM SHOWROOM.

accompanying illustration it will be seen that the showroom accommodation is excellent. Retailers are invited to send their customers to make a selection of the goods displayed.

Obituary.

Mr. AMBROSE FIRTH, chairman of directors of the Brightside Foundry and Engineering Co., died on January 11th. He was 77 years of age and began business on his own account when only 19.

The death occurred last week of Mr. WILLIAM BATES, formerly electrical engineer of Birkenhead. After his retirement from the Birkenhead Corporation's service, Mr. Bates entered the coal trade, and for his services during the war in connection with the coaling of ships on Government duty he was awarded the O.B.E.

On January 12th the death took place of Mr. GEORGE CROSLAND TAYLOR, a director of the British Insulated and Helsby Cables. He was 65 years of age. The eldest son of Mr. Tyson Taylor, a well-known Huddersfield woollen manufacturer, he was led to invent electric cables as the result of being taken into his father's business. He conceived the idea of knitting together strands of copper wire after the manner of the wool used in his father's factory. Electrical development being then in the air, Mr. Crosland Taylor persevered in his research and experiments with such success that in 1867, with his younger brother, Mr. James Taylor, he founded the Helsby Cable Works. Mr. Crosland Taylor was a Justice of the Peace, a member of the Royal Geographical Society, and was noted for research work in chemistry, being a member of the Chemical Society.

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Companies' Meetings, Reports, etc.

A second interim dividend of 6 per cent. has been declared by the SHANGHAI ELECTRIC CONSTRUCTION CO.

It is stated that the BRITISH BROADCASTING CO. will shortly make an issue of shares for public subscription.

The BRAZILIAN TRACTION, LIGHT AND POWER CO. has declared a dividend of 1 per cent. on the ordinary shares.

Shareholders in FERRANTI, LTD., on January 12th unanimously agreed to the capital reorganisation scheme put forward at the meeting on December 14th last.

The Provincial Underwriters Association is offering for subscription an issue of 35 755 6 per cent. cumulative preference shares of £1 each at par in the WESTERN ELECTRIC DISTRIBUTING CORPORATION.

The interest on the 4 per cent. mortgage debenture stock of the EASTERN EXTENSION AUSTRALASIA AND CHINA TELEGRAPH CO. for the half-year ending January 31st, will be paid by warrant on February 1st.

The accounts of GWYNNE'S ENGINEERING CO., for the thirteen months to September 30th last, after writing off £21 911 for depreciation of buildings, machinery, plant, etc., show a loss of £126 658, which increases debit balance to be carried forward to £478 545.

The following resolution was carried at an extraordinary general meeting of the UNITED RIVER PLATE TELEPHONE CO. on Tuesday: —" That the capital of the company be increased to £3 000 000 by the creation of 100 000 new shares of £5 each, to be issued on such terms and conditions, and at such times as the Board of Directors may determine."

The directors of the BRITISH COLUMBIA ELECTRIC RAILWAY CO. recommend a final dividend on the preferred ordinary stock at the rate of 18s. 8d. per cent. per annum, free of income-tax, making £4 13s. 8d. per cent. for the year, and a final dividend on the deferred ordinary stock at the rate of £2 9s. 8d. per cent. per annum, free of income tax, making £6 4s. 8d. per cent. for the year.

The report of the BRITISH MANNESMANN TUBE CO. for the year ended June 30th, 1922, shows a loss of £106 318, compared with a net profit for the previous year of £62 829. The directors state that the year has been marked with a continued depression in trade, and also with further depreciation in trading stocks. From the loss of £106 318 is deducted the balance brought forward, after paying a dividend of 4 per cent for the previous year of £55 913, leaving an adverse balance to be carried forward of £50 405.

The accounts of the CHATHAM AND DISTRICT LIGHT RAILWAYS CO. for 1922 show a net profit of £12 632 14s. 5d., to which is added £598 17s. 2d. brought forward. Interim dividends at the rate of 5 per cent. per annum on the preference and ordinary shares have already been paid for the first half of the year. It is proposed to pay a dividend at the rate of 5 per cent. on the preference and 6 per cent. on the ordinary shares (making 5½ per cent. for the year) for the last half of the year. £1 324 11s. 11d. is carried forward. There was a decrease of £1 148 in the revenue, and £6 113 in expenses, as compared with 1921.

For the year ended October 31st, 1922, ALLEN-LIVERSIDGE, LTD, made a net profit of £32 696 (against £30 468), to which are added transfer fees, £36, and £3 240 brought forward. After deducting interest on loans and debenture stock (£6 382), and fees, etc., there remains a balance of £27 074. The directors propose to write off debenture issue and amalgamation expenses, which stand at £923, and to write £3 500 off discount and commission on debenture issue. A final dividend is to be paid at the rate of 9 per cent. per annum, making 8 per cent. for the year (against 10 per cent.), leaving £4 721 to be carried forward.

New Companies.

FRED TOWNEND AND CO., LTD.—Private. Reg. Jan. 9th. Capital, £12 000 in £1 shares. To carry on the business of engineers, manufacturers of and dealers in electric engines, etc. Reg. office: Albion Works, Acton, London, W.

RADIO, PHONOPORE AND ELECTRICALS, LTD.—Private. Reg. Jan. 12th. Capital, £5 000 in £1 shares. Manufacturers of telegraphic, telephonic, phonoporic and wireless instruments, etc. Reg. office: 139, Cannon Street, London, E.C.4.

DICKSON AND GOW, LTD.—Private. Reg. in Edinburgh, Jan. 4th, Capital, £1 000 in £1 shares. Manufacturers of wireless telegraph, telephone and electrical instruments. J. H. Dickson, 14, Eton Place, Glasgow, electrical engineer, is a subscriber.

RESIDENTIAL WIRELESS, LTD.—Private. Reg. Jan. 12th. Capital, £1 000 in £1 shares. Manufacturers and importers of instruments, etc., used in connection with wireless telegraphy and telephony, etc. Secretary: G. F. Jones, 104, Gilda Brook Road, Eccles.

NORTH EAST COAST WIRELESS CO., LTD.—Private. Reg. Jan. 12th. Capital, £1 000 in £1 shares. To acquire the business carried on at Sunderland by H. St. J. Ward, C. F. Westerby and A. Davison as the " North East Coast Wireless Co." Reg. office: Blenheim Chambers, High Street, Sunderland.

RE-ECHO WIRELESS MANUFACTURING CO., LTD.—Private. Reg. Jan. 4th. Capital, £3 000 in £1 shares. To take over the business of manufacturers of wireless telephony apparatus carried on by S. F. O'Hara and J. B. Bignamy, at 10A, Hatton Wall, Hatton Garden, E.C. The first directors are S. F. O'Hara, J. B. Bignamy and W. R. Hargroves.

PETO SCOTT CO., LTD.—Private. Reg. Jan. 5th. Capital, £500 in £1 shares. To adopt an agreement with W. Scott Worthington, and to carry on the business of manufacturers of and dealers in wireless, telegraphic and telephonic apparatus and appliances, etc. W. Scott Worthington, 17, Frome Road, Wood Green, N.22; radio engineer, is a director.

In our issue of December 29th we stated that Mr. S. G. Wybrow was a provisional director of a new company styled INVENTIONS DEVELOPMENTS, LTD. Mr. Wybrow now informs us that at the meeting of the company, called to elect directors, his name was not put forward.

Tenders Invited and Accepted.

UNITED KINGDOM.

CO-OPERATIVE SOCIETY, MIDWAY, MELTHAM, January 22nd.—Electric light wiring and fitting.

LEWISHAM (LONDON) GUARDIANS, January 22nd.—Two electric lifts, with motors, for the hospital. Particulars from Mr. George W. Martin, consulting engineer.

NEWCASTLE-UNDER-LYME CORPORATION, January 23rd.—About 1 900 yards single, l.t., paper-lead covered, steel armoured distributor cable. Specification from the Borough Electrical Engineer.

MANCHESTER EDUCATION COMMITTEE, January 24th.—Electric light wiring and fitting of Oswald Road, Lily Lane, Lancasterian and Byrom Street municipal schools. Specifications from Education Offices, Deansgate, Manchester.

STOCKTON-ON-TEES CORPORATION, January 24th.—Four-core, paper insulated, lead covered, wire-armoured cable. Specification from the Electrical Engineer, Thompson Street, Stockton-on-Tees.

STALYBRIDGE AND DUKINFIELD JOINT SEWERAGE BOARD, January 27th.—Wiring for power and lighting at the sewage disposal works, Bradley Hurst, Dukinfield. Specification from Mr. R. Blackmore, Generating Station, Tame Valley, Stalybridge.

BELFAST CORPORATION, January 30th.—Electrically-driven centrifugal pump (18 000 gallons per minute). Specification from the City Electrical Engineer.

HAMMERSMITH (LONDON) BOROUGH COUNCIL, January 31st.—Three, six or twelve months' supply of stores for the Electricity Department, including insulated wire, joint boxes and connections, meters, insulating compound and electric light sundries. Specification from the Borough Electrical Engineer, 85, Fulham Palace Road, W.6.

SKIPTON URBAN DISTRICT COUNCIL, February 5th.—E.H.T. and l.t. switchgear (Section B) and transformers (Section C). Specification from Mr. Walter Emmott, 35, Commercial Street, Sheffield.

LAMBETH (LONDON) GUARDIANS, February 6th.—Electric light wiring and fitting of hospital, Brook Street, S.E. Specification from the Clerk, Brook Street, Kennington Road, S.E.11.

FARNHAM AND HARTLEY DISTRICT SCHOOL, Crandall, Hants, February 12th.—10½ B.H.P. Hornsby oil engine and dynamo, battery, switchboard and Stannos concentric wiring. Specifications from Handcock and Dykes, 11, Victoria Street, London, S.W.1.

LONDON COUNTY COUNCIL, February 12th.—About 3 300 tons (or alternatively 4 900 tons) standard steel girder tramway rails, lipless track rails and renewable guard rails, with fastenings. Specifications from the Chief Engineer, Old County Hall, Spring Gardens, S.W.1.

MANCHESTER CORPORATION, February 12th.—33 000 and 6 600 V switchgear and earthing resistances for Dickinson Street Station. Specifications from Mr. F. E. Hughes, Town Hall, Manchester.

METROPOLITAN WATER BOARD, February 14th.—Six or twelve months' supply of electric lamps. Forms of tender from the Chief Engineer, 173, Rosebery Avenue, E.C.1.

AUSTRALIA.

VICTORIAN RAILWAY COMMISSION, February 28th.*—Electric train lighting equipment (axle generator system).

VICTORIAN ELECTRICITY COMMISSION.—*Correction.*—April 28th.—Transformers and spares. We are asked to announce that the number of the specification for this contract is 23/9, and not 25/9 as stated in an advertisement in our last issue.

The tender of McHardy and Elliot for tramcar top covers, £14 260 has been accepted by EDINBURGH CORPORATION.

THE COMMONWEALTH EDISON COMPANY, of Chicago, have placed a contract with C. A. Parsons and Co. for a 40 000 kW turbo-alternator.

Callender's Cable and Construction Co. have secured a contract from BIRKENHEAD ELECTRICITY COMMITTEE, for six miles of single conductor service cable, £843 3s.

GLASGOW CORPORATION have accepted the following tenders; W. C. Martin and Co., cable for Knightswood Hospital, £131: Enfield-Ediswan Cable Works, tramway trolley wire; D. Henderson, wiring of Sandyhills houses, £1 170; R. J. McIntyre, further development of wiring in Mosspark houses, £2 290; Ferranti, Ltd., four 100 kVA transformers, £680 10s.; British Electric Transformer Co., two 200 kVA transformers, £530.

* Particulars from the Department of Overseas Trade.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

ARGENT ARCHER AND CO., 89, Abbey Road, St. John's Wood, electrical engineers. £14 2s. 10d. November 24th.

EDNEY, G. W., 13, King Square Avenue, Bristol, electrical engineer. £16 14s. 11d. November 17th.

MAYFAIR LIGHT AND POWER CO., LTD., 48, Upper Berkeley Street, W., electricians. £44 4s. 5d. December 4th.

STANDARD ELECTRIC SIGN CO., LTD., 62, Oxford Street, W., £11 18s. 4d. November 21st.

WALKER, Mr. F. (trading as SOWERBY AND ROGERS), 122, High Road, Kilburn, electrical engineer. £26 6s. 5d. November 23rd.

WALLIS, H., AND CO., 285, St. Phillips Road, Sheffield, electricians. £17 9s. 1d. November 27th.

Bill of Sale.

GEE, Thomas Harold, 17, Belmont Road, New Brighton, electrical contractor. January 15th. £55.

Receivership.

B. E. MANUFACTURING CO., LTD., manufacturers of electrical apparatus, etc., London.—J. E. Pritchard, of 115, Colmore Row, Birmingham, ceased to act as receiver or manager on January 3rd, 1923.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

LYTO, LTD. (late T. E. SLAUGHTER AND CO., LTD.), London, S.W., manufacturers of batteries.—Registered January 3rd, £200 debentures, balance of £1 500; general charge. *——. July 18th, 1922.

SLOUGH AND DATCHET ELECTRIC SUPPLY CO., LTD.—Registered January 6th, deed securing £35 000 and further advance up to £5 000, to Clerical Medical and General Life Assurance Society; charged on premises at Chalvey, also general charge. *£34 594 19s. 9d. April 19th, 1922.

Satisfaction.

SHEERNESS AND DISTRICT ELECTRIC POWER AND TRACTION CO., LTD. (late COUNTY OF KENT ELECTRICAL POWER DISTRIBUTION CO., LTD.).—Satisfaction registered January 6th, £28 280, balance of amount registered May 2nd, 1905, to January 27th, 1922.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Bankruptcy Information.

THOMAS, Frederick Harold, 19, Marlborough Road, in the county borough of Swansea, and EVANS, Walter Ernest, 4, Morriston Terrace, St. Thomas, Swansea aforesaid, and carrying on business in co-partnership at Salubrious Chambers, Salubrious Place, Swansea aforesaid, under the style of THOMAS AND EVANS, electrical engineers. First meeting, January 23rd, 11 a.m., Official Receiver's Offices, Government Buildings, St. Mary's Street, Swansea. Public examination, February 23rd, 11 a.m., Town Hall, Swansea.

Notices of Dividends.

DEPLEDGE, Robert Adrian (trading as the SCUNTHORPE ELECTRICAL ENGINEERING CO.), late 102, now 53, Frodingham Road, Scunthorpe, electrical engineer. Amount per £—2s. 11d. First and final. Payable, January 16th, 1, Town Hall Street, Grimsby.

HURWORTH, Walter, and WATMOUGH, Arthur Appleby, carrying on business in co-partnership under the style of HURWORTH, WATMOUGH AND CO., at 41, Town Street, Horsforth, and 1, Back James Street, Harrogate, electrical engineers. Amount per £—7d. First and final. Payable January 25th, Official Receiver's Office, 24, Bond Street, Leeds.

SHAW, Walter, the Younger, 26, Westcliffe Road, Shipley, Yorkshire, electrical engineer. Amount per £—2s. First and final. Payable, January 18th, Official Receiver's Office, 12, Duke Street, Bradford.

Edinburgh Gazette.

LIVINGSTON AND MALCOLM, electricians, 7, Canal Street, Coatbridge. First and final dividend of 1s. 8d. per £, payable at the office of John E. Watson and Macharg, 30, George Square, Glasgow, on February 27th. Wm. Gilchrist, trustee.

Bankruptcy Proceedings.

MODERN ELECTRICAL SUPPLY CO., LTD.—The petition of General Electric Co., Ltd., for the winding up of this company came before Mr. Justice Lawrence in the Compulsory Winding-up Court on January 16th. Mr. Lyndon, for petitioners, said it was a case of voluntary winding-up which would prejudice the creditors, a large proportion of whom were in favour of a compulsory order. The only opposition came from a gentleman whose conduct it was desired to investigate. Mr. Vaisey, for the gentleman in question, said he did not oppose the petition, but he protested strongly against certain statements made in the petition. His Lordship made the usual compulsory winding-up order.

Forty Years Ago.

"The Electrician," January 20th, 1883.

CONVERSAZIONE.—Last week the Birmingham and Midlands Institute gave their annual conversazione, in which electricity played an important part. Amongst other things, the operations of boiling and roasting by means of the current were shown to those present. A number of other familiar lecture experiments were also carried out. The current was supplied by Messrs. Winfield and Co.

The FERRANTI DYNAMO MACHINE.—We are informed that at Messrs. Copestakes, Hughes, and Crampton's works at Nottingham, where the first Ferranti installation has been made, it is found possible to turn out any number of lights without altering the speed of the dynamo machine. At the present time there are 100 C Swan lamps in use there, and recently, on the occasion of an inspection of the lights, one block after the other was turned out, until only one was left burning in the engine house. This installation has given so much satisfaction that it is, we understand, about to be increased to 500 lights. The work has been executed by the Hammond Electric Light and Power Supply Company.

TATE'S ENGINE STOPPER.—Some weeks since we illustrated and described Tate's electric apparatus for closing the valve of an engine and thereby stopping it. This apparatus is now at work in some of the large mills at Dundee, in Scotland. In describing the apparatus at work the "Dundee Advertiser" of Tuesday last says: "The huge engine in Manhattan Works (Colonel Sandeman's), working at from 600 to 700 horse-power, and driving a fly-wheel of about 35 tons weight, formerly took two minutes to come to rest after the steam had been taken off. This apparatus has been fitted to it, and the ponderous engine is now brought up in thirty seconds. To see this powerful, majestic piece of machinery, the developer of power for a large range of works, almost immediately brought to a standstill by the mere touching of a button at the far end of the building is an impressive illustration of the easy control of enormous force by wisely ordained arrangements." To mill-owners the utility of the apparatus will be evident.

Prices of Metals, Chemicals, etc.

TUESDAY, January 16.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£67 10 0	—	10s.
Electro Wirebars ..	,,	£70 15 0	—	£1 5 0
H.C. Wire, basis ..	per lb.	10 1/16d.	—	1/8d.
Sheet	,,	10 1/8d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2 1/16d.	—	1/8d.
Brass 60/40—				
Rod, basis	,,	7d.	—	
Sheet, basis	,,	9 1/2d.	—	—
Wire, basis	,,	10 1/2d.	1/8d.	—
Pig Iron—				
Cleveland Warrants	per ton	£4 16 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£18 0 0	—	—
Lead Pig—				
English	,,	£28 0 0	—	—
Foreign or Colonial	,,	£26 17 6	5s.	
Tin—				
Ingot	,,	£181 7 6	£2 0 0	—
Wire, basis	per lb.	2s. 5d.	1/4d.	—
Aluminium Ingots ..	per ton	£100 0 0	—	—
Spelter	,,	£35 0 0	—	12s. 6d.
Mercury	per bottle	£11 5 0	—	5s.

Sulphur (Flowers)—Ton £9 *Sodium Chlorate*—Per lb. 2 3/4d.
,, (Roll-Brimstone)—,, £8 10s. *Sulphuric Acid* (Pyrites, 168°) per ton, £7 10s.
Copper Sulphate.— ,, £26 *Sodium Bichromate*.—Per lb. 4 1/2d.
Boric Acid (Crystals). ,, £55
Rubber.—Para fine, 1s. 2 3/4d.; plantation 1st latex 1s. 4 1/2d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

188 355 TRENCH, S., and BROWNE, G. W. Shock-proof accumulator case. (5/7/21.)
188 370 VESME, E. Method of increasing the output of gas from electrolytic apparatus. (29/7/21.)
188 391 BRITISH THOMSON-HOUSTON CO., LTD. (GENERAL ELECTRIC CO.). Recording apparatus for electric current impulses. (8/8/21.) (Addition to 130 762.)
188 400 AGATE, C. S., and HILL, A. E. Means for regulating the strength of electric currents. (10/8/21.)
188 407 HALL, J. Electric-light fitting. (3/2/22.)
188 418 TOGAMI, N. Electric distributing systems. (23/8/21.)
168 597 AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. Telephone systems. (3/9/20.)
188 430 WACKER, G. W. Circuit-closers for electrically-operated alarm mechanisms of the thief or burglar type. (30/8/21.)
188 439 ORANGE, J. A., and METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Electric fires or radiators. (6/9/21.)
188 447 CAMERON, H. G., and METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Sealing of electrical conductors in glass or the like. (13/9/21.)
188 448 MARKS, E. C. R. (SIEMENS-SCHUCKERTWERKE GES.). Electrically-driven lifting gear. (13/9/21.)
188 465 GASCOYNE, B. B. Electrical resistance-board or panel for tandem lamp circuits. (21/9/21.)
175 239 KRUPP AKT.-GES., F. Mounting of electric conductors in casings. (10/2/21.)
188 466 CHEETHAM G. A., SMETHURST, W., and METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Electric relay devices. (21/9/21.)
183 104 SCHNEIDER, F. Receiving devices for electric waves. (13/7/21.)
188 471 BRITISH THOMSON-HOUSTON CO., LTD. (GENERAL ELECTRIC CO.). Systems of and apparatus for electric motor control. (24/9/21.)
188 476 BRITISH THOMSON-HOUSTON CO., LTD. (GENERAL ELECTRIC CO.). Electric switches. (29/9/21.)
188 477 SIEMENS BROS. AND CO., LTD., and WHITEHEAD, A. C. Filament lamps for vehicles. (29/9/21.)
188 483 WALKER, H. S. Radio-telephone transmitter. (4/10/21.)
170 286 WESTERN ELECTRIC CO., LTD. Electrical signalling systems employing high-frequency carrier waves. (11/10/20.)
188 495 FINIZIO, T. D. Electric irons. (14/10/21.)
188 505 BRITISH THOMSON-HOUSTON CO., LTD. (GENERAL ELECTRIC CO.). Radio-signalling systems. (20/10/21.)
188 513 BRITISH THOMSON-HOUSTON CO., LTD. (GENERAL ELECTRIC CO.). Electric switches or circuit-breakers. (26/10/21.)
188 518 BADEN, H. E. P., and ELECTRO-HEATER CO., INC. Electric water heaters. (31/10/21.)
188 532 NALDER BROS. AND THOMPSON, LTD., and LIPMAN, C. L. Alternating-current electric instruments for indicating synchronism, power factor, phase difference or the like. (11/11/21.) (Addition to 162 471.)
188 533 STIGANT, S. A., SCASE, O. E., and JOHNSON AND PHILLIPS, LTD. Tapping switches for changing voltage ratios of transformers or the like. (11/11/21.)
172 619 WESTERN ELECTRIC CO., LTD. Method of applying magnetic material to electrical conductors. (8/12/20.)
188 551 DORNIG, W. Systems for transforming the frequency of electric currents. (30/11/21.)
173 529 QUARZLAMPEN-GES. Mercury vapour apparatus and more especially quartz lamps. (31/12/20.)

APPLICATIONS FOR PATENTS.

January 1, 1923.

4 R. W. BILL and H. HEATH. Electrical cases.
12 H. MCCLELLAND. Resistances.
26 S. M. ROWLANDS. Loud-speaking devices for telephones.
40 W. LANGDON-DAVIES and A. SOAMES. Electric arc welding.
46 T. H. GILL and H. COX-WALKER. Wireless navigational apparatus.
47 T. H. GILL and H. COX-WALKER. Devices for indicating magnetic directions.
89 AKERBUND. Shield for radiography, etc. (20/12/21, Sweden.)
92 S. O. COWPER COLES. Coating iron and steel wire with zinc.
94 BRITISH THOMSON-HOUSTON CO. Centrifugal mechanism for electric switches, etc. (8/6/22, U.S.)
97 J. B. PARKER. Electric vehicles.
103 C. W. SAUNDERS and S. D. WHITE. Locking device for securing electric lamps to holders.
112 J. H. COOK. Aerial for wireless apparatus.

January 2, 1923.

116 P. GATES. Electrical or mechanical advertising devices.
129 A. G. ADAMS and M. B. BRAILSFORD. Telephone recorder.
133 T. RONDELLI. Electric cigar lighters.
134 RADIO COMMUNICATION CO. and J. SCOTT TAGGART. Amplifying systems for wireless telegraphy.
135 RADIO COMMUNICATION CO. and J. SCOTT TAGGART. Coupling circuits for wireless telegraphy.
136 RADIO COMMUNICATION CO. and J. SCOTT TAGGART. Insulators.
143 F. H. PAGE. Separate recording of local and trunk telephone calls.
148 J. B. ENTZ. Electric power transmission system for vehicles.
150 S. M. FRANSES. Loud-speaking telephones. (21/11/22, France.)
152 S. HYDE, J. R. BINDIN and T. E. BROOKS. Grid leaks for thermionic valves.
154 H. B. CLAPP. Resistances.
159 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Power-generating plants.
160 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Control of electric furnaces.
161 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Circuit-breaker systems.
162 WESTERN ELECTRIC CO. (DEAKIN). Private branch exchanges.
173 L. A. FRIEDMAN. Dry-battery machines.
184 W. T. HENLEY'S TELEGRAPH WORKS CO. and P. DUNSHEATH. Jointing metal-sheathed cables.

January 3, 1923.

188 G. E. MOORE. Means for testing electric meters, etc.
195 F. W. BAKER. Commutators or contact-breakers for electric ignition systems.
221 C. H. WHITE. Rectifiers for electric circuits.
230 G. BUHLER. Electric striking apparatus for clocks. (20/5/22, Germany.)
233 FAVARGER ET CIE, SOC. ANON. Electric installation for remote control of indicating instruments. (19/1/22, Switzerland.)
241 BRUSH ELECTRICAL ENGINEERING CO. and W. E. HALL. Underframes for tramcars.
250 BRITISH THOMSON-HOUSTON CO. Electro-magnets.

January 4, 1923.

274 RADIO COMMUNICATION CO., J. SCOTT TAGGART and E. H. ROBINSON. High-frequency electric signalling systems.
281 F. MORTON AND CO., J. CUBBIN and J. HALLIDAY. Telegraph poles, etc.
304 RADIO COMMUNICATION CO. and N. LEE and J. REE. Electric circuits for electric discharge devices.
313 C. E. NIGHTINGALE. Charging and discharging storage batteries.
341 AUTOMATIC TELEPHONE MANUFACTURING CO. Telephone systems.
342 H. M. GRISS. Wireless receiving apparatus.
353 METROPOLITAN-VICKERS ELECTRICAL CO. Steam turbine installations.
354 METROPOLITAN-VICKERS ELECTRICAL CO. and A. E. L. SCANES. Electrical amplifying apparatus.
370 BRITISH THOMSON-HOUSTON CO. and J. GRAY Thermionic devices.
371 SOC. INDUSTRIELLE DES PROCEDES W. A. LOTH. Electro-magnetic underground prospecting. (4/1/22, France.)
372 BRITISH THOMSON-HOUSTON CO. High-frequency signalling systems.

January 5, 1923.

376 W. A. JOHNSTON. Pressure-controlled regulator for electric motors.
396 H. BOHLE. Electric cooking apparatus.
401 M. A. CODD. Induction coils.
407 L. D. WILLIAMS. Anti-spilling device for batteries.
410 J. E. S. TRELAWNY. Flexible electric leads.
414 HUMBER, LTD. and J. A. COLE. Circuit-breakers.
418 J. E. SAVIDGE and E. L. TERREY. Electric lighting systems.
424 WESTERN ELECTRIC CO. Telephone systems. (5/1/22, U.S.)
440 R. H. WINTER. Variable resistances.
455 BRITISH THOMSON-HOUSTON CO. Incandescent lamps.
459 N. ASHBRIDGE. Resistance coils.
460 RELAY AUTOMATIC TELEPHONE CO. and R. MORDIN. Automatic telephone systems, etc.
461 and 462 RELAY AUTOMATIC TELEPHONE CO. and B. B. JOHNSON. Telephone systems.
463 B. B. JOHNSON. Automatic telephone systems, etc.
474 F. PERI. Vacuum tubes. (7/10/22, France.)
475 F. PERI. Vacuum tubes. (12/10/22, France.)
480 J. W. HALL, G. DERHAM and G. TIPPING. Thermionic valve arrangements.
481 P. RIGBY. Arc lamps.
486 J. GRAY. Thermionic devices.

January 6, 1923.

491 H. BOHLE. Heating element for cooking utensils, etc.
501 G. A. MARSHALL and D. MILLAR. Rectifiers for battery-charging from motor-car magneto.
515 C. W. COOK. Safety switchgear.
517 W. DIGGLE. Wireless receiving circuits.
521 RADIO COMMUNICATION CO. and J. SCOTT TAGGART. Electric signalling systems.
523 DOCKER BROS. and W. H. PETERS. Insulating paints and varnishes.
533 F. FERNIE. Electric cables.
548 J. Y. BROWN. Insulating cap or hood for wireless aerial circuits.
551 FERRANTI, LTD., and A. W. G. TUCKER. Switches.
558 A. LINARD. Electric switch.
562 J. VIGNEAULT. Electric heaters.

Arrangements for the Week.

FRIDAY, JANUARY 19th (To-day).

INSTITUTION OF MECHANICAL ENGINEERS.

6 *p.m.* At the Institution, Storey's Gate, London, S.W.1. Symposium of short Papers on "Indicators."

JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette entitled "Paraffin as Fuel for Marine Motors."

BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION.

7.30 *p.m.* At Caxton Hall, Caxton Street, London, S.W.1. Salesmanship Conferences. Lecture on "Wiring Salesmanship in Relation to Spring Cleaning, Decoration, etc.," by Mr. H. T. Young.

SATURDAY, JANUARY 20th.

PAISLEY ASSOCIATION OF ELECTRICAL ENGINEERS.

3 *p.m.* Visit to the Glasgow Corporation Tramways Repairs Department, Coplawhill Car Works, Glasgow.

JUNIOR INSTITUTION OF ENGINEERS (NORTH EASTERN SECTION).

Visit to Messrs. Dexford's Pallion Engine and Shipbuilding Works, Sunderland.

MONDAY, JANUARY 22nd.

INSTITUTION OF ELECTRICAL ENGINEERS (WESTERN CENTRE).

5.30 *p.m.* At the Grand Hotel, Broad Street, Bristol. Address by the President, Mr. Frank Gill.

INSTITUTION OF ELECTRICAL ENGINEERS.

7 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London. Informal Meeting. Discussion on "Insulators and Insulating Materials." Opened by Mr. A. G. Warren.

INSTITUTION OF MECHANICAL ENGINEERS (GRADUATES' SECTION).

7 *p.m.* At the Institution, Storey's Gate, London, S.W.1. Informal Discussion on "The Value of College Training to Engineers."

INSTITUTION OF ELECTRICAL ENGINEERS (NORTH-EASTERN CENTRE).

7.15 p.m. At Armstrong College, Newcastle-on-Tyne. Lecture on "Multispeed and Cascade Induction Motors," by Mr. F. Creedy.

BRADFORD ENGINEERING SOCIETY.

7.30 *p.m.* At the Technical College, Bradford. Lecture on "Coal Economy in Connection with Steam Raising," by Mr. D. Wilson.

TUESDAY, JANUARY 23rd.

INSTITUTION OF ELECTRICAL ENGINEERS (NORTH-WESTERN CENTRE).

7 *p.m.* At the Engineers' Club, Albert Square, Manchester. Lecture on "Works Production," by Mr. G. H. Nelson.

WEDNESDAY, JANUARY 24th.

LIVERPOOL ENGINEERING SOCIETY.

At the Royal Institution, Colquitt Street, Liverpool. Lecture on "Wave Transmission of Power," by Mr. W. Dinwoodie.

THE WOMEN'S ENGINEERING SOCIETY.

6.15 *p.m.* At 26, George Street, Hanover Square, London. Lecture on "Mechanical Injection of Fuel as Applied to Diesel Engines," by Miss V. Holmes.

INDUSTRIAL LEAGUE AND COUNCIL.

7.30 *p.m.* At Caxton Hall, Caxton Street, London, S.W.1. Lecture on "Education as a Function of Management," by Mr. H. H. Elvin.

THURSDAY, JANUARY 25th.

INSTITUTION OF ELECTRICAL ENGINEERS (SOUTH MIDLAND CENTRE).

7 *p.m.* At the City Council Chamber, Birmingham. Joint Meeting with Local Branches of the Institution of Mechanical Engineers and Institution of Civil Engineers.

CHELMSFORD ENGINEERING SOCIETY.

7 *p.m.* At the East Anglian Institute of Agriculture, Chelmsford. Lecture on "The Development of Large Power Stations," by Mr. W. H. Patchell.

FRIDAY, JANUARY 26th.

JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette entitled "K.V.A. and Its Measurement" (Demonstrations) by Mr. G. F. Shotter.

EDINBURGH ELECTRICAL SOCIETY.

8 *p.m.* At Philosophical Institute, 4, Queen Street, Edinburgh. Lecture on "Internal Combustion Engines," by Mr. J. Hastie.

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THE ELECTRICIAN

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CONTENTS.

Notes of the Week	81	East Midlands Electricity District	100
Production and Unemployment	83	Improvements at Lots Road	100
Works Production. By G. H. Nelson. Illustrated	84	Registration of Electrical Contractors	100
Industrial Research	86	Imperial Notes	100
Some Recent Physical Apparatus. Illustrated	87	Foreign Notes	100
The Design of Radio Towers and Masts: Wind Pressure Assumptions. By C. F. Elwell. Illustrated	88	Electricity Supply	101
		Hydro-Electric Supply for Dublin	101
Institution of Electrical Engineers	90	Stainless Steel	101
Salesmanship and Spring Cleaning	91	Wireless News	102
Manufacturer—Factor—Retailer. By "A Spectator"	92	Books Received	102
Electrically-Heated High Pressure Boilers. Illustrated	93	Electric Traction	103
Correspondence	93	Municipal Electricity Accounts	103
Reviews	93	Duke of York Visits Electric Wire Works	103
The Automatic Control of Motors. Illustrated	94	Tenders Invited and Accepted	104
An Up-to-Date Lighting Scheme. Illustrated	95	Shop Window Lighting	105
Merchandise to Sell and Profit By. Illustrated	96	The Future of British Trade	105
Catalogues, Price Lists, etc.	97	Municipal Contracts Going Abroad	105
Electrically Operated Railways	98	Dumfries and an Electrical Engineer	105
Earthing in Coal Mines	98	The Fire at Liberty's	105
The British Association	98	Companies, Meetings, Reports, etc.	106
Electric Truck Cranes	98	New Companies	106
Electric Furnaces for Brass Melting	98	Business Items	106
Electricity in the Aluminium Foundry	98	Commercial Intelligence	107
Legal Intelligence	99	Forty Years Ago	107
Institution Notes	99	Prices of Metals, Chemicals, etc.	107
Personal Items	99	Patent Record	108
		Arrangements for the Week	108

Notes of the Week.

The Standardisation of Wall-Plugs.

"Standardisation" has become such an everyday word in the electrical industry that we are tending to forget its real significance, and often the possibilties of greater developments arising out of standardisation are neglected. Particularly is this so when the device is of relatively minor importance, and a special case in point is that of wall plugs and sockets. For many years all concerned have suffered from the confusion of the gauges of plugs for a given capacity, and there seemed no way out of the difficulty until in December, 1915, the British Engineering Standards Association published their specification on the subject. Unfortunately the war and the consequent economic conditions made it impossible to do anything tangible in the way of commercial production, but during the last few months the largest suppliers of this device have announced that they now have a range of wall plugs ready, designed in every detail to comply with the B.E.S.A. specification.

Standardisation a Chimera.

It is to be hoped—in fact, the industry must demand—that the trade will give the makers of these standard plugs every support. Already the cry has gone up that the new designs are more expensive—Mr. Marryat mentioned this at the Salesmanship Conference last week—and that for this reason what may be called the old design, must continue to be used. If this attitude is persisted in then "standardisation" is a chimera. We consider this price question must be treated broadly by the trade. It is obvious that a device made to specification must for the present be more expensive than that of the average non-standard wall plug which it is desired to supersede. Further, the development charges for each manufacturer are heavy, but as the sales of the present design increase so these charges can be written off, and costs can be brought down Competition, too, will solve the question of price, and soon there will be a number of keenly competitive manufacturers turning out a range of wall plugs to the specification, and more will follow.

The Duty of the Trade.

Considered therefore in the light of the larger development of the "electrical idea," and of the benefit of the industry as a whole, it is the duty of the trade to use the standard plug on every occasion. The course to be followed is simple—lay down a definite rule that non-B.E.S.A. wall plugs are not to be employed on any installation work. Of course, in the case of factories where the installation must comply with the Home Office regulations, wall plugs to the B.E.S.A. specification must be used. Outside this field, however, the situation is uncontrollable by "laws and regulations," but supply companies can help the good work of raising the standard of electrical practice by refusing to pass any new installation where B.E.S.A. plugs are not installed.

A Hydro-Electric Supply for Dublin.

While we are often told of the latent power that lies awaiting development in the Highlands of Scotland, it is forgotten that Ireland, too, has waterfalls which might be put to satisfactory industrial uses. We are reminded of this fact by a report which has recently been made by Mr. Buchi, a Swiss engineer, to the Dublin Corporation. In this document, extracts from which are given elsewhere in this issue, it is suggested that a storage reservoir should be built at Poulaphouca, some miles from Dublin. This would supply a 12 000 kW hydro-electric station at Ballymore-Eustace, while a second reservoir at Leixlip would supply a 7 200 kW station. Transmission would be at 50 000 V, and the existing steam stations would be used for peak or emergency loads. The total

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cost of the scheme is put at £1 130 000, and the cost per unit delivered at the sub-station is estimated at 0·57d. for water power alone and at 0·74d. for water power plus steam. It will be noticed that the capital charges for the generating plant in the larger station amount to just over £60 per kW and in the smaller station to about £40 per kW, doubtless owing to the less extensive nature of the works. Including the transmission lines, the total cost would be about £56 per kW, which hardly compares favourably with similar costs for a modern steam scheme. On the other hand, the working costs are low (though it is not stated exactly what is included), and do compare favourably with the present working cost of 3·17d. in Dublin and with those of many other places. Unfortunately the political situation will prevent much progress being made with the scheme at present, and in the interval that must elapse it is to be hoped that costs will fall.

Training in Illuminating Engineering.

A DISCUSSION on the need of training in illuminating engineering was opened by Mr. C. E. GREENSLADE and Mr. J. E. S. WHITE at the last meeting of the Illuminating Engineering Society. The authors took a wide view of the problem, and the paper led to an interesting discussion, in which a number of representatives of technical colleges took part. A specially serviceable contribution was that of Dr. F. T. CHAPMAN, who is associated with the Board of Education. There is little doubt that even to this day education in lighting matters is inadequately dealt with. A certain amount of information is included in the curriculum at the various engineering colleges, but in many cases the treatment is hardly up-to-date. Photometry is apt to be relegated to the physics laboratory and there dealt with in too academic a manner. We hope that the Illuminating Engineering Society will be successful in inducing professors and educationists to review existing courses and to devote more attention to practical lighting problems and less to the manufacture of lamps—a matter that is hardly suitable for any but casual reference in lectures. We gather that an inquiry which the Society is making on this subject has received an encouraging response, and this was confirmed by the general tenor of contributions to the discussion. It was agreed that the most hopeful plan is to use existing courses as a basis for improvement. It will be admitted that at present the time is scarcely ripe for a full day course on illuminating engineering, though this is a matter which may be kept in mind for future adoption.

Popular Lectures on Illumination.

WE were, however, glad to see that the Society is not confining its attention to courses for students. The need for a better general knowledge of lighting amongst the non-technical public is great. It would, for instance, greatly simplify the problems of the expert if such bodies as street lighting committees were more conversant with the facts of illumination, and if managers of factories understood better the important part that good illumination plays in aiding safety and assisting efficient production. Some comments on this aspect of the subject by Miss E. SQUIRE, one of the Home Office Inspectors of Factories, were entirely to the point. Apart, therefore, from the regular instruction of students, there should be occasional lectures on illumination, open to the public, at educational institutions. Needless to say, in such addresses no attempt would be made to present detailed engineering data, but a sense of the romance of lighting and of the wide field for useful effort in the application of light in the service of mankind might be awakened. Illumination essentially involves an appeal to the eye and lends itself particularly well to demonstration and experiment. At such gatherings as the recent Scientific Novelties Exhibition at King's College a few lectures on this subject would have been appropriate.

L.C.C. Does E.D.A.'s Job.

On Tuesday the London County Council instructed its General Purposes Committee to report whether steps should be taken to secure that "gas companies should not spread illness or death by poisonous fumes" and whether "recent enterprises on the part of the electricity undertakings of the Borough Councils of Hackney, Poplar, St. Marylebone, Stepney and Woolwich," do not "tend to show that gas is no longer necessary to the running of a house, either in respect of lighting, heating or cooking." We think it right to place on record our belief that the gas companies do not primarily exist to spread illness or death, though an examination of their balance sheets shows that if that is their sole object there is evidently money in it. We welcome the enquiry, however, for if it does nothing else it will show that the gas companies have neglected precautionary measures of repair and maintenance, measures which, if undertaken when they should have been, would have prevented the extraordinary succession of accidents that have culminated in this enquiry. From the electrical point of view we also welcome the enquiry. It will bring out that "gas is no longer necessary" in the home because electricity can do all gas can do and do it much better. If Mr. L. L. ROBINSON is allowed to give evidence he will leave the Committee in no doubt on that score and should even convince those of our contemporaries who, much as they dislike gas, are still afraid of electricity "because it is so expensive." On the whole, we are not sure whether members of the L.C.C. should not be made honorary members of E.D.A. But perhaps that would be a little precipitate.

Confusion at Southend.

THE air of Southend-on-Sea, whatever may be its tonic qualities, does not seem to lead to clear thinking on such subjects as electricity supply. For reasons which to them seemed good, but to us do not, the Electricity Committee decided to purchase some Diesel engines. From this simple beginning a condition of affairs has arisen, which, to quote a lady member of the Council, is "confusion worse confounded." A tender amounting to £16 500 for three 900 kW sets was accepted, but these were afterwards found to have only a capacity of 750 kW and Mr. BIRKETT disclaimed any responsibility for them. It also appeared dimly through the fog that the whole scheme would cost some £42 000, and that another scheme would provide plant of 2 260 kW capacity for £29 000. The MAYOR stated that the engines in the second scheme were smaller than those in the first and not of the right type, but as four are to be used instead of three, the aggregate capacity would be as we have stated. There were other little matters, such as ease of renewals, which affected the situation.

Who Forgot the Dynamos?

BUT this is not the end of the story. At the last meeting of the Council the Electricity Committee recommended that £3 700 should be spend in reconditioning each engine and £5 094 on purchasing dynamos for them. It was pointed out that some £5 700 more would thus be spent. But the cream of the proceedings was the stupefaction of some of the members that the original price of the engines did not include the dynamos. "The Council," said one gentleman, "should have been told exactly what their commitments were." To this the plea of misunderstanding was entered, while another councillor was not surprised that members were confused, and neither are we. It is not a very creditable example of local Government, though perhaps it is unkind to say that it would never have occurred had Southend adopted a proper scheme of electricity supply instead of these patchwork quilt arrangements. It is now stated that the Commissioners are to hold an enquiry into the whole matter. We shall be interested to hear the outcome.

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Are Lamp Resistances Lighting?

Two ingenious gentlemen, described as well-known local electrical engineers, have been fined at Bath for using current for lighting which was supplied at the power rate. "Surplus energy" from a battery-charging circuit was employed for lighting the premises and a small plug circuit from the power mains was used to illuminate the shop windows. Neither seems a very heinous offence, but we suppose that discipline must be preserved. The first case, however, raises an interesting point. The lamps were apparently used as a resistance in the charging circuit in order that the battery might be supplied at the proper voltage, and Mr. FRANCIS TEAGUE admitted that there was nothing to force the defendants to keep the lamps on the charging board or to cover them up. One of the defendants said that the "surplus lighting" was no good for lighting. Altogether a very pretty problem, which would be overcome by having a two-rate tariff and a little imagination!

Solving the Outlet Problem.

WE were glad to hear at the Salesmanship Conference last Friday the constant reiteration of the fact that the use of electricity in the home will be badly handicapped unless an adequate number of "outlets" are provided. To illustrate the importance of that problem and to assist in its solution is, we need hardly say, the object of our "All-Electric" House Competition. Outlets in any quantity can, it is true, be provided once the house is built, but at what expense and inconvenience! Far better is it to plan the installation on broad lines before the foundations are dug, and in this way to obtain an installation that is an installation and not a make-shift. Another important point is that two-rate tariffs should be available, as these are essential to the proper solution of the problem. Architects, builders and electrical engineers, too, have got to recognise and to be taught that the wiring is as essential to house design as the drains. The result of our competition will enable them to make this very necessary educational advance.

Production and Unemployment.

The proceedings at the meeting of the Institution of Electrical Engineers last week are worth recording for two reasons. It was the second occasion this session on which a non-technical Paper has been discussed, and the speakers' remarks were contributed with a fire and point which makes us wonder whether there is something in pure science and technology that causes the tongue to be tied and the brain to function ambiguously. To be just, Mr. NELSON'S exposition of his Paper was neither clear nor free from ambiguity. This was partly due to an heroic attempt to deal with a great deal in a short time and partly to a bad cold. We wish that at the meetings authors would discard their Papers altogether and deliver or read a summary dealing only with the main points in a controversial manner. It would be more interesting for the audience and less of a speed test for them.

The Main Thesis.

Such a summary of Mr. NELSON'S Paper would have been particularly valuable. The subject of works production is intricate and complicated, and the result is that the main thesis of the Paper may easily be missed. This main thesis we take to be: The need for careful finance, increased production and co-operation between all those concerned; a thesis, in fact, which is so well worn as to have become quite threadbare, but a thesis which Mr. NELSON was able to discuss from more than one fresh point of view.

A Successful Practical System.

Mr. NELSON has one great advantage over the theorists. The system he supports has been in practical use for some months, and the results prove the soundness of his ideas. The relation between the total value of the work in progress and the value of the monthly output of completed machines was reduced from 7 months to 4½ months, the average time of manufacture was reduced from 22 weeks to 18 weeks, the number of machines overdue was reduced by two-thirds, the number of defects arising during manufacture was reduced by two-thirds, and the accumulative effect of all these reductions was, as might be expected, favourably reflected in the total cost of manufacture.

How the Results are Obtained.

To some extent these results have been obtained by methods that are well known in modern factories, without supernatural aid, without, we are glad to note, a superabundance of forms, by a careful attention to detail, but by a realisation that a broad outlook is more important than details. On the one hand re-designing a bracket allowed a two-part instead of a four-part pattern to be used and a consequent saving of 17·5 per cent. of the total factory cost to be realised; while on the other production generally has been cheapened and profit increased far out of proportion to the increase in that modern bogey, the overhead charges. Criticism there may be on matters of detail; criticism there certainly was at the meeting; but without even summarising the various points that were made or expressing our agreement or disagreement with them, we reiterate that the system must be judged by the results and that the figures we have given, which are but examples of many that are to be found in the Paper, show that something has been achieved and that whatever the system is it is not wholly bad.

Planning Ahead.

Interesting as all this is, the most suggestive part of the Paper is that which deals with the human element. That subject also is not new, but Mr. NELSON has succeeded in dealing with it from a more human point of view than some of his predecessors. He realises that ca'canny and other problems are due not only to false economic teaching but to fear of sudden unemployment. For the natural consequences of this fear the employer is as responsible as the trade union agitator. The workman only sees the job upon which he is at work and is ignorant whether or not there is more work ahead. There is often not more work ahead because the employer has not planned for the future. And, as more than one speaker in the discussion pointed out, the success of Mr. FORD and his methods is less due to courageous and spectacular mass production than to the fact that he is able to get a maximum of work out of his employees by showing them that however much they do there will be still more to do.

Unemployment Insurance.

This, of course, is not the whole story. But even those who do not agree with Mr. FORD and his ideas will be interested in Mr. NELSON'S scheme of "bonus-insurance." Briefly, he proposes to start an unemployment sinking fund to which every employee would contribute from his "extra-effort" pay and to which the employer also would contribute *pro rata*. The difficulty about this system which immediately arises is that the man who works best is least likely to be discharged, and that therefore those who make the most effort are contributing to help those who make the least, and will contribute the more the harder they work. The scheme, though interesting, therefore has its weak points, and we are sorry that more attention was not called to it in the discussion. We feel that the problem would better be tackled by some scheme of unemployment by industries and by the education of the workman in personal economics, so that slumps and booms in production may be levelled out.

Taken as a whole, the Paper calls attention to the need for the consideration of many complicated subjects, and records what has been done in improving our industrial methods. From that point of view it is a valuable contribution.

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Works Production.*

By G. H. NELSON.

Among the causes of the present depression are taxes, the consequent higher prices for commodities and their effect in forcing up wages, which in turn increases prices still more; also, the rash speculation which is the accumulative effect of these factors. The application of remedies, such as the limitation of credit, the cessation of purely speculative orders, and the necessary fall in wages are causing general suffering. Economy is now essential. The particular problem the author deals with is the basis of production of the best article in the shortest time at the lowest price. Lower cost does not necessarily mean lower wages but involves economical effort by both employer and employee. "Ca-canny" methods can be eliminated by a management that looks for and removes the causes. The fundamental element is co-operation.

A Complex Process.

The manufacture of electrical articles is a complex process. To illustrate this the author gives a list of 4582 distinct parts, involving the use of 55 different materials, needed in the construction of a rotary converter. If the manufacture of such machinery is carried out on a fairly large scale the works organisation should be sectionalised. Fig. 1 shows the relation between the various sections. In these days it is impossible for one man to attend to buying, works managing, costing, etc. The advantage of a proper system, as described by the author, is illustrated by the following results:—

(1) The relation between the total value of the work in progress and the value of the monthly output of completed machines was reduced from 7 months to 4½.

(2) The average time of manufacture of a certain size of machine was reduced from 22 weeks to 18 weeks, and that of other sizes relatively. This has since been still further reduced.

(3) The number of machines overdue was reduced two-thirds.

(4) The number of defects arising during manufacture on various operations has been reduced two-thirds.

(5) The accumulative effect has reduced the cost of manufacture by a considerable percentage.

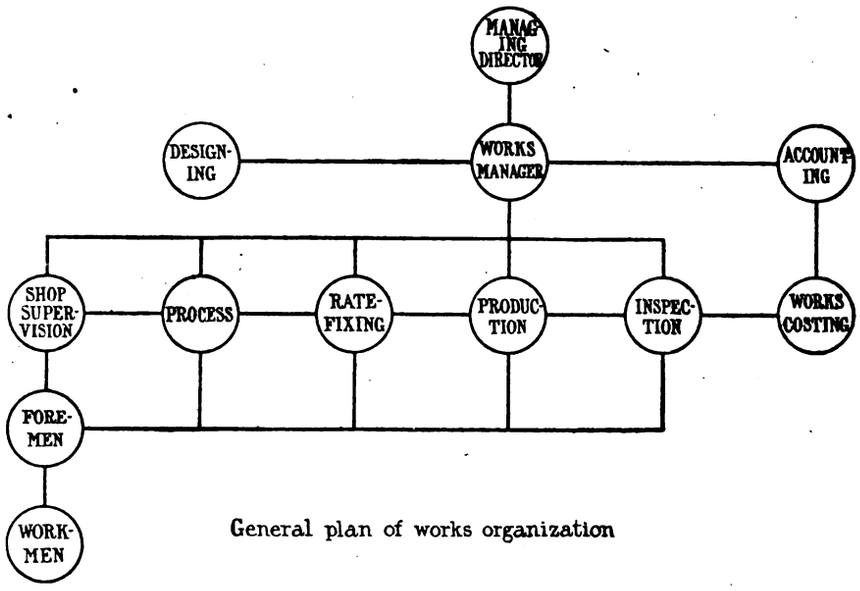
While men in the works cannot be expected to know the technical details in the designer's mind, it is advisable to give the men doing the work as much information as possible. In working out designs it is desirable to consult any men in the works with specialised knowledge that would be helpful. Thus a case of a bracket, where the co-operation of the foundry expert and machine expert led to a saving of 17½ per cent. of the total factory cost, is mentioned. The design of each part should be discussed by designer, manufacturer and (if necessary) the salesman before it is finally put into manufacture.

The Handling of Labour.

The most important element in works superintendence is the handling of labour. Most workmen are reasonable men, and an effort should be made to alter distorted views. The proper training of apprentices is of great importance for the future. In Sheffield apprentices are given, in the employers' time, instruction by skilled men in fitting, turning, winding, etc., and also details of rate-fixing and costing. In this training lectures on economics should be included. Some of the lectures, particularly those on economics, should be extended to the fully paid workmen. A course on economics should also be included in the curriculum of universities and technical colleges. The works committee has proved a useful channel for bringing the views of the management on all sorts of questions before the workers. Monthly foremen's meetings, where problems of general interest met with during the previous month can be discussed, are also very useful.

Fear of Unemployment.

Conversation with good workers suggests that the greatest brake on productive effort is the fear of unemployment, leading to the mistaken practice of spinning out the work. The author proposes a method of dealing with this problem, based on the creation of a sinking fund in a "payment by results" works, and therefore dependent on the workers' efforts, though both the employer and employee would contribute. In the engineering industry agreements already exist by which a pieceworker of average ability must be able to earn 33⅓ per cent. bonus; most workers by extra effort could earn considerably more. The unemployment sinking fund might therefore be based on a contribution of a fixed sum, say 1s. for every 1 per cent. earned over 33⅓ per cent., the employer contributing a like amount. In order to overcome the possible objection that employers would know how much money workers had saved in this way, the fund might be administered by the various works committees or district committees.



General plan of works organization

FIG. 1.

The technical process department is necessary because many problems involved in the manufacture of electrical machinery cannot be left to the shops to solve. The department must study such problems and issue instructions. Records should be kept of all process specifications so that these can be looked up by new men afterwards. The department also issues the necessary specification for buying material. In an appendix to the original paper an example of a manufacturing process and a purchasing specification for asbestos millboard are given.

Rate-Fixing Questions.

The author next proceeds to the consideration of rate-fixing and the mechanical process department. Piecework

* Abstract of a Paper read before the Institution of Electrical Engineers.

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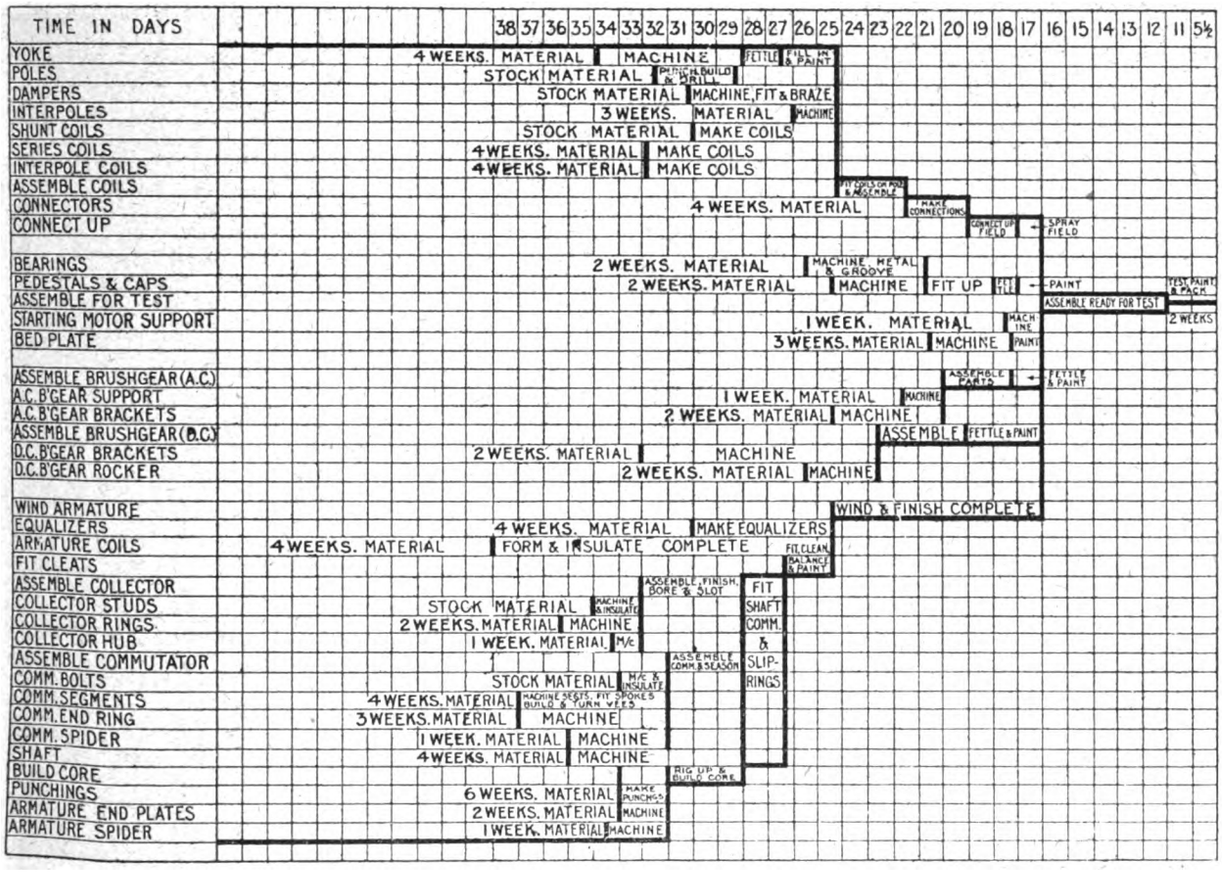
times are often fixed by foremen or those who have graduated from the class of workmen. For very simple products this arrangement may be adequate, but for the complex electrical products not only piecework time but the machine, type of tool used, and class of finish for every operation must be decided by engineers. Hence the process must consist of two branches, one of which deals almost entirely with time-studies of feeds and speeds. The process sheet is of a very detailed character with tools, hourly rate of tool, class and rate of labour, war allowances, factory expenses, total cost of labour and factory expense, sequence of operations and shops in which operations are performed, all set out. The author, in the original paper, gives a typical table for the yoke of a rotary converter. In fixing piecework time the process engineer assumes average quality of material, normal machining allowances, average skill of worker, etc. If the time allotted is disputed by the operator, the foreman is consulted; and if he also disagrees, the time-study man for that department is called in. The operator may also examine the detailed figures of the process engineer. In the case of faulty material the matter is taken up with the suppliers. In other cases the matter is dealt with perfectly frankly, corrections being made if justified, and the operators given the benefit of any doubt. Besides establishing piecework times the process department performs other useful functions. Thus it can keep the purchasing department posted as to the values of material from different sources, can supply the estimating department with accurate data for estimates. Disputes regarding piecework times have often led to interesting discoveries and shown how improvements in existing methods could be made.

Table I.

Machine Production Chart—Summary for Type X Machine.



The Production Department.

In the production department the works manager must be a man of wide education and practical experience, and should make sure that work is not systematised beyond practical and commercial limits. He fixes the shop-capacity in conjunction with the requirements of the sales organisation and the views of the rate-fixing department. Every month is laid out, and the commercial department is advised of forward requirements. If monthly orders exceed capacity the fact is revealed in good time to enable extensions to be made or outside help enlisted. When an order is received it is placed in its proper position in the main programme, as illustrated in Table I. Detail requirements are so recorded that they are automatically urged, the urging being divided into three sections, namely manufacturing information, material, and work in various departments of the shop. This is done on a weekly basis. The production department comprises two sections, one handling specification sheets, the main production programme, materials from outside suppliers, and all work within the office; the other dealing with materials after receipt in the shops. An example of a foreman's weekly production list is given; in practice he receives instructions for four weeks. Production meetings are held weekly at which the shop superintendent, buyer, production chief and foreman are present. A diagram is presented in the original paper showing the actual tonnage output in successive months. A return is made to the works manager each week from each department of items not completed to schedule, so that reasons for the non-completion may be obtained. For certain works of 700 hands the production staff consisted of 1 chief, 2 assistants, 3 clerks and 1 typist, exclusive of 4 foremen's clerks.

Great importance is attached to the work of the inspection department, which should take entire responsibility for the testing and inspection of raw materials. In the shops the representatives of this department should act as a safeguard to management and foremen, but the latter should have the real responsibility for quality of product. Foremen should feel that the department aids them in avoiding mistakes; on no account should the impression be gained that they are spies on the manufacturing section. Criticism should be avoided except where gross negligence or wilful opposition occurs. In various sections the number of hands per inspector varies from 35 to 70. The cost of such inspection is only 0·7 per cent. of factory cost of output. A diagram shows how, in successive inspections, the number of defects is reduced to negligible proportions in the finished article.

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Costing Department.

The work of the costing department may be divided into two sections relating to (1) direct labour and materials, (2) factory overhead expenses. Elasticity in the costing system is an important feature. In many works the "Hollerith" card index system is used. This is sound in principle, but flexibility requires care. In estimating overhead charges the author considers that a machine rate basis is the only sound method A percentage on labour may be quite wrong, as is emphasised by considering the case of a man and boy working on the same machine. In the case of most machine tools the machine rate basis is taken as 40 hours per week. A portion of the fixed charges (rates, rents, taxes, depreciation, etc.) is allotted to the floor space occupied by machine and the adjacent space for storing the raw and finished product. Power charges are obtained by taking actual measurements at the machine. Tool charges are arrived at by estimating the value of tools used in a definite period and using this as the basis for an hourly cost of tools. Hourly charges for machines are arrived at for depreciation, general shop labour and materials, operation of cranes, etc. At one works employing 1 000 hands this system was instituted and was running well in three months. Factory expenses are dealt with in three groups: (*a*) items controlled by foreman; (*b*) items controlled by superintendent of works; and (*c*) expenditure controlled by board and general management. A diagram is given in the original paper illustrating the variation in factory and labour expenses. The author considers that such information should be given to foremen.

In order to illustrate the relation between output and costs of production, the author presents the following table showing conditions when 500 and 2 000 machines respectively are turned out :—

Output per Year.

	Under bad management. 500 machines	Under excellent management. 2 000 machines, working day and night
	£	£
Cost of material	10 000	40 000
Cost of labour	3 000	12 000
Extra for night work	—	3 000
Factory expenses	6 000	6 000
Extra for night work	—	1 500
Selling expenses	8 000	9 000
Total cost of machines	27 000	71 500
Total selling price (including 10 per cent. profit)	29 700	78 650
Selling price per machine (including 10 per cent. profit)	£59·4	£39·325

Another table shows how a loss of £5 000 with an output of only 500 machines may be turned into £4 000 profit with 1 000 and £16 500 profit with 2 000 machines output.

During a tour of inspection of American works the author did not meet with any organisation which could improve that outlined in the paper. The average manual output of employees was, however, higher than in this country, and this was ascribed to the greater confidence between employer and employee. In conclusion he acknowledges the courtesy of the Metropolitan-Vickers Electrical Co. in permitting publication of much information obtaining in the running of their works at Sheffield.

Station Employees under 18.

Factory Act Restrictions and Regulations.

The question sometimes arises as to what regulations apply to boys working in electricity supply stations. Eighteen is the age at which a boy becomes an adult under the Factory Act, but while he is under age he is "a young person," and his employment in a generating station is subject to the provisions of the Factory Act of 1901 as amended by the Act of 1920 relating to the employment of young persons. This latter Act precludes the employment of young persons at night. "Night" is defined as a period of eleven consecutive hours, which must include the hours between 10 p.m. and 5 a.m. Boys, however, of 16 and upwards may be employed in generating stations in two day shifts not exceeding eight hours each between the hours of six and ten, but this exception is made only in favour of boys who are employed as assistants to adults who are actually present during the whole time of their employment. Further, the employer in such case must send notice to the District Inspector of Factories. Overtime and Sunday employment of young persons are prohibited.

Industrial Research.

Records of Great Importance Obtained.

As we have often pointed out, the BRITISH ELECTRICAL AND ALLIED INDUSTRIES RESEARCH ASSOCIATION is obtaining records of high importance to the electrical industry, and the latest half-yearly report shows that this work is being satisfactorily continued. Among its recent work a classification of fibrous insulating materials, their use and requirements, has been completed, and a series of suitable test methods has also been developed. These will form the basis of the purchasing specifications which the Association is drafting for materials of this group. Experiments upon the heat-resisting properties of composite insulating materials have been completed, and sufficient data have been obtained to draft a specification dealing with these properties. A provisional classification has been drawn up of the moulding properties of composite insulators, and attention has been given to the effects of oils upon these materials.

Properties of Porcelain Investigated.

A full report upon the whole of the investigations of porcelain may shortly be expected. These investigations include tests of electric strength up to 300° C. and resistivity tests to 1 200° C. Progress has been made upon the study of porosity by electrical methods, and upon the uniformity of vitrification. For certain researches upon porcelain, the Association is co-operating with Government departments, notably with the General Post Office in the study of surface deposits.

Work upon Micanite Nearly Complete.

Work upon micanite, embracing a wide range of physical, mechanical and electrical tests, is almost complete, and a report will shortly be issued upon this material. The study of mica has proceeded as far as the mechanical properties. Researches upon insulating oils are directed towards the improvement of the electrical characteristics, to the determination of physical constants, and to the phenomena of heat transference. Sludging tests are under discussion with foreign experts, and it is believed that these may be simplified. Oil purification by the use of centrifugal separators has been most promising, and the merits and limitations of available machines for this purpose are being studied.

The electric strength of insulating oils is the subject of a detailed investigation, in which the superiority of the horizontal position for spherical test electrodes has been definitely established.

Researches on Electric Control Apparatus.

Amongst the most important of the Association's activities are the researches upon electric control apparatus; it is disturbing to learn that certain of these are held-up pending the provision of the necessary facilities and funds. The value of these researches, especially to large users and suppliers of electricity, is such that a special appeal is made for support. For instance, the unique installation of test apparatus erected at the Carville Power Station for the investigation of switching and arcing has already given some most valuable results. The opportunity presents itself for the execution of additiona work whilst this equipment is yet available.

The corrosion researches upon steam condensers, carried out in co-operation with the Institute of Metals, are proceeding actively. Research upon turbines and upon the behaviour of steam in turbines, forms another co-operative feature of the Association's activities; reports are expected upon blading and nozzles research.

Varnish Paper and Synthetic Resin.

Varnish-paper boards and tubes of synthetic resin from a variety of sources have been tested, and have shown wide divergencies in quality; the more promising of these have been selected for further tests. It has been demonstrated to manufacturers that these products are capable of marked improvement, and they are giving the matter close attention. Researches concerning the thermal resistivity of dielectrics in general are unfortunately to be deferred through exhaustion of funds. The study of dielectric losses, however, has been extended to cover radio frequencies and good progress has been made in the application of cathode ray tubes to this investigation. Various interested technical bodies have received recommendations covering the heat-resisting properties of dielectrics, and methods of test are being developed to deal with every branch of insulating materials. A report just received shows that some quite unexpectedly important features are apparent in the relative accuracy of laboratory and workshop tests for electric strength.

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Some Recent Physical Apparatus.

An Interesting Exhibition at South Kensington.

(*Concluded from page* 65.)

NALDER BROTHERS AND THOMPSON.

NALDER BROTHERS AND THOMPSON showed a large variety of their well known switchboard instruments, including power factor meters, frequency meters, synchroscopes, three-phase volt meters, power relays, etc. We also noticed a flame-proof ammeter with deep flanges, for use in fiery mines. The deflectional frequency meter and the synchroscope exhibited have already been described in our columns.

The Lipman Power Factor Meter.

The Lipman power factor meter is, we believe, a new departure in the design of instruments of this kind. It works on the principle of the "component fields," according to which the electro-magnetic forces acting upon the moving iron systems are produced by field coils having their axes parallel to each other and in separate parallel planes. The moving element comprises a spindle (made up of one or more co-axial magnetic systems, which are magnetised by individual pressure coils) and an appropriate number of thin iron vanes mounted thereon in these parallel planes. The vanes are specially shaped and their axes of symmetry are set so as to correspond to the time-electrical displacement (expressed in degrees of phase angle) of the currents in the various phases in the system on which the instruments is to be used (i.e., 90° and 120° for two and three-phase circuits respectively).

Rotational Drag Torque Eliminated.

The distinguishing feature of these phasemeters is that owing to their special construction no resultant rotating field is set up, and consequently no "rotational drag torque" upon the moving iron system is produced, and the disadvantages arising from that torque are eliminated. The combined electro-magnetic effect of the current and pressure windings is such that for any given power factor the moving system is in neutral equilibrium, and it is therefore independent of the magnitude of the load. If the phase angle between the current and potential difference of the mains alters by a given amount, the moving system will shift by an equal amount and will again take up a definite and stable position corresponding to the new conditions. The position of the pointer therefore indicates the phase angle. For convenience, however, the scale is graduated in values of the power factor. It is claimed that with this improved construction correct indications are obtained at all currents between 1/10th and full load. Other advantages are an extremely light movement, a small volt-ampere consumption, efficient air damping, high torque and perfect freedom of rotation of pointer, giving 360° scale of theoretical shape as illustrated in Fig. 8.

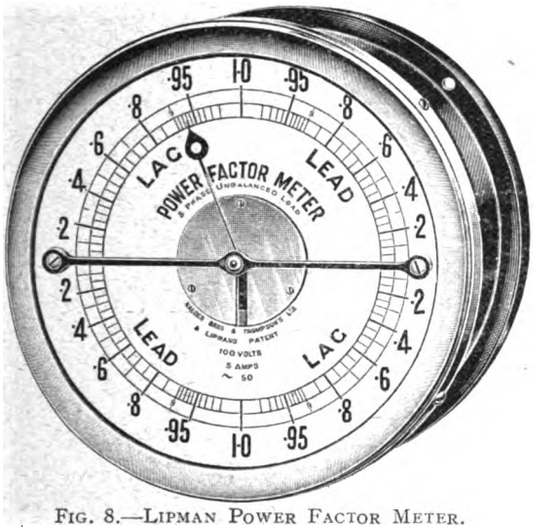

FIG. 8.—LIPMAN POWER FACTOR METER.

H. TINSLEY & CO.

A comprehensive exhibit of measuring instruments was shown by TINSLEY AND CO. Attention may be called to the Anson relay for recording high speed radio signals. The apparatus consists of a valve circuit which in combination with a neon lamp gives large fluctuations in current in a relay or recording circuit for small received e.m.f.'s.

Two sources of current are needed to work this instrument, one of low voltage, to heat the filament of the valve, and another of 240 V, to light the neon lamp. The steadiness of this last source of supply need not be of a very high order, but it is better that it should be as nearly so as possible. The output required in this circuit is a continuous discharge of about 5 mA. Both these should be direct current, but alternating current can be used under some conditions. The great features of this relay are stated to be its simplicity, the constancy with which it works, and the absence of adjustment necessary while operating. There is no practical limit to the speed at which it can receive signals, if these are amplified to a magnitude of a few volts. At the input terminals 1 V. will produce a change of about 1 mA. in the relay circuit. The relay can be used for recording weak signals in the presence of strong interference from atmospherics, and the record will show both the signal and the interference in their relative proportions.

Phonic Motors.

The phonic motors, which were also shown, are due to Dr. Wood, and should prove useful to physicists requiring a constant speed device. These motors run off an electrically controlled tuning fork, in synchronism with it. They are wound for any voltage, and are made in two sizes, the larger of which is sufficiently powerful to drive a commercial type of cinematograph camera at a constant speed.

A New A. C. Potentiometer.

Perhaps the most interesting exhibit shown by this firm was a new form of a.c. potentiometer. This instrument has been specially designed for the measurement of small phase angles. The readings obtained on the potentiometer are two e.m.f. components at 90°, so that the absolute magnitude of the e.m.f. under measurement is not given directly but must be determined by the square root of the sum of the two squares of the components.

The instrument consists of two potentiometers fed with alternating current, in quadrature with each other. In the circuit of the first potentiometer a reflecting dynamometer of a special design is connected in series. This allows of comparison between the effective values of the alternating current and direct current in the following way:—An e.m.f. balance is obtained against a standard cell when direct current is fed to this potentiometer circuit, and the reflecting dynamometer is balanced for these conditions, that is, when this potentiometer is reading correct values of voltage. The direct current is now replaced by alternating current, which is adjusted until the dynamometer reads the same value, thus giving correct voltage values in this potentiometer with alternating current, since all coils are non-inductive.

Special arrangements are provided to procure perfect quadrature between this potentiometer, which may be called the "in-phase" potentiometer, and the second, which may be termed the "quadrature" potentiometer.

THE EDISON SWAN ELECTRIC CO.

The EDISON SWAN ELECTRIC CO. exhibited a large selection of valves for wireless telegraphy, Neon lamps ignition testers and Pointolite lamps, the largest of the last named being 10 000 c.p. A defect of the Pointolite lamp hitherto has been that it was only suitable for direct current circuits. The lamps could in fact be used with alternating currents, but used in this way caused the rapid destruction of the heating electrode. The lamp has now been further developed in such a way that two tungsten balls are provided as electrodes; both act as sources of light and the heating electrode is cut out of circuit as soon as the arc is established.

A. GALLENKAMP & CO.

GALLENKAMP AND CO. exhibited a large number of electrically heated laboratory furnaces which are now fairly well known. In addition to these and apparatus for physical chemistry, an electric thermostate, as suggested by Mr. S. C. Bradford, was shown. This is in the form of a bath, which was heated electrically, the current being cut off by means of a mercury thermostate when necessary, and the water was stirred by means of a novel type of stirrer actuated by an electro-magnetic plunger. Each time the plunger rose it broke the electric energising circuit, and consequently fell, this cycle being repeated.

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The Design of Radio Towers and Masts: Wind-Pressure Assumptions.*

By C. F. ELWELL.

The general theoretical treatment of the subject of this Paper extends from the time of Galileo (1590). It was put into practical form by Newton in his "Principia" about 1687, and his formula, modified to apply particularly to air, can be expressed as:

$$p = \frac{0{\cdot}0027}{1+0{\cdot}003665\,t} \cdot \frac{P}{P_1} v^2$$

where p = pressure in lb. per sq. ft. of exposed area;
t = temperature in degrees C.;
P = barometric pressure at place of observation;
P_1 = barometric pressure at sea level at the 45th parallel of latitude and at 0° C.; and
v = velocity of fluid in miles per hour.

At zero temperature and sea level barometric pressure at the 45th parallel this formula reduces to:

$$p = K \times 0{\cdot}0027\, v^2$$
$$= K \times \frac{1}{370} \times v^2$$

K varies between 1·3 and 1·8, the gain being ascribed particularly to the partial vacuum in the rear of the plates. In these investigations some have added constants to allow for

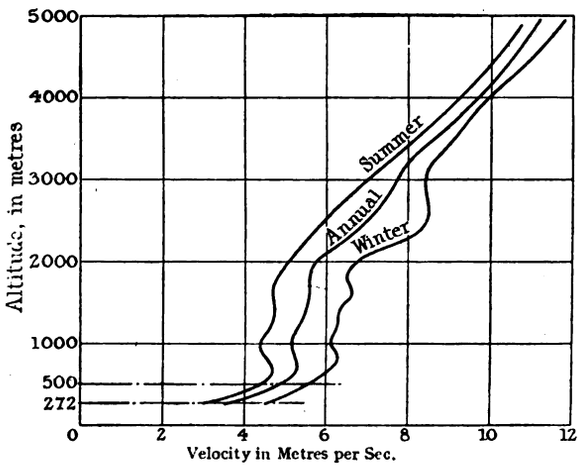

FIG. 1.—INCREASE OF WIND VELOCITY WITH ELEVATION (FABRIS).

this, while others have added terms to express variations in the higher powers of v, producing formulæ of the general form

$$p = A + Bv + Cv^2 + Dv^3.$$

Stevenson,† E. Douglas Archibald,‡ and Sir Napier Shaw§ have proposed formulæ of this kind.

In general it has been found that near the earth the actual velocity is exceedingly irregular, but that the average velocity increases with height. The rate of increase increases with the average velocity and decreases with the elevation.

Among the most interesting observations on the relation of wind velocity to altitude are those of Dr. Cesare Fabris based on some 200 pilot-balloon flights made at nearly equal intervals during the period June, 1910 to May, 1911 at Vigga di Valle, Italy, the principal ærological station of the Royal Italian Oceanographic Committee. This station is about 25 miles north-west of Rome and its co-ordinates are as follows: Lat. 42° 04′ 41″ N., long. 12° 12′ 43″ E., altitude 272·4 m. Fig. 1 gives an indication of the relative velocity at various heights above ground level—i.e., 272 m. Although the curves are for elevations greatly in excess of those of any interest to the designer of radio masts, it is interesting to note that each shows a distinct and regular increase of wind velocity with height, for the range of 272 m. to 600 m.—i.e., a range of about 1 000 ft.

J. S. Dines also carried out balloon observations at Farnborough in 1912.

Reference is made to some assumptions and experiments which have been made in the past, including those of the Tay Bridge Commission, the American Society of Civil Engineers, 1880, the tests made on the Forth Bridge by Sir Benjamin Baker (1884–1890),* at Bidston Observatory, near Liverpool, the Eiffel Tower observations (1889),† and the S. P. Wing experiments at Ballybunion‡; to assumptions in connection with radio towers and chimney in the United States.

Radio Central Station of the Radio Corporation.

In the recently constructed station at Port Jefferson, Long Island, U.S.A., the towers, of which there will ultimately be 72, are 400 ft. in height. The wind load assumed in the design was 30 lb. per sq. ft. on twice the projected area of one face for the top 300 ft., and a similar figure on 1·5 times the face for the lower 100 ft.

Radio Station at Croix D'Hins, Bordeaux, France.

The eight towers at the Bordeaux station§ are each 820 ft. in height, and were designed by the Bureau of Yards and Docks, U.S. Navy, and constructed by the Pittsburgh Des

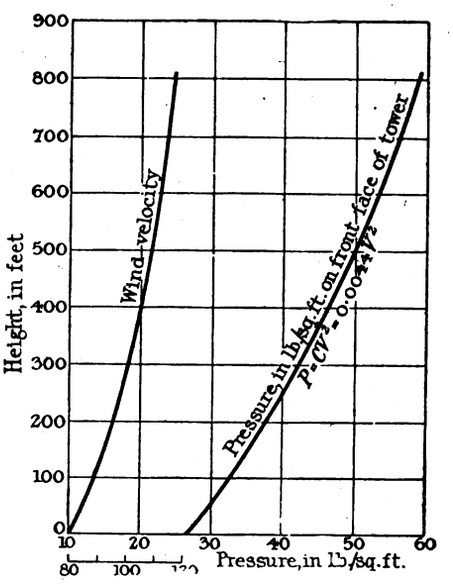

FIG. 2.—INCREASE OF VELOCITY AND PRESSURE WITH ELEVATION (WING).

Moines Steel Co. The wind pressure assumed was 30 lb. per sq. ft. on 1·5 times the area of one face.

Marconi Company 820 ft. Tower Specification.

In a specification issued in 1919 by the Marconi Company for 820 ft. steel towers, the wind pressure specified was 30 lb. per sq. ft. on the whole of one face in the direction of the wind, and a similar pressure on the back.

Imperial Wireless Commission Specification.

In a specification recently issued by the General Post Office, covering 820 ft. masts for the Imperial wireless chain, a wind pressure of 60 lb. per sq. ft. over the entire height of the mast is specified on 1·6 times the front face area for triangular masts, and 1·8 times the front face area for square section masts.

Head Frames.

M. S. Ketchum in his "Structural Engineer's Handbook" specifies for wind loads on head frames a pressure of 50 lb. per sq. ft. acting on the projection of the members of the head frame. R. Fleming says "the load of 50 lb. seems excessive even for head frames in locations subject to high winds."

Conclusion.

Many more examples of the variety of specifications employed in the past for the pressures due to wind could be quoted, but sufficient have been given to prove considerable difference of

* Abstract of a paper read before the Wireless Section of the Institution of Electrical Engineers.

† "Journal of the Scottish Meteorological Society," 1880, vol. v, p. 384.

‡ "Nature," 1886, vol. xxxiii, p. 593.

§ Advisory Committee for Aeronautics, Report No. 9, 1909, p. 8.

* "Engineering," 1890, vol. xlix, p. 219.

† "Scientific American Supplement," 1890, vol. xxx, p. 12121.

‡ "Electrician," 1921, vol. lxxxvii, p. 6.

§ "Engineering News Record," 1922, vol. lxxxviii, p. 438.

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opinion. By tabulating the data and reducing to a common form of expression—e.g., the total pressure on the structure in lb. per sq. ft. of the front face, the divergence of opinion can readily be seen to be from 15 to 112 lb. per sq. ft.

Special Factors in Mast Design.

In building design, the assumption that the wind pressure at the top is the same as at ground level may not be productive of any harmful results. In radio mast and tower design the load due to the wind is, however, the chief load. Masts when unloaded are held vertical and designed to lie in a straight line, or as an arc of a circle when fully loaded. A wrongful assumption as to wind-pressure distribution from the top of the structure to the bottom can readily upset the designer's calculations as to the position which the masts will take up in a gale.

In order to appreciate the economic waste which is present in employing 60 lb. per sq. ft. for example, over the entire height of an 830 ft. mast, as opposed to a graded wind pressure of from 27 to 59 lb. per sq. ft., the comparative quantities of structural steel, stay wire and concrete have been calculated. If, as is very possible, the assumption of 27 to 59 lb. per sq. ft. should be excessive and one-half of these values be sufficient, then the further possible saving is also shown.

	60 lb.	27–59 lb.	13·5–29·5 lb.
Structural steel ..	128	100	75
Stay wire	140	100	50
Concrete	155	100	50

We have no definite knowledge as to how wind pressures, especially high wind pressures, vary with elevation, but it seems clear that they are not the same at the ground as at, say, an elevation of 1 000 ft., and the evidence points to the top pressure being more than double the pressure at the ground, so that it is not a negligible factor. The designer then seems to be more nearly approximating to actual condition if he adopts such a curve as Fig. 2 than if he assumes the same pressure both at the top and at the bottom of the structure. In the author's design work this curve is used for lack of knowledge of one which more nearly approximates to actual conditions.

More Knowledge Necessary.

If no more data exist on this important subject than has been brought out in this paper, it seems to indicate that we should attempt to gain this knowledge without delay. With the large number of high radio masts and towers which have been built in recent years, there are many opportunities for fixing recording anemometers or pressure indicators at ground level, at the top and in as many intermediate positions as funds will permit. If this paper should serve to inspire any of the owners of high radio masts or towers to equip them with the necessary recording instruments with a view to filling a void in our knlowledge it will not have been in vain. The Imperial Wireless Commission, the Radio Research Board, the National Physical Laboratory and the British Metereological Office acting in collaboration with the owners of high masts could soon produce a much more accurate solution of this important problem. If the Wireless Section of this Institution would take an active interest in the solution of this problem, more satisfactory data would soon become available.

DISCUSSION.

The reading of the paper occupied only about half an hour, and left ample time for discussion without extending the meeting into the late hours, which are becoming so common when authors take up most of the time themselves. The discussion did not produce very much more additional information and the arguments put forward were chiefly to the effect that the author's plea for a more rational basis was not justified on account of ignorance of the actual conditions of pressure during the rare and short intervals in which the masts were subjected to excessive wind pressures.

Peace Time or Crisis ?

Dr. W. H. ECCLES considered that the paper brought forward two main points. First, the desirability of grading the wind pressure and next that constructions tended to be too costly. With ordinary winds, the grading pressure was right, but in time of crisis the air motion was quite different. In England the atmosphere would probably be set in whirling motion and the velocity at the bottom would be greater than that at the top, and probably accompanied by rain or hail or snow. In Hong Kong, as an example, a typhoon was to be expected every few years. The dynamics had also to be considered since the tower might move 10 ft. at the top. Pivoted masts would have a considerable side thrust at base which would be considerably reduced by keeping the centre of gravity of the structure nearer to the ground by adopting an assumption of uniform wind loading. When considering the cost, the importance of absolute reliability must be considered and a little extra cost would provide a justifiable margin of insurance.

Some More Forth Bridge Figures.

MAJOR A. S. ANGWIN gave figures of further records taken on the Forth Bridge from 1901 to 1906. At an elevation of 378 ft. there was a pressure of 65 lb. per sq. ft. in a gale. Using Wing's formula this would indicate a pressure of 85 lb. per sq. ft. at the top of an 800 ft. tower, which seemed to indicate something wrong in Wing's formula. Up to 100 ft. it might apply. It was necessary to consider more particularly the effects of gales or gusts, and a good basis would be to assume a suggested load of 30 lb., and on this superimpose a pressure of 25 lb. per sq. ft. on lengths up to 100 ft. Information was needed on a form factor for the allowance to be made for the back of the mast to which wind tunnel tests seemed to be applicable.

MR. C. C. J. TROST pointed out that the results of Fig. 2 varied with the locality and considered that in France towers were built lighter on account of low wind pressures recorded at the Eiffel Tower. Was there any relation between ordinary and ultimate pressures ? The Marconi specification was now 30 lb. to 59 lb. per sq. ft. of exposed area.

The Importance of Eddies.

MR. A. GRAY considered the importance of eddies in testing masts. Sometimes they added to and sometimes subtracted from the actual load on the mast by their varying direction. In the West Indies in 1898 every house was unroofed and the tops were blown off palm trees, but the stumps remained. Wireless masts also stood up. The effect of an eddy was to deliver a local blow and due allowance must be made for this.

PROF. C. L. FORTESCUE inquired what was the effect of the wind pressure upon the aerial. Was not this a large proportion of the total load on the mast ?

PROF. G. W. O. HOWE approached the subject as a layman. Were the figures those at which the tower was expected to fail, or was there a further margin of safety ?

MR. A. C. BROWN queried the effect of snow in increasing the wind area of the aerial wires.

The Author's Reply.

The AUTHOR in reply acknowledged Dr. Eccles' instructive remarks, but considered experience had now been gained over a sufficient number of years to enable it to be applied safely to the problem. At Honolulu there was a destructive wind called the Cona, which had an uprooting or whirling effect, and it was prophesied that masts which he built there in 1911 would not survive. They were, however, still in perfect condition. The dynamics of mast movement was a separate subject and was by no means overlooked in the complete design of a tower. When considering a margin of insurance one should remember the ample factors of safety allowed in the structure after the wind assumptions had been made, and in many cases the premium being paid for an additional margin of safety was very much too high. Major Angwin's figures also were covered by the factor of safety which was allowed. As regards form factor, usual figures were $1\frac{1}{2}$, $1\frac{3}{4}$, and 1·8 and these had been fairly well justified by experiment. The latest Marconi figures agreed closely with Wing's recommendations. He remembered a hurricane at Mauritius which blew boats ashore, but after all it was only 60 miles an hour. The question of aerial pull was a subject concerning rather the bending of the top portion of the tower. Factors of safety were allowed, as a rule, of 3 on the steel wire stays and 4 on the steel lattice work. Snow and ice certainly would add additional loading, and at Fort Jefferson, where such deposits were common a special installation had been put in to melt the snow from the wires.

Wireless Reception Underground.

The NEW YORK correspondent of "The Times" reports that on Friday night engineers of the Interborough Rapid Transit Co., with a receiving set only 18 in. long and 7 in. wide and a loop aerial 4 ft. high, captured part of a concert being given in New York while their train was travelling at forty miles an hour under the bottom of the East River. A few minutes later they caught part of the programme of the Kansas City broadcasting station, 1 300 miles away. During most of the time the engineers heard with perfect clearness, though there was considerable interference by induction from passing trains and the motors in the train on which they were travelling.

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Institution of Electrical Engineers.

At the meeting of the Institution of Electrical Engineers on Thursday, January 18th, the PRESIDENT opened the proceedings by introducing Dr. H. W. Nicholls. Dr. Nicholls, as we announced last week, is in charge of the radio research department of the American Telegraph and Telephone Co., and is in this country in connection with the arrangements for radio-telephonic communication with America. Dr. NICHOLLS, in the course of a short speech, explained the object of his visit and said he looked forward to radio-telephonic communication still further binding together the two peoples of the same race and of the same language, " or somewhat the same language," he jokingly added. The position now was that it would be possible to inaugurate regular radio-telephonic communication between England and New York as soon as the demand called for it. He was sure that the Institution of Electrical Engineers and the American Institute of Electrical Engineers would co-operate to this end. Speaking of the assistance he had received at the hands of British engineers since he had been over here, he said that if those engineers whom he had met were a fair sample of the engineering efficiency of this country, then there ought to be a general migration of American and other engineers to this country " to learn how it is done."

The PRESIDENT also read two short messages which had passed between himself and the other side during the two hours' radio conversation.

Mr. G. H. NELSON then read his Paper on " Works Production," which will be found in abstract on p. 84 of this issue.

Economics as an Anæsthetic.

Mr. H. W. MENSFORTH, in opening the discussion, said the author had assumed too patronising an attitude towards the workpeople. Judging by the number of times he had mentioned the teaching of economics, it almost seemed as if he regarded that subject as an anæsthetic and expected the workman would always accept the employer's views on it. His experience was that the average workman had ideas of his own on economics, and we should not get far if we tried to teach the workman employers' economics. The first question the workman would ask, when the question of production was discussed, was " What do you sell the article for ? " For the factory cost might be only half what the customer paid, and the workman would want to know how the difference was made up. The author had said that the agreements now existing provided that the man " must " be able to earn 33⅓ per cent. bonus. This should be " shall " and not " must "—an important difference. The table showing the effect of selling more or less machines than the estimated number made matters simpler than they were. There were few factories which had such a relation between the labour and factory costs, and it would be impossible to increase the output by 100 per cent. without a material increase in the overhead charges. Works Committees had failed too often because employers did not give them full freedom to function properly. Every grievance, real or imaginary, should be allowed to be brought up, for imaginary grievances were just as dangerous as real ones. One of the reasons of the better output of workmen in the States was that they were better supplied with work. There should be a separate organisation for this purpose.

Mr. J. HURFORD thought it important that the foreman, who came into contact with all the men's grievances and troubles, should have ample opportunity to explain them to the management. He also disagreed as to the table of figures for selling 500, 1 000 and 2 000 motors, especially in regard to the item of selling cost. This must be more the larger the number of motors.

Specialisation not Sufficiently General.

Mr. W. F. HIGGS said many of the difficulties in electrical manufacturing were due to the fact that there was not sufficient specialisation. He had had the experience of being engaged with two firms both manufacturing the same article in the same district. The two firms were about the same size, and yet one firm turned the articles out at 50 per cent. less cost than the other. Insufficient attention was paid to design and costing. He would like to know whether the author was really a believer in piecework. One of the largest switchgear manufacturers in this country worked on day work and made just as good profits as factories on piecework. Sufficient attention was not paid to clear drawings in many electrical factories.

Workers' Slight Knowledge of Economics.

Lieut.-Col. K. EDGCUMBE spoke of the author's modesty in not having too many forms, which was a disease in many cases, and on the subject of economics disagreed with Mr. Mensforth. His experience was that the average workman did not have any knowledge of what might be termed the fundamental common sense of economics. That was due to our system of education. He was going to ask the author to tell him privately how he managed to sell four times the output with only a small increase in the selling costs.

Mr. J. R. COWIE called attention to the absence of any reference to a stores department in the Paper. If this were not efficient it could hang up the whole factory. Further, according to the chart, there seemed to be no connection between the design department and the process or progress department.

Students' Training Criticised.

Mr. F. TREMAIN, as an old inspector for buyers in factories, spoke of the need for a change in the method of training students in technical colleges. Extraordinary stories could be told of the horrible messes which these students made when they got into the works. Technical college training was much too academic.

The Place of the Purchasing Department.

Mr. R. S. ALLEN pointed out that no reference was made to the purchasing department, which he considered a very important section. The cost of material per machine for 500 motors was given as the same as for 2 000 motors, but an efficient purchasing department would make a saving on the larger number. The planning department should fix the rates at an early stage. The sinking fund for unemployment was admirable, but there would be difficulties in applying it.

Mr. H. B. BROWN deplored the fact that the Board of Education in 1918 decided to abandon its examinations in science, and the City and Guilds of London College had followed suit, with the exception of the examinations in telephony and telegraphy. Thus the workman had not the opportunities he ought to have of proving that he had any education beyond a board school education.

Mr. H. N. RICHARDSON said, as regards the workman's knowledge of economics, the trade union leaders prepared ten or a dozen stock questions and the men did not go far beyond them. As regards the cost of production being 50 per cent. and the remaining 50 per cent. being seemingly profit, it was very easy to show the men that there were such things as distribution costs and so on, and he himself took the opportunity—visiting many works at various times—to have little chats with the men and explain some of these points to them. More good would be done that way than by giving lectures. If more of this missionary work was done it would be extremely valuable. Designing ought to be linked up directly with production and it ought also to be linked up with the process department. A great deal could be done in the works by the use of electric trucks to keep the men continuously at work.

Keeping Proper Records.

Mr. W. BURNAND referred to the suggestion in the Paper detrimental to one-man businesses, and humorously suggested that in his own case his business had provided him with a " genial occupation " for over 20 years. He had always paid 20s. in the pound and his capital was 20 times that which he started with. He agreed with the importance of keeping proper records, but the so-called efficiency experts often went to useless trouble in these matters when much simpler methods were equally effective. Much of the American success in production was that they planned ahead much better than we do. All systems must be judged by results, and the fact that Mr. Nelson's system had been such a success was proof of its being a good one.

Professor Niels Bohr, of Copenhagen University, who has just received the Nobel Prize for Physics, has been conducting investigations which, within the past week, have led to the discovery of a NEW METAL ELEMENT which will be numbered 72 in the list, and has been given the name of hafnium. The investigations have been conducted by Moseley's method.

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Salesmanship and Spring Cleaning.

At the salesmanship conference of the ELECTRICAL DEVELOPMENT ASSOCIATION held at Caxton Hall, Westminster, on Friday last, Mr. H. T. YOUNG read a Paper on "Wiring Salesmanship in Relation to Spring Cleaning, Decoration, etc."

More Conferences in the Autumn.

Mr. R. S. DOWNE (Brompton and Kensington Electricity Supply Co.), who occupied the chair, said it was the intention of the E.D.A. to arrange for a further series of conferences next autumn. Those who saw American papers were amazed at the number of uses to which the American contractor was able to induce his customers to apply energy. In the area of supply of his own company it had been found that practically 50 per cent. of the consumers were only using electricity for lighting.

Applied Salesmanship and Installation Sales.

Mr. YOUNG dealt briefly with general salesmanship, and then passed on to applied salesmanship and the subject of installation sales. Spring cleaning offered opportunities which were not taken full advantage of by the electrical salesman, and the fullest advantage could only be taken by a study of furniture, pictures, decorations, china and so on. As an instance, he mentioned that he knew a customer whom he was going to approach had a valuable picture. Before calling on him he learned all he could about that particular picture from an eighteenpenny book, and so was able to discuss it with the customer. He attributed his getting the order to that fact as much as anything else, and he urged salesmen to note the tastes and hobbies of their customers and then get discreetly into conversation about them.

A Showroom Essential.

In selling wiring, the customer's mind must be kept as far as possible on the beautiful and useful fittings and the service obtained after the work was completed. From this point of view it was essential to have a showroom where the fittings could be examined, and it was also of value to offer to fix certain fittings for approval. In dealing with wiring, the salesman had to work through the consulting engineer, the architect, the builder, the landlord and the householder, either in combination or individually.

Consulting Engineer of Immense Value.

The consulting engineer was of immense value to the industry. The architect was also an important man, and had been too much neglected by the salesman. Experience had shown that the architect was less progressive than the customer in regard to cooking and heating electrically, his views often being based on experience with lamp radiators and early cooking apparatus.

Mr. YOUNG said he would like to see a committee set up by the E.D.A. to consider the best methods for keeping the architect in touch with electrical progress. The speculative builder required handling in a similar manner to the architect, while the landlord must be approached from the point of view of the saving to be made in decorations by wiring the house for electricity, the improvement in the value of his house by using electricity should also be impressed upon him. The tenant or householder was also a person to keep in touch with. His objection usually was that he did not intend to spend money for the benefit of the landlord. Much progress could be made by emphasising the cleanliness, convenience and comfort obtainable, and there were many tenants, when convinced, who would be willing to pay for the wiring rather than be without them. There was no reason why heating and cooking cables and apparatus should not be installed so that they could be easily removed by the tenant when he left or sold to the incoming tenant.

The Number of Points Important.

It was important to see that as many points as possible were installed, especially in the dining-room. Plugs should be arranged so that apparatus could be used on sideboards or dining tables with short flexible cords. Then a plug on the landing allowed a vacuum cleaner to be used easily on the stair-carpet. The treads wore out by reason of the grit, which could be removed by a vacuum cleaner more easily than in any other way. Again, the carpet near the fireplace was worn out quickly when a coal fire was used, and this suggested a plug for a heater. There were numerous similar ways in which it could be proved that electricity saved more than it cost.

Spring and Autumn Planning.

There were two seasons of the year for which special plans should be made by electrical salesmen—the spring and late autumn. Although he only dealt with springtime, carefully prepared plans should be made immediately after Christmas, and lists of householders should be prepared under at least three headings: (1) Consumers with whom business had been or was continuously being done; (2) householders who were already using electricity for some purpose; and (3) those not using electricity. These different classes could not be dealt with in the same way, and the E.D.A. might compose some standard letters and literature for dealing with them. Communications must be followed up, and they must keep on trying to get an interview, remembering that if a prospect was difficult to get at he was also difficult for competitors. Exhibitions and demonstrations of fittings and apparatus would help considerably, and this led to the point that co-operation between all sections of the industry was essential.

DISCUSSION.

As usual, a fairly long discussion followed the reading of the Paper, in the course of which some attention was given to the B.E.S.A. standard plug. It was pointed out that the trouble was that the standard plugs were never used, because the price was high. Mr. H. MARRYAT said that the cost was prohibitive for competitive work owing to the small demand, and suggested that manufacturers should be urged to make larger quantities on speculation with a view to bringing down the cost. Mr. J. W. BEAUCHAMP said that the E.D.A. wanted everybody to work for standard dimensions. They did not want the consumers to buy the B.E.S.A. standard plug necessarily, but to use the standard pin, in order to get interchangeability.

Overlapping of Circulars.

Another point that aroused considerable interest was that of the overlapping of similar circulars sent out by neighbouring contractors. Mr. RAWLINGS held that it was of the utmost importance that two contractors should not use the same circulars, and for that reason he deprecated the broadcasting of circulars by the E.D.A. to contractors. If a prospective customer received two exactly similar circulars from neighbouring contractors, Mr. Rawlings held that he would throw them away. Mr. BEAUCHAMP, on the other hand, was of the opinion that, if a circular were well illustrated and well written, the second, third or fourth which a man received would help, and he did not think that so much harm would be done as was anticipated by Mr. Rawlings. It was also pointed out by another speaker that the E.D.A. supplied information as a guide to contractors to construct their own letters, and Mr. YOUNG emphasised, in his reply to the discussion that the letters should be sent out on the letter headings of the firms sending them. To a suggestion that he should see that similar circulars were not sent to neighbouring contractors, Mr. BEAUCHAMP replied that he was a poor man, and if he received an order from a contractor for £20 worth of circulars, he could not very well say the man could not have them, because they had already been supplied to another contractor.

Ignorant Architects.

A good deal of discussion was directed to the fact that architects are not well informed on electrical matters, and mention was made of the forthcoming joint meeting of the Institution of Electrical Engineers and the Royal Institute of British Architects, when Mr. Beauchamp is to take up the cudgels on behalf of the electrical industry. It was suggested by Mr. A. GOWANS WHYTE that more attention should be paid to the architectural student, and that it would be valuable if something about electric lighting and cooking were included in his ordinary curriculum.

Illustrating the need for more staff conferences, Mr. YOUNG said that he paid 3½d. per unit for power, and he used so much that when the meter reader made his inspection on one occasion he had remarked that he had never seen such extravagance. Those sort of remarks were calculated to do harm to the industry, and he hoped that Mr. Beauchamp would emphasis the value of staff conferences.

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Manufacturer—Factor—Retailer.

A Study of the Present Trading Conditions and Some Suggestions.

By "A SPECTATOR."

It has become commonplace during the last few years to attribute all the ills from which the electrical industry is suffering to the chaotic trading conditions which prevail. In this and two subsequent articles I shall attempt to analyse impartially the present state of affairs. It is a remarkable fact that while each and all concerned are fretting with a grievance, not one attempt has been made clearly to lay out the case and help to define the real issue.

Variety of Apparatus and Multiplicity of Discounts.

In a discussion of this nature it is wise to define the issue at once and lay out clearly the lines of apparatus concerned. Speaking generally, all the lines are those which would come under a merchandising programme—that is, lines which the retailer is selling every day to the public, either as material used in installation work or separate apparatus. Under the heading of each line I show in detail the "trade" or "retail" discounts. There is, I have found, a great lack of knowledge on both the range of apparatus and the variety of discounts quoted. Hence I shall err on the side of making this list comprehensive, because unless one has a clear knowledge and touch with each and every class of apparatus it is not realised how complex the range is. Also it will show how difficult it is to have one set plan of discounts and trading conditions for the whole range of apparatus. Still further to show how chaotic the present conditions are. We can therefore compile the following list :—

Discounts Analysed.

LAMPS (vacuum and gasfilled).—Minimum discount of 15 per cent. on "Elma" makes, with other discounts for quantities. A very complex system. Lamp makers outside the "Elma" allow larger discounts.

FITTINGS (for commercial lighting).—Net, 25 per cent., 33⅓ per cent., and 50 per cent.

FITTINGS (for domestic lighting).—Net 25 per cent., 33⅓ per cent., and 50 per cent.

FITTINGS (of more ornate type for architectural schemes and the like).—Usually quoted at net prices to the architect with a reservation of 10 per cent. discount or commission to the contractor.

Accessories.

For lampholders, tumbler switches, etc., it is now almost universal for "suppliers" to quote net prices on all lines which come under this heading. Some few still follow the practice of quoting gross list prices, and discounts vary; some at 25 per cent., others at 33⅓ per cent., and still further some at 50 per cent.

Cables, Flexibles and Wires.

The position with cables and wires is difficult to state briefly. Taking first the practice of the makers in the C.M.A., the majority have current a price list giving gross list prices which when laid down were subject to a simple discount. Prices have, however, altered so much that net prices are now quoted. Makers outside the C.M.A. follow the practice of quoting net prices. It must be added that all C.M.A. makers follow the practice of supplying cables and flexibles in 100 yd. coils, and makers outside the C.M.A. supply cable (that is, V.I.R., in more "everyday" sizes) in 110 yd. coils, and flexibles in 72 yd. coils. Bearing in mind that conduit and casing and capping is sold at a price per 100 ft., the contractor certainly has one grievance well founded, even if the case goes against him on all the other counts.

Conduit and Conduit Fittings.

Usually conduit and conduit fittings are sold at net prices, although a few "suppliers" still follow the plan of quoting a gross list price for conduit fittings with an average discount of 33⅓ per cent.

FANS (domestic and office pattern of a portable type) are priced net, with discounts of 25 per cent. and 33⅓ per cent.

FANS (heavy type as exhaust fans for factory and commercial use) are priced net, with discounts of 15 per cent., 20 per cent., 25 per cent., and 33⅓ per cent.

Heating, Cooking and other Apparatus.

Small portable appliances, 25 per cent. and 33⅓ per cent.
Fires, 25 per cent., 33⅓ per cent., and 50 per cent.
Domestic cookers, 20 per cent., 25 per cent., and 33⅓ per cent.
Large cookers, net and 20 per cent.
Hot water circulators, net and 20 per cent., 25 per cent., and 33⅓ per cent.
Vacuum cleaners, 20 per cent. and 25 per cent.
Medical apparatus, 20 per cent. and 25 per cent.
Industrial heating apparatus, net and 20 per cent.
Ironing machines, 10 per cent., 15 per cent., and 20 per cent.
Electric washers, 10 per cent., 15 per cent., and 20 per cent.

LIGHTING GLASS.—Net, 25 per cent., 33⅓ per cent., 50 per cent. (some 25 per cent. and 20 per cent.).

SILK SHADES.—Net, 25 per cent., 33⅓ per cent., and 50 per cent.

IRONCLAD SWITCHGEAR.—Net, 20 per cent., 25 per cent., and 33⅓ per cent.

BELLS.—Net, 25 per cent., 33⅓ per cent., and 50 per cent.

TELEPHONES.—25 per cent. and 33⅓ per cent.

BATTERIES.—Net, 25 per cent., 33⅓ per cent., and 50 per cent.

SMALL MOTORS (for domestic use).—Net, 10 per cent. and 20 per cent.

POCKET LAMPS.—Net, 33⅓ per cent. and 50 per cent.

SMALL NOVELTIES.—33⅓ per cent. and 50 per cent.

Parties Concerned in the Discussion.

The parties concerned in the discussion are the manufacturer, factor, retailer, and the public. A brief list! How simple our problem would be if it really represented the source of production, distribution and consumption! It is not a correct list. The following is a selection from the multitude selling various kinds of apparatus :—

(A) Manufacturers selling to super factors, factors, contractors, trade users, supply companies, and the public.

(B) Super factors selling to manufacturers, factors, contractors, trade users, supply companies, and the public.

(C) Factors selling to manufacturers, contractors, trade users supply companies, and the public.

(D) Hardware agents selling to super factors, factors, and contractors.

(E) Large hardware factors selling to hardware agents, super factors, factors, and contractors.

(F) Electrical contractors conducting a factor's and agency business under the guise of a contractor and selling to other factors, contractors, and the rest.

(G) Fittings makers (noted of Birmingham) selling to super factors, factors, contractors, and supply companies. (Under this heading can also be placed the brass stamper who hawks small parts to assemble simple accessories and fittings to the super factors, factors, and to the larger buyers of the contractors and supply companies.)

(H) Lighting glass manufacturers, and agents, selling to super factors, factors, contractors, and to large departmental stores having an electrical department.

(I) Silk shade makers selling to super factors, factors, contractors, and to large departmental stores.

(J) Large departmental stores with an electrical department selling to the public.

(K) The retailer (contractors and supply companies) selling to the public.

(L) Last, but not least, the consuming public, and it is here that we have the consolation that they are not selling to the rest.

At first glance it will be thought that my list is an exaggeration, also that some of these "suppliers" I have named are of no account. Further, criticism may be made that some do not trade in the channels I have named. In a relative sense such criticisms can stand, but none the less I should be missing the object and plan of these notes if I did not state the whole case. It may be that in some cases there is justification for the plan of selling.

Narrowing down the issue, we are faced with this question: Can we reduce the number of "sellers," or can we regulate their activities? And a further question: Can we reduce the scale of discounts to a common denominative? Before I attempt to put forward my suggestions in reply it will help us to focus our grievance if I state what I believe is the general opinion of the principal parties concerned, viz., the manufacturer, the factor and the retailer.

I purpose doing this in an article next week.

The late Mr. H. WOODVILLE MILLER, who died on December 4th, left estate of the gross value of £18,782.

The attempt to amalgamate the NATIONAL ALLIANCE OF EMPLOYERS AND EMPLOYED with the INDUSTRIAL LEAGUE AND COUNCIL has proved unsuccessful. Difference in the constitution of the two organisations is stated to be the point of difficulty.

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Electrically-Heated High Pressure Boilers.

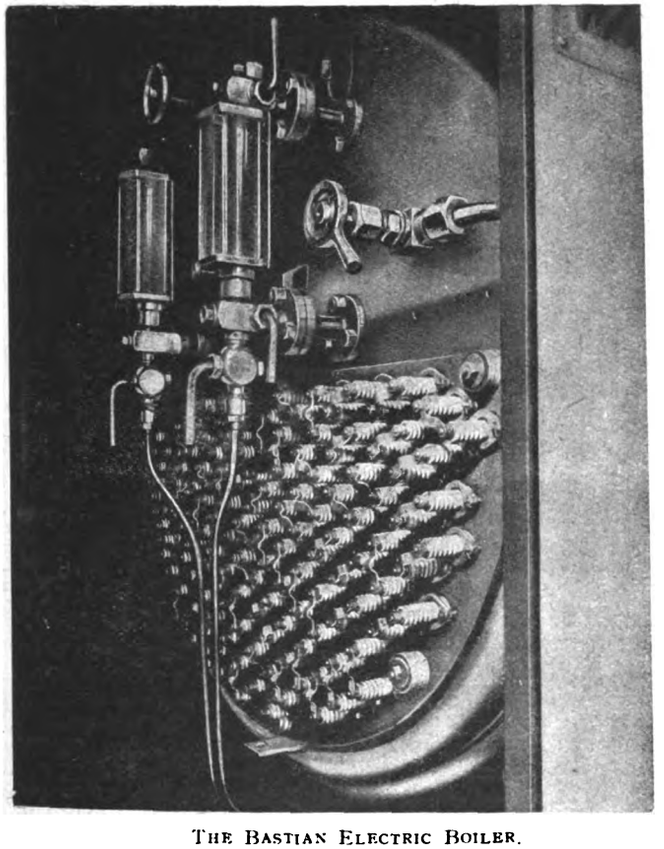
The North Eastern Railway electric passenger locomotive has already been widely described and discussed in the technical Press until everybody knows everything about it. Well, not quite everything!—for this locomotive contains, among other interesting features, a 408 kW electrically-heated boiler, which has been designed by Mr. C. ORME BASTIAN in conjunction with Messrs. Merz and McLellan.

This boiler, which we illustrate below, is sufficient to heat the largest train dealt with in ordinary service. Naturally, the Bastian quartzalite heating elements are of special design for connection across the full-line pressure of 1 500 V, and trials have yielded an efficiency of 98 per cent. During one boiler trial at about three-quarter load, with an input of only 298 kWh, 970 lb. of water were evaporated at 120 lb. pressure, and this pressure was reached in twenty-four minutes from first switching on with feed-water at 41° Fahrenheit.

This multitubular-type boiler is fitted with 144 tubes, each of which contains a Bastian quartzalite heating element of 2·84 kW capacity. The Tabasco resistances inside ⅜ in. quartzalite tubes are of Bastian and Allen's patented closely-wound spiral construction which excludes the possibility of "hot spots" developing through irregularity in the spacing of the convolutions.

Taking the surface of the 144 tabasco spirals as being equivalent to the grate surface of a fuel-fired boiler, the surface ratio of the boiler is only two, and although the boiler is approximately 547 H.P., it is only 3 ft. 4 in. diameter by 3 ft. 4 in. long over the tube plates. The shell is ½ in. thick, and is rivetted to the flanged tube plates (which are ½ in. thick) by a single row of ¾ in. rivets. The lagging is ¾ in. thick, and the boiler is finally clothed with 15 B.W.G. mild steel plates.

The illustration shows the front end of the boiler with the cover plate removed, and the heating elements, which pass through the boiler-tubes from end to end, are supported between buffer springs,



THE BASTIAN ELECTRIC BOILER.

and are thus well protected against damage through the violent vibration and mechanical shocks inevitable on such service. Extended trials with a small 50 H.P. boiler proved that all the necessary requirements were satisfactorily fulfilled.

Ample heat regulation is provided as the elements are connected in four groups, by means of which heating capacities from 68 kW up to full load can be obtained in six steps of 68 kW each, and the boiler is automatically protected against damage by four electromagnetically balanced relays.

It is, of course, obviously preferable to dispense with the oil-fuel boilers which are used for train heating in other countries on electric locomotives, while, as steam for heating must be available on lines where traction is changed from electric to steam working or *vice versa*, some compromise of this kind is necessary. It should be quite successful.

Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment, and are requested to keep their communications as short as is consonant with their argument.

POWER TRANSFORMERS FOR 66 000 V.

To the Editor of THE ELECTRICIAN.

SIR,—Referring to Mr. Taylor's letter of the 12th inst. (see THE ELECTRICIAN, Jan. 19th), the 110 000 V single phase and three-phase transformers mentioned in our letter to you of the 8th inst., are for 110 000 V across each phase, and not for 63 500 V as Mr. Taylor erroneously surmises.

This is obvious from the statement in our letter of the 8th inst. (see THE ELECTRICIAN, Jan. 12th) that the three-phase transformers are delta connected on the h.t. side.

The 132 000 V transformer mentioned is not in service, but is designed for a 132 000 V line, with three single phase transformers connected in star on the h.t. side. In considering the "voltage class" of such transformers, the line voltage is the criterion, as this is the voltage for which the transformer has to be insulated.—We are, etc.,

METROPOLITAN-VICKERS ELECTRICAL CO., LTD.
Trafford Park, A. G. ELLIS.
January 20th.

Reviews.

Electricity in Agriculture. By A. H. ALLEN. (London: Sir Isaac Pitman and Sons). Pp. viii+114. Price 2s. 6d. net.

A discussion of the application of electricity to agriculture must naturally be divided into two parts. One deals with such matters as electric ploughing, haulage, pumping, irrigation and dairy work; the other concerns itself with what is conveniently called electro-culture. The former problems are financial and economic rather than technical, and Mr. Allen rightly calls attention to the assistance in these directions that electricity can give to what was once our chief, and is still one of our principal, industries. The paragraphs "What Electricity Can Do" and "Possibilities of Electrification," are most useful as are the detailed descriptions of plant available for the various applications. This portion of the book should be studied by every farmer who wishes to be entitled be called progressive. He will find here all that he wants to improve his lot, and that of his wife as well, and he can adopt Mr. Allen's statements and advice with every confidence in their accuracy.

Mr. Allen devotes but a few pages to the subject of electro-culture, and we rather wish he had not. Here technical difficulties far overshadow those of every other kind, and Mr. Allen's judicial summary (he is used to being judicial) comes therefore as an anti-climax. It extenuates nothing, sets down nought in malice, but at the moment it must be more of a warning to the farmer than an example.

Applied Calculus. By F. F. P. BISACRE, M.A., B.Sc. A.M.I.C.E. (London: Blackie & Son, Ltd.). Pp. xiv+446. 10s. 6d. net.

The author's aim is to provide an elementary introduction to the Differential and Integral Calculus for Engineering and other science students whose mathematical equipment is comprised within the narrow limits of algebra up to quadratic equations; plane trigonometry up to the sums and difference theorems of sines, cosines and tangents; elementary geometry; and the method of graphs. A practical working knowledge of the elements of the calculus is so great an aid to students of geometry, physics and chemical theory, both in simplifying their calculations and extending their scope, that some of the most successful teachers of these subjects are now in the habit of introducing its principles and notation in the course of their own lectures. A successful attempt to supply a handbook for the use of students of only slight mathematical knowledge is therefore to be welcomed, and there can be no question that the present volume merits such welcome from the students to whom it is addressed. The introduction of Taylor's theorem is excluded, as its adequate treatment would have involved consideration of the difficult problems of the convergence of series. The important exponential and logarithmic functions, however, are brought within the purview of the book by taking the logarithmic tables for granted, and hence deriving the more important properties of the functions. The practical examples, with necessary explanations, start in Chapter I., and altogether occupy about half the volume, simultaneously adding greatly to its value and making it more interesting to the student.

G. W. DE T.

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The Automatic Control of Motors.

The design of automatic switchgear has long received the attention of ELECTRIC CONTROL, LTD., and we illustrate herewith (Fig. 1) a number of d.c. contactor controllers which form part of an order for 90 d.c. and a.c. controllers which this firm are at the present time manufacturing for one of the most modern steel works. Each controller consists of the necessary D.P. reversing contactors, which are interlocked, and of S.P. accelerating contactors, all of which are fitted with magnetic blow-outs.

Acceleration.

Acceleration is by current limit or series relay control, and the same coil is used for the blow-out and the relay, thus eliminating unnecessary duplicating of parts, and considerably reducing the overall size. On the left hand of the contactor there is a lever, hinged near the middle and with a copper contact fitted to its lower arm, while its upper arm carries a steel pole piece which forms part of the blow-out core. On the contactor armature there is another contact which may be called the interlock contact.

Operation.

Immediately the contacts of the first contactor touch, the current passes through the blow-out coil. This causes the top part of the relay lever to be pulled in against the spring, and thereby lifts the copper contact on the lower end of the lever away from the interlock contact, which is fitted to the contactor armature, and which is therefore moved into position when the armature closes. As the motor accelerates the current in the blow-out or relay coil decreases, and when it reaches the predetermined value for which the relay has been adjusted, by means of the spring mentioned above, the relay contact drops down on to the interlock contact and makes the control circuit of the operating coil of the next contactor, which then closes. The same operation is repeated again on this contactor and on each successive contactor until the last one closes. On non-reversing controllers, the last contactor is fitted with an auxiliary switch which open circuits all the intermediate contactors.

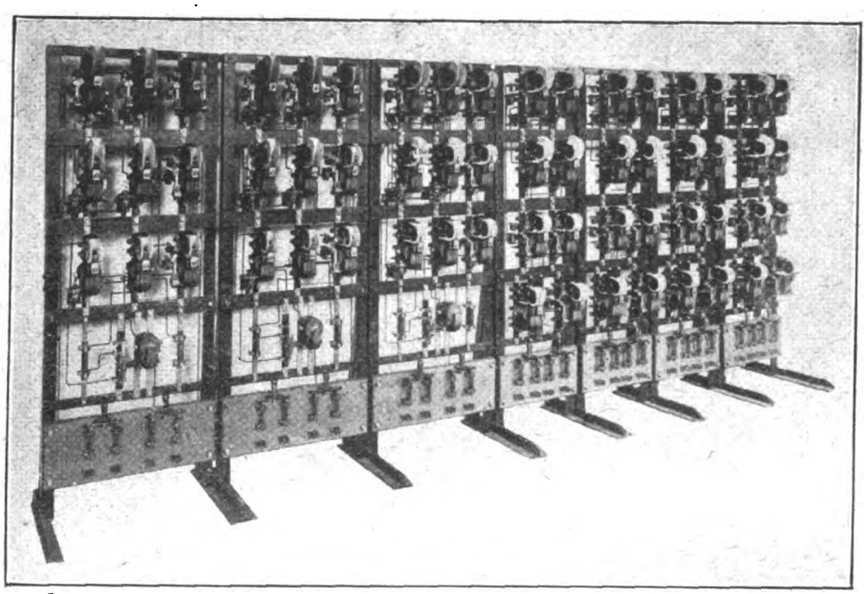

FIG. 1.—A GROUP OF AUTOMATIC CONTROLLERS FOR IRON AND STEEL WORKS.

Oscillograph Records.

Fig. 2 is an oscillogram showing the current taken by a motor on a fly-wheel load. All the relays were adjusted to drop out at the same current value, and the oscillogram clearly proves that they do this. The setting of the relay is easily adjusted by means of the spring and adjusting screw shown on the right of the contactor. As the relay will pick up with a current value less than 10 per cent. in excess of the drop-out value, it is only necessary to adjust the relay for the latter and the former will always take care of itself. The relay can be set to operate over the whole range of current for which the contactor is rated. The armature of the contractor (see Fig. 3) of the cast steel type which has been selected after experimenting with cast iron and other forms of contactor armature. The cast steel armature gives a pull more than twice that given by the cast iron type of the same size. The weight of the cast steel armature is sufficient, when properly balanced, to prevent any rebound when the contactor opens—a very important consideration in steel works practice where the operation is very frequent and the vibration considerable. The contacts are of hard-drawn copper and both of the same shape and size, and are arranged so as to provide both a roll and a wipe action.

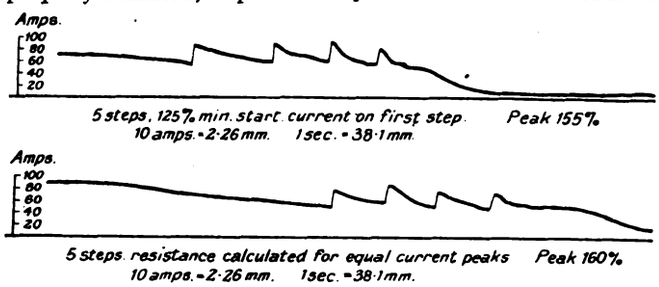

FIG. 2.—OSCILLOGRAM OF D.C. MOTOR STARTING WITH SERIES RELAY CONTROL.

Spring Arrangements.

The springs for maintaining the necessary pressure on the contacts are of note as they differ essentially from the form usually employed on contactor switches. They are arranged in such a way that a very large range of compression is available and yet only a small part of the range is used. The consequence is that the force exerted by the springs on the contacts remains constant is independent of any wear and ensures a longer life.

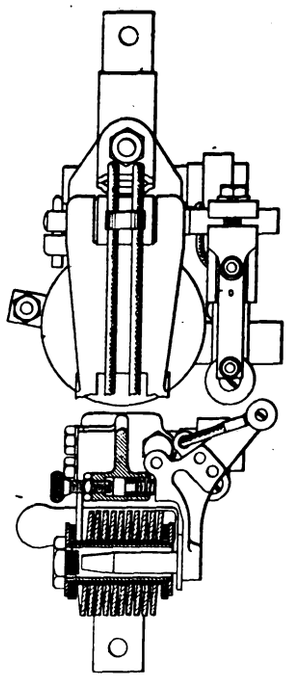

FIG. 3.—SECTION OF THE CONTACTOR.

The operating coil is liberally designed so that no economy resistances are used and the temperature rise on continuous duty is within very safe limits. The coil is anchored to the magnet frame in such a way as to prevent any possibility of relative movement. Special care has been taken in winding the coil to reduce the difference of potential between successive layers, thus improving the insulating qualities. The flexibles used are of a special type and are suspended on the outside and free of the contactor, and the joints are specially designed to prevent any possibility of the flexibles breaking.

The steel and mica form of construction which is used with these d.c. contactor controllers is much stronger and more accessible than the usual slate construction. This design was specially got out for steel works practice as it is rigid, light and compact, and able to withstand the most severe service. The steel bars are of square section with the mica moulded on and specially protected so as to entirely eliminate any possibility of flaking.

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An Up-To-Date Lighting Scheme.

Austin Reed's New Premises in the Provinces.

The march towards the better illumination of shops and shop windows still continues, and one of the most remarkable examples of this progress is to be found at Austin Reed's new building in Leeds. In fact it may be said that it represents a complete break-away from the conventional methods.

It is sad, but true, that in the case of most new buildings the artificial lighting is considered (if it is considered at all) as a matter entirely outside the scope of the architect, with the result that it is usually left until a late stage and to the unadvised decisions of the owner of the building or of an electrician employed by the owner. The idea that the lighting installation (including all fittings and equipment) is as much a part of the architect's work as a drain or a chimney-stack is still more unfamiliar then it should be.

On the other hand, the architect bestows a great deal of attention upon the natural lighting, partly because of its influence upon the

FIG. 1.—INDIRECT LIGHTING BY MEANS OF X-RAY REFLECTORS AND MAZDA LAMPS CONCEALED IN THE TOPS OF TWO ORNAMENTAL FLOOR STANDARDS AND IN THE TOPS OF SHELVES AND FIXTURES.

health of the inhabitants, and partly because of its effect upon the appearance of the interior. Precisely the same factors should hold with artificial lighting—with this qualification, that with the latter there is far more scope for the exercise of the architect's skill and artistry.

In the case of the Austin Reed building, the architects (Messrs. Westwood and Emberton) designed the lighting scheme when they designed the building, and the two sets of plans are complementary and interdependent. The lighting is definitely planned for this particular building, and although the general methods might be applicable elsewhere, the treatment and equipment would need to be considerably modified.

FIG. 2.—NIGHT PHOTOGRAPH OF READY-MADE CLOTHING DEPARTMENT. NATURAL AND ARTIFICIAL ILLUMINATION, BOTH OBTAINED THROUGH GLASS ROOF.

Pedestal Units in the Showrooms.

The main showrooms on the ground and first floors are lighted in an unusual fashion. Indirect lighting is employed; that is to say, the light is thrown upwards on to the ceiling, and from there is reflected in a soft, diffused illumination throughout the apartment. Ordinarily, as is well known, indirect lighting is effected by means of opaque bowl fittings, containing X-ray silvered glass reflectors, suspended from the ceiling, or else by means of cornice units.

It was desired, however, to keep the ceiling entirely clear, and it was therefore necessary to design an alternative and equally efficient means of utilising the X-ray reflectors. It was decided to conceal the reflectors in the tops of ornamental wood pedestals about 7 ft. 6 in. high, standing in the middle of the floor. Fig. 1 illustrates one of the showrooms. The main illumination is provided by two pedestals, each fitted with three X-ray reflectors and three Mazda gasfilled lamps. The pedestals were specially designed by the architects to harmonise with the panelling and other woodwork. These main units are supplemented by X-ray reflectors concealed in the tops of shelves and similar fixtures which were constructed with that end in view.

The illumination is diffused throughout the showroom, and the general effect is beautiful. From the decorative and architectural point of view, the advantage of keeping the ceiling clear of suspended fittings in a room of this kind is obvious.

Daylight at Night.

In the ready-made clothing department (Fig. 2) the light sources are not merely invisible but are entirely external to the room. This department is on the top floor, and has a frosted glass roof which provides natural lighting during the day. Above this glass roof are fixed a number of X-ray reflectors containing high-powered Mazda gasfilled lamps, the light from these lamps being reflected downward through the glass. The lamps, of course, cannot be seen through the frosted glass, which by diffusing and refracting the light, produces an illumination very similar in effect to daylight.

This method of lighting, which eliminates glare and reduces shadows to the natural chiaroscuro of diffused daylight, is, it is claimed, ideal in a room where the colours and fit of garments have to be judged.

FIG. 3.—WINDOW ILLUMINATED BY X-RAY UNITS AND FLOOD LIGHTS.

Had hanging fittings been employed in the lighting of the clothing department, the light distribution would have been bad, there would have been a good deal of glare, either from the lamps or by reflection from the glass roof, and the glass roof itself, with the exception of the portions above the fittings would have presented an appearance of murkiness and gloom.

Windows Lighting Scheme.

The windows are lighted by X-Ray "Scoopette" reflectors and Navy bulb lamps. The X-ray units are fixed along the top front edge of the window and are concealed by a narrow curtain. In this way a uniform, brilliant illumination is concentrated on the display, which is thus made to look farmore attractive and can be studied far more easily than would have been the case had the windows been lighted by means of lamps suspended within the field of vision.

Floodlighting.

Fig. 3 illustrates very effectively the brilliant stage-like illumination of the window. The same picture also shows how the name at the top of the building is lighted. Four B.T.-H. floodlight projectors equipped with Mazda gasfilled lamps are fixed to the top of the canopy, and the four beams are concentrated upon the words "Austin Reed." With more projectors and a different arrangement it would have been equally easy to light the entire façade, but in this case it was only desired to light the name.

The projectors are weatherproof and universally adjustable and are equipped with powerful reflectors. Practically they are miniature naval searchlights adapted to the pacific needs of commercial illumination.

Notes on the Photographs.

All the photographs reproduced in this article were taken by the unaided light of the Mazda lamps installed in the various departments. Moreover, they were all taken with exposures ranging from three to four minutes. The pictures therefore give a fairly accurate idea of the quality and integrity of the illumination. There are no signs of halation in the photographs because there are no visible light sources to cause it.

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Merchandise to Sell and Profit By.

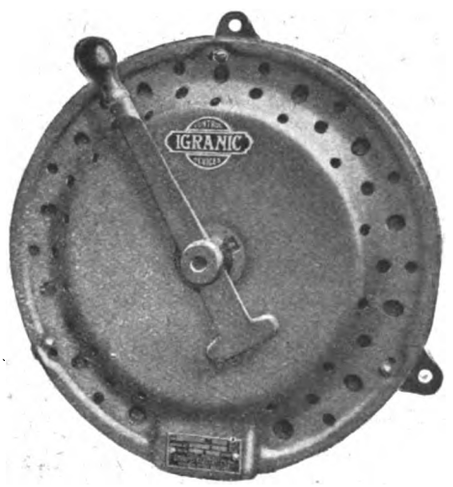
In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

A Dimmer to Pull Dancing Hall Business.

Speaking in the terms of averages, contractors do not realise the business possibilities of using dimmers in concert and dancing halls and skating rinks. No attention is paid to *creating* this business, hence the manufacturers have had to deal direct with the user-buyer of this class of apparatus or else the numerous cinematograph accessory providers reap the business. Possibly the explanation is that the publicity matter issued by the manufacturers has not been on the right lines to pull this business, but if this is so the complaint cannot be laid against the leaflet No. 1 300 just issued by the IGRANIC ELECTRIC CO. Briefly, yet lucidly, the list describes all that is necessary of the dimmer which we illustrate.



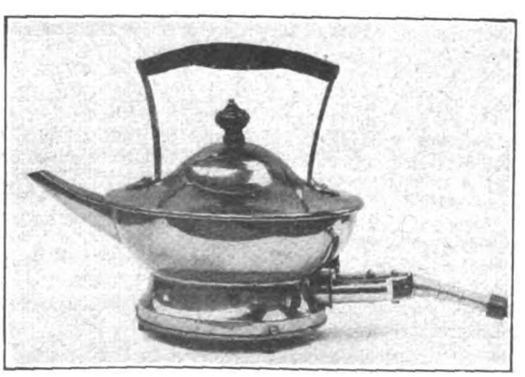
THE IGRANIC SMALL DIMMER.

The whole feature of the design is its suitability for use in cinemas, small theatres, concert halls, dance halls, and skating rinks.

The dimmer is designed for continuous duty on either d.c. or a.c. circuits and is capable of controlling metal filament lamps up to 2 640 W. Essentially the design consists of either one or two circular plates, bolted together and operated by a single lever. The standard dimmer is arranged for fixing flat against the wall with the operating lever in front. If desired, however, the dimmer can be supplied fitted with a bracket for supporting the plates at right angles to the wall, or on rear of a board with hand wheel drive.

"Creda" Kettles.

The CREDENDA CONDUITS CO. have escaped conventionality with the kettle which we illustrate. The design is striking, but none the less chaste, and is a line for retailers actively to merchandise. Kettles have become such a "bread and butter" line for the retailer that all kettles appear to be as alike as "Tweedledum and Tweedledee." This is a mistake because it camouflages many so-called



A NEAT "CREDA" KETTLE.

cheap kettles which prove a never-ending source of worry to the retailer to patch them up and keep them in service. This "Creda" kettle is listed at 60s., and for the value offered in design, workmanship, and efficiency, is not expensive. A particular "selling" feature of this kettle is that it can be fitted with the "Creda" patent protector or cutout.

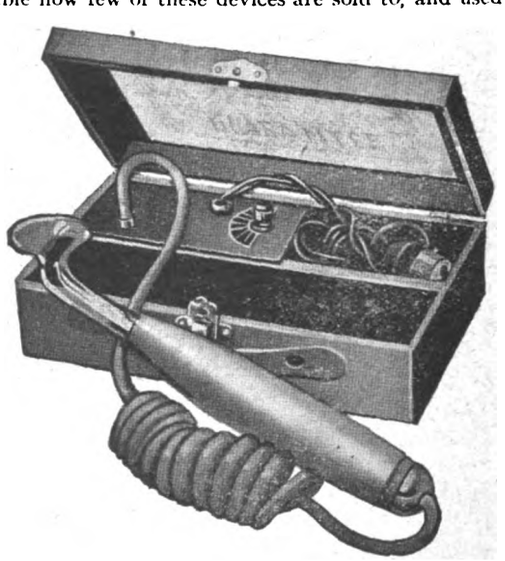
A "Quiklok" Ceiling Rose for Quick Work.

Ceiling roses are considered the "bread and cheese" of installation work, and it is not difficult to appreciate the reason why; but very few contractors give this question any thought. Ceiling roses are, however, a "question," and every pattern designed to simplify wiring and reduce labour charges should be closely analysed. The "Quiklok" ceiling rose manufactured by the BRITISH THOMSON-HOUSTON CO. is one which can well maintain the claims put forward that it is a device to save time and money—not forgetting temper. The illustration is of the ordinary round pattern with leading-in holes at the back, but it is also made in a square pattern with leading-in holes at the side for cleat wiring. "Bread and cheese" ceiling roses are now offered at very low prices, and it is on this device that the buyer for a contractor makes many mistakes. More time and money are wasted in the installation of cheap ceiling roses than on any other device. Therefore the initial cost of the "Quiklok" will be appreciated when it is realised the enormous saving which can be effected. These savings can be at once realised from a brief description. The terminals of the flexible are contained in the cover. The effect of this simple departure from the traditional method of construction is revolutionary. A batch of pendants can be completely wired at the bench in a single operation. The fixing of the base to the ceiling is a very simple operation, and the covers having been wired can be readily connected and locked by a quarter turn. The "Quiklok" ceiling rose is destined to oust the present labour-wasting device, and to prove the doom of "top-of-the-ladder-hands-above-the-head" method of wiring. Stocks are held at all local offices of the British Thomson-Houston Co.

THE "QUIKLOK" CEILING ROSE.

High Frequency Apparatus.

In distributing the "Vio-Ray" High Frequency apparatus, L. G. HAWKINS offer the retailer another line of popular devices to catch domestic business. High frequency apparatus is not new, but it is remarkable how few of these devices are sold to, and used by, the



THE "VIO-RAY" EQUIPMENT.

public. This fact must be compared with the very remarkable one that many women spend at least 10s. per week for a brief treatment of high frequency apparatus. Retailers should therefore make this fact the big talking point to obtain this business. It wants but very little calculation to show that at, say, 10s. per week, the initial cost can soon be worked off. Of the relatively few sets of this apparatus which are being sold to the public the majority are sol

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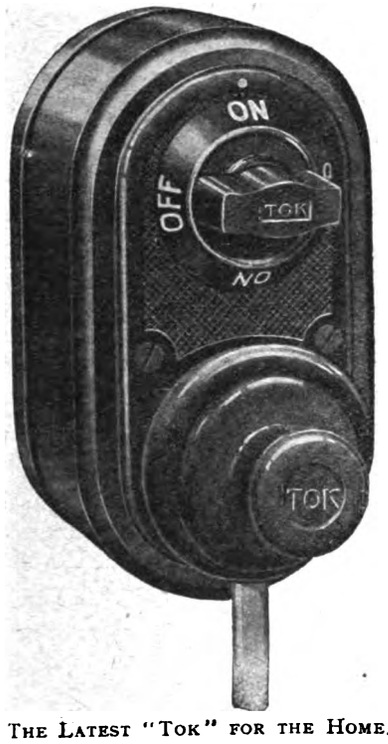
through retailers other than electrical retailers. As in the case of "wireless" apparatus, it behoves all electrical retailers to obtain not only a larger share of the present level of business, but to see that they create a demand and raise the level. L. G. HAWKINS offer a most comprehensive range of sets varying in price from £7 10s. for a set for professional use to £4 19s. 6d. for the less ambitious set for domestic use (our illustration is of the last named).

"Tok" Interlocking Switch-Plug.

The many excellent designs of interlocking switch-plugs now on the market must make a difficult problem for the contractor to solve as to which is the best for any particular installation. It must also be a knotty point for supply engineers as to which is the best to



THE LATEST "TOK" FOR THE HOME.

approve for use in their area. One pattern of particular merit is that manufactured by TOK SWITCHES. It is fully described in a folder which can be readily obtained on application, but a particular feature must be briefly commented on, because it is one of the few (if not the only one) of the patterns employing a rotary snap switch. There are a number of devices which operate by means of a milled disc, but they are merely slow-make tumbler switches adapted. It is the accepted practice that for circuits of 5 A and upwards a rotary action is best from every point of view. Therefore the TOK interlocking switch-plug has all the advantages of this type of switch action and the very necessary feature of an interlocked plug. It is very interesting to note that the plug has been designed to meet the E.S.C. specification. The switch (which is a D.P. action at 20 A) also has an interesting feature that the handle or knob cannot be turned in the wrong direction nor unscrewed by the uninitiated.

A Whip-all for All Housewives.

The SUN ELECTRICAL CO. have just placed upon the English market the "Air-O-Mix" Whip-all. Hence retailers have a new and useful device which will sell if they rally and sound the slogan "A whip-all for *all* housewives," because among the many talking points for the device is the fact that cakes, etc., come out very much lighter in cooking if the ingredients have been mixed with an "Air-O-Mix." One only has to reflect but a brief while to realise how many housewives can be tempted by this virtue only. How many housewives there must be who would gladly pay £5 10s. (which is the list price of the complete apparatus as illustrated) to enable them to eclipse their neighbours in cake making! The apparatus is also a food and drink mixer. It aerates the material being mixed. It consists of an efficient two-speed electric motor which quietly drives a rapidly revolving spindle, at the bottom of which are two aerial tubes. The value of this aeration is very marked; for instance, people who have trouble in digesting milk can do so without difficulty if the milk is mixed with an "Air-O-Mix" Whip-all.

THE SUN "WHIP-ALL."

A G.E.C. Twin Fire.

The H.O. 608/608a ornamental cast iron "Magnet" fire, manufactured by the GENERAL ELECTRIC CO., is a really charming adjunct to the drawing-room. It differs from the usual fire, inasmuch as it is nearly twice the width and yet manages to preserve a neat and

The Latest G.E.C. Fire.

distinctive appearance. The loading is 4 000 W, and in a black finish with brass ornaments is listed at £25. This fire is particularly alluring when finished in oxy silver, but a similar effect is obtained with an armour-bright finish for £26. The design is one to capture the business of retailers' patrons who want "something different, something big, something ——"

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

List No. 18, depicting ARNOLD GOODWIN'S "Beatall" air compressors should be in every buyer's catalogue library.

The LONDON FACTORS AND AGENTS issue a comprehensive net trade price list of all their lines from accumulators to wall plugs.

The "Runbaken" magnetic dashboard petrol gauge is described in a compelling booklet just issued by the RUNBAKEN MAGNETO CO.

The ENGLISH ELECTRIC CO. have just issued a new booklet No. 340, being a list of electric winding plants installed by this company. A very interesting booklet.

All those interested in dynamos and motors should see the new stock list issued by the ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, for January, 1923.

All retail buyers should study RADIO INSTRUMENTS new booklet, entitled "For Everything Wireless." The wireless cabinet receivers, shown in the booklet are par excellence.

LOCAL AND AUTO ECONOMY ACCESSORIES have issued Bulletin No. 3 describing the R.E.F. pressure lubricator. A most interesting and descriptive publication which will be sent on application to all engineers interested.

Particular attention should be paid to L. G. HAWKINS' new advertising schemes for 1923. All "Universal" heating and cooking appliances are reduced and those of "Miller" table lamps lines. Particulars should be obtained.

The JACKSON ELECTRIC CO. issue Cooker Pamphlet B, and introduce three new models in their ranges—Nos. 30, 31, 32, and also Cat. No. 22. It would be well for retailers to see this pamphlet and catalogue at the earliest opportunity.

The K.B.B. Medical Lamp for Therapeutic Treatment by ultra violet rays is of extreme importance to firms dealing with electro-medical apparatus. Particulars obtainable from sole agents, WATSON AND SONS (Electro-medical), Ltd.

In the new issue of the "Magnet" Electric Cooking (Booklet H.2860) of the GENERAL ELECTRIC CO. there are many devices which are extremely attractive. Special attention should be given to p. 6, illustrating a milk steriliser and bronchitis kettle which will be invaluable in a sick room. Booklet H.2831 gives all kinds and sizes of electric fires from the simple "sunflower" type to the elaborate double fire No. H.608/608*a* on p. 17. Buyers would do well to procure these booklets. All prices are lower.

The BRITISH THOMSON-HOUSTON CO. continue to set the vogue in artistic and compelling publicity. We have just received a series of nine folders describing, with prices, various electric light fittings. The plan of the whole series has been to show one class of fitting on each folder, thus the whole set covers wall brackets, dining-room pendants and all the other usual domestic requirements. The folders provide for overprinting with retailer's name and address which is a very useful service provided by the B.T.-H. in connection with much of their publicity.

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Electrically-Operated Railways.

Notable Service Records in the United States.

THE "Railway Gazette," in its current issue, gives particulars of some notable service records made on electrically-operated lines in the United States, compiled by Mr. Homer K. Smith for the "Railway Electrical Engineer."

On the New York, New Haven and Hartford Railway, which has 550 miles of electrified track, in 1921 the electric passenger locomotives averaged 33 000 miles per locomotive failure, the average detention per failure being 18 minutes. That annual mileage per locomotive was nearly 60 000. The freight locomotive mileage per locomotive failure was approximately 22 500. These locomotives frequently made two round trips in 24 hours, mileage 272, whereas under steam operation the daily locomotive mileage was from 100 to 120. During the years 1915–21, 16 electric switching locomotives were in actual service over 70 per cent. of the total time, and during 1916 they realised over 77 per cent. These locomotives are operated 24 hours per day, and consistently make 140 miles on the basis of a running speed of 6 miles per hour. They have replaced steam locomotives in the ratio of 2 to 1, and have realised a coal saving of 65 per cent. On the Pennsylvania electrified lines in New York main-line electric locomotives realised 78 600 miles per detention on account of locomotive troubles, and during one year there was a total train delay, due to failure of motive power, of only 55 minutes. These locomotives are now averaging about 4 500 miles per month. On the Norfolk and Western Railroad two 300-ton electric locomotives now haul trains of 3 250 tons at 14 miles per hour, whereas previously 3 Mallet steam locomotives were required, the speed then being 7 miles per hour. 12 electric locomotives were purchased to replace 24 Mallet engines and still handle the service, although when placed in traffic 33 Mallet locomotives would have been required, and the volume of traffic has further increased since. During 1922 these engines made an average mileage of 37 820, more than 100 miles per day per engine. On the New York, Westchester and Boston Railway, during the heavy snowstorms of 1919-20, when the service on many steam roads was seriously demoralised, operation of the suburban service was 100 per cent. perfect. In 1919 average mileage per car was over 42 000, and the average car mileage per minute of delay over 2 700. On the Philadelphia suburban service, Pennsylvania Railroad, approximately 600 trains per day are now operated, as compared with 160 under steam conditions. During the year 1919 over 2 883 000 car miles were run, with an average of over 48 000 car miles per detention.

Earthing in Coal Mines.

Safety in Handling Coal Cutting Machinery.

In a paper recently read before the NATIONAL ASSOCIATION OF COLLIERY MANAGERS, Mr. A. W. Williams made out a good case for specially secure earthing arrangements in collieries. Mr. Williams contended that even permanently erected apparatus lending itself to mechanical and electrical bonding could only be regarded as conveying immunity from shock if there was some means of continuously recording the conditions of the earthing system. The most urgent case was the treatment of portable machinery used with coal cutters. Such machines were often situated in awkward positions, generally with lack of room for proper attention and ease in manipulation. Of accidents ascribed to the use of electricity in mines about 10 per cent. were due to causes which could not be traced. But the causes of the remaining 90 per cent. could be ascertained and many of these were preventible. Among the causes were mentioned accidental contact with live metal on the pommels when disconnected from coal cutter, the operator attempting to reverse coal cutting machines by withdrawing the pommel with the current on; faulty earth contacts where pommels were connected to coal cutter or the gate or switch, the frame becoming charged owing to faulty insulation of current-carrying parts and indifferent earth contact. In this connection the Williams-Rowley earthing system was described. This involves a species of electric interlock which secures that the earth to frame is made first and broken last, that pressure cannot be put on trailing cables or pommels when the latter are not connected up, and that gate and switch cannot be closed until the earth circuit is established and both pommels are well home. The apparatus embodies other precautionary principles which the author described in detail.

The British Association.

Presidents and Recorders for September Meeting.

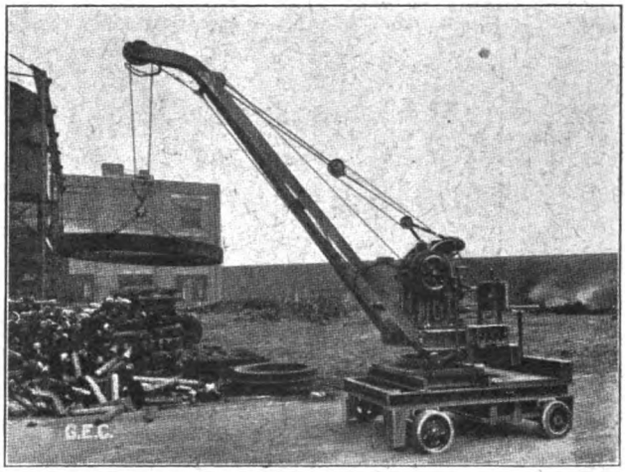
Sir Ernest Rutherford will preside at the meeting of the BRITISH ASSOCIATION at Liverpool in September next. Presidents and recorders of individual sections have been appointed as follows:—Section A (Mathematical and Physical Science): Prof. J. C. McLellan; Prof. A. O. Rankine, Imperial College of Science and Technology, S.W.7. Section B (Chemistry): Prof. F. G. Donnan; Prof. C. H. Desch, The University, Sheffield. Section F (Economics): Sir W. H. Beveridge; Prof. H. M. Hallsworth, Armstrong College, Newcastle-on-Tyne. Section G (Engineering): Sir H. Fowler; Prof. G. W. O. Howe, The University, Glasgow. Section L (Educational Science): Prof. T. P. Nunn; Mr. D. Berridge, The College, Malvern.

Electric Truck Cranes.

Design and Performance of the Witton-Kramer Type.

In every works and warehouse may be found instances of loads which have to be lifted and transported from positions that cannot be reached by the ordinary hoisting appliances. The electric truck has solved this question to some extent and the solution will be further assisted by the use of the electric truck crane, bui lt rctas an accessory to the truck, but designed throughout as an electric travelling crane. With a machine of this description loads can be picked up and deposited and the crane can be moved rapidly to any spot where a load has to be handled.

The "Witton-Kramer" crane, which we illustrate herewith, has been designed for this purpose. It is of the two-motor type, one motor being used for propelling the crane, the other to operate the hoisting, slewing and derricking motions. Clutches are utilised to transfer the drive to the desired motion. The crane is capable of lifting a load of 1 ton at a radius of 10 ft. and at a speed of 20 ft.



THE "WITTON-KRAMER" CRANE AT WORK.

per min. It slews at 3 revs. per min. and travels at 4 miles per hour. The arrangement is such that all motions including travelling can be operated from the driver's platform with the jib directly in the line of travel. Electric or mechanical brakes are fitted to all motions. The battery is built into the truck and is of sufficient capacity to supply the crane for six hours without recharging. It is manufactured by the GENERAL ELECTRIC CO.

Electric Furnaces for Brass Melting.

Would Save Millions, says U.S. Bureau of Mines.

As the result of a study of brass furnace practice in the United States, the Bureau of Mines declares that the complete substitution of electric furnaces for the crucible and oil-fired types should result in savings in the brass melting industry amounting to two or three million dollars a year. The Bureau estimates that if all brass made in the country could have been melted electrically in 1917 and 1918 the war expenses of the country would have been reduced some twenty million dollars. The manufacture of brass in the old-style types of furnace has been characterised by enormous losses of zinc through vaporisation, possibly as much as 6 per cent. of the metal present having been lost in making brass casting and 10 per cent. in making wrought brass. It has been estimated that 7 500 lb. of zinc passed into the atmosphere daily in the form of zinc oxides from the chimneys of the brass-casting shops of Waterbury, Conn., alone.

Electricity in the Aluminium Foundry.

Modern American Practice.

"Engineering Production" gives some details of the electrically-heated furnaces which are being used in the aluminium foundries of the Dayton Engineering Laboratories Co. As is well known, the electric furnace has long been used in the manufacture of aluminium, but there are few aluminium foundries so equipped owing to the large amount of heat required and to the high cost of current. In the Dayton Foundries the Bailey electric furnace is used. Current is generated at 6 600 V and stepped down to 80 V for use in the furnace, whose normal charge is 600 lb.; careful check is kept on the temperature of the molten metal by means of a pyrometer and accurate records of the consumption are possible owing to the employment of both maximum demand and kilowatt hour meters. A recent monthly report of the furnace shows that it was 13 working days in use and in that time melted 22·1 tons with a total energy consumption of 16 080 kWh, or an average of 728 kWh per ton. Electric furnaces are also used by the company for brass melting, two 2 kW resistance type furnaces, each with a capacity of 600 lb. being employed. These furnaces have a guaranteed melting loss of less than 1½ per cent. and will melt one ton with an energy consumption of 400 kWh if operated continuously, or of 550 kWh when working on a nine-hour day.

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Legal Intelligence.

Rights of Supply Co.: Judgment Reserved.

In the Court of Appeal before the Master of the Rolls and Lords Justices Warrington and Younger on January 17th, the case of the Attorney-General *v.* the Corporation of Southport was heard upon the appeal of the plaintiff suing at the relation of the Birkdale District Electric Supply Co. from the judgment of Mr. Justice Eve in the Chancery Division dismissing the action which was brought for an injunction to restrain the defendants from supplying electricity for traction in the urban district of Birkdale or for the lighting the public lamps there.

It appeared that the relators had been entitled under an order of 1918 to supply electrical energy within the district in question since 1902, and from that date until November, 1921, they had been supplying not only all the consumers of electrical energy, but had been lighting the public lamps and driving the tramways in that district or area. In 1911, the defendants obtained an extension order by virtue of which Southport now included Birkdale and the urban district council ceased to exist, and their rights and liabilities were taken over by the defendants; and the defendants' case was that having swallowed up the local council they were at liberty to take away from the relators parts of their rights of supply, and so diminish the value of their undertaking.

True Construction of the Word "Supply."

The real contract between the parties turned upon the true construction of the word "supply" in the phrase "to supply electrical energy." The tramways in Birkdale are in a continuous line with those in the borough of Southport before its extension joining up at what was in those days the boundary between the borough and the urban district. From the time of the extension and until recently the Corporation provided current for driving the cars up to the old borough boundary, and the relator provided it for driving them beyond that point. In February, 1918, the tramways company surrendered to the Corporation, amongst other things, their lease of the tramways in the old Birkdale district, and therefore the Corporation became owners of the whole length of the tramways. The effect of the surrender was to put an end to the agreement between the relators and the tramways company, and accordingly a fresh agreement dated October 3rd, 1918, was entered into between the relators and the Corporation, which in effect reproduced from March 1st, 1918, *mutatis mutandis*, the conditions of the earlier agreement, except that instead of being determinable on the determination of the leasehold interval, it might be put an end to at any time by three months' notice from either party. On August 10th last the Corporation gave three months' notice to terminate the agreement, and it ended at midnight on November 10th.

Judgment in Court Below.

Mr. Justice Eve in the Court below, following a judgment of the late Mr. Justice North in the case of the West Surrey Water Co. *v.* the Guardians of the Chertsey Union, held that the word "supply" in the Statute and Order compelled him to decide that the relators had no course of action, and he, as before stated, dismissed the action with costs. From this result the relators now appealed.

Mr. Maugham and Mr. Guest Mathews appeared in support of the appeal, and Mr. Tomlin, K.C., and Mr. Bischoff for the respondent Corporation.

Mr. Maugham explained that in 1912 Southport absorbed Birkdale, previously a separate district. On this taking place, the Southport Corporation became liable under all contracts by which the Birkdale Urban District Council were bound, and the question in this case was whether on the construction of one of such agreements and of Section 23 of the Electric Lighting Act, 1909, the Corporation of Southport were entitled to supply electric energy for the purpose of tramways in what was lately the urban district of Birkdale. The construction of the relators was that both by contract and by Act of Parliament the Urban District Council of Birkdale was precluded from supplying electric energy for the purpose of drawing these trams or for other purposes, and the Corporation of Southport were in the same position.

Mr. Tomlin submitted that the Corporation were in the position that they could make use of any energy they generated. Such use was not a "supply" within the meaning of the Act. "Supply" meant giving something to another person, and the use by the Corporation of electric energy generated by themselves could not be converted into a "supply," because statutory permission might be necessary for transmission.

Their lordships reserved judgment.

An Irregular Use of Electricity.

At Bath last week Edward C. Sidney and Griffiths Ellis, partners in the firm of Sidney and Ellis, electrical engineers, were summoned for improperly using electricity at their business premises, 12, Barton Street, on January 3rd. It was stated by the prosecution that electricity supplied to the defendants for power purposes at 2½d. per kWh was being used for artificial lighting, for which they ought to have been charged from the lighting meter at 8d. per kWh.

The defendants were in the habit of transforming down the current which was supplied at 220 V by the Corporation, to something like 6 or 10 V for the purpose of charging batteries for motor cars. The surplus energy was used by this firm for the purpose of artificially lighting the premises.

Mr. Sidney, in evidence, said that instead of putting resistance lamps in the switchboard and wasting energy, they carried the current by wires over benches and suspended three lamps. By this means they found they could control their amperage when charging accumulators much more easily than by working direct from the switchboard. The light obtained was useless for practical purposes.

The magistrates fined the defendants 50s. each.

British Thomson-Houston Litigation.

In the Chancery Division before Mr. Justice Sargant last week, Mr. Moritz moved for judgment in the action of the British Thomson-Houston Co. *v.* The Advance Lamp Co. He said it was a patent action and judgment was asked for by consent. It was a case in which the patent had been held to be valid.

His lordship gave judgment as asked.

A similar judgment was given by Mr. Justice Romer on a motion by the British Thomson-Houston Co. against the A. and A. Electrical Co., of Farringdon Street, E.C.

Institution Notes.

The summer visit of the INSTITUTION OF AUTOMOBILE ENGINEERS will be held in Liverpool commencing on June 18th.

The following paper by Dr. J. Holker was read before the ROYAL SOCIETY yesterday (Thursday):—"The Periodic Opacity of Certain Colloids in Progressively Increasing Concentrations of Electrolytes."

The dinner of the SCOTTISH CENTRE OF THE INSTITUTION OF ELECTRICAL ENGINEERS will take place on March 5th at the Central Station Hotel, Glasgow. Tickets (price 17s. 6d., exclusive of wines) may be obtained from Mr. W. L. Winning, 166, St. Vincent Street, Glasgow.

The annual dinner of the NORTH WESTERN CENTRE OF THE INSTITUTION OF ELECTRICAL ENGINEERS will be held on February 23rd, at the Midland Hotel, Manchester. Tickets (price 12s. 6d., exclusive of wines) may be had from Mr. A. L. Green, 8, Westminster Avenue, Whalley Range, Manchester.

At the meeting of the INSTITUTION OF ELECTRICAL ENGINEERS, to be held on Thursday, February 1st, the President will present to Mr. J. W. Meares, late local hon. secretary of the Institution in India, and Electrical Adviser to the Indian Government, a salver and cigarette box subscribed for by his friends in India on the occasion of his retirement from the Indian Government Service, and as a token of his valuable services to the profession in India.

Among the demonstrations which will be given by old students at FINSBURY TECHNICAL COLLEGE after Sir Oliver Lodge's lecture on February 1st, in memory of Silvanus Thompson, are the following:—Mr. Mordey will show some effects of alternating magnetism; Prof. Coker will demonstrate the strains set up by cutting tools, as shown under polarised light; Prof. Desch will project microphotographs of various alloys. Prof. Eccles will show novel applications of the thermionic valve, and the ladies will be entertained by a wireless concert, the reception being arranged for by Mr. Franklin. The plant of the College will be operated by present students.

Personal Items.

Sir VINCENT L. RAVEN has been appointed technical adviser to the London and North-Eastern Railway.

Mr. FRANK THORP has been appointed London engineer to Ferguson, Pailin, Ltd., in succession to Mr. J. H. Sandiford.

Mr. V. SINCLAIR has been appointed to take charge of the publicity department of the Sterling Telephone and Electric Co.

Mr. WILLIAM A. VALENTINE, deputy controller of the London Telephone Service, has been appointed to succeed Mr. G. A. Preston as controller.

Sir WILLIAM NOBLE, formerly engineer-in-chief to the G.P.O., has joined the board of directors of the Walker-Weston Co., reinforced concrete engineers.

SIR GEORGE and LADY SUTTON, on Saturday, entertained over 1 200 Beckenham school children at the Crystal Palace Circus and to tea. The arrangements were made through the school committees.

Mr. ARCHER SMITH, Newcastle-on-Tyne, district manager of the Post Office telephones, is shortly taking up similar duties at Manchester. He will be succeeded by Mr. J. D. W. STEWART, now at Manchester.

Mr. J. W. KIRKLAND, for many years managing director of the South African General Electric Co., Johannesburg, has been appointed manager of the London office of the International General Electric Co., New York. Mr. Kirkland will arrive from South Africa to take up his new duties about March 1st.

Preston Electricity Committee has recommended the Council to assess the amount of compensation to be paid to Mr. J. H. TONGE, for the abolition of his office as engineer of National Electric Supply Co., at an annual sum of £645 11s. 11d., a portion of such pension to be commuted by payment of a sum approximately £2 000 if terms can be agreed. They also recommend compensation to Mr. T. CROSS, secretary to the company, at the annual sum of £343 6s. 8d.

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East Midlands Electricity District.

Inquiry Opened at Nottingham.

An inquiry into the area to be included in the East Midlands Electricity District was opened by the Electricity Commissioners in Nottingham on Tuesday. Sir John Snell was in the chair.

An outline of the proposals of the Conference of Municipal Authorities was put forward by their counsel, Mr. Tyldesley Jones. The area provisionally determined by the Commissioners included the boroughs of Nottingham, Leicester, Derby, Burton, Loughborough, Newark and Mansfield, and various rural authorities. An area of 1 000 square miles was involved. The scheme provided for the constitution of an Electricity Advisory Committee of 27 members, of whom 15 were to be appointed by the corporations and municipalities, five by the Derbyshire and Notts and the Leicestershire and Warwickshire Power companies, three by county councils (Notts, Derbyshire and Leicestershire), two by the railway companies, and two by large consumers. This part of the scheme had been agreed to by all except some rural districts, which differed on the question of representation.

Proposed Extension of Existing Stations.

As regarded the technical side of the scheme, there was a difference of opinion between the corporations and the power companies as to the most economical way of generation. The scheme provided for a standard frequency of 50 cycles, main transmission at 33 000 V and secondary transmission at 11 000 and 6 600 V respectively. Generating stations existing or in course of construction at the following places would continue to be utilised :—Nottingham, Leicester, Derby, Burton and Spondon. The Nottingham station (a new one just commenced by the installation of a plant of 30 000 kW in three units of 10 000 kW each) was proposed to be enlarged to 200 000 kW ; Leicester (a new station just opened) to 50 000 kW ; Derby to 40 000 kW ; Burton to 30 000 kW ; and Spondon to 40 000 kW. A new station would possibly be erected at Newark. The main transmission lines would be partly overhead on steel towers and poles, and partly lead-covered, paper-insulated cables, armoured and laid direct in the ground. Secondary mains for distributing would also be partly overhead on poles and partly underground cables.

Stations to be Dispensed With.

The following generating stations would not be further extended and would cease to be utilised as such as soon as other supplies became available at rates justifying the shutting down of the stations in question, viz. :—Loughborough, Mansfield, Melton Mowbray, Long Eaton and Ilkeston. In order to make effective use of the generating stations to be retained and under construction, and to supplement existing interconnecting cables, main transmission lines would be laid. The general feeling of the conference was that the way in which the district would be and ought to be developed was by pushing out from each of the present centres, until the mains so pushed out got near enough to form interconnections between generating stations. The scheme of control of interconnected generating stations should be prepared by the Engineer's Advisory Sub-Committee for approval by the full committee, and should be submitted by the committee to the Commissioners for approval.

The proceedings were adjourned.

Improvements at Lots Road.

New Turbo-Alternator and Other Extensions.

In connection with the tube extensions now in hand, the London Electric Railway Co. have placed a contract for a new 15 000 kW turbo-alternator for their central generating station at Lots Road, Chelsea. The turbines are to be constructed by C. A. Parsons and Co., and the alternator by the Metropolitan-Vickers Electrical Co.

The value of these contracts is £53 000, but this amount does not include the cost of the additional condensing plant. The contract for this has still to be placed. Other improvements now being made at Chelsea include the replacing of the cast iron cylinders of the existing turbines with steel cylinders.

It is stated that the total cost of the extensions and new equipment will exceed £100 000.

Registration of Electrical Contractors.

A voluntary scheme of registration of electrical contractors has been approved by a Committee set up by the Institution of Electrical Engineers, and invitations have been issued to the constituent bodies of this Committee, as under, to nominate representatives should they desire to be represented on the Registration Authority :—The Institution of Electrical Engineers, the Electrical Contractors' Association (Inc.), including N. Ireland, the E.C.A. of Scotland, the Electrical Contractors of the Irish Free State, Royal Institution of British Architects, Provincial Electric Supply Committee of the United Kingdom, Incorporated Municipal Electrical Association, Incorporated Association of Electric Power Companies, Conference of Chief Officials of London Electric Supply Companies, Association of Consulting Engineers, British Electrical Development Association, B.E.A.M.A., Fire Offices Committee, Electrical Wholesalers Federation.

Imperial Notes.

Australia.

The Lord Mayor of Sydney has declined to recommend the City Council to rescind its decision to order 25 000 ELECTRICITY METERS from England and to endeavour to get the order placed with an Australian firm at a price 12½ per cent. higher.

AN EXHIBITION OF JAPANESE GOODS was opened in Sydney (N.S.W.) a few weeks ago. It was organised by the Osaka Commercial Museum, a Government Insti ution, which conducted a similar show in India last year. The articles shown included electrical apparatus and a wide range of other goods, all marked with prices either f.o.b. Osaka or c.i.f. Sydney.

The Victorian House of Assembly has adopted a Bill providing for the raising of a sum of £1 576 000 to be spent on the WORKS OF THE STATE ELECTRICITY COMMISSION. Included in the sum total are £760 000 for additions to the main scheme, power house, etc., at Yallourn (Morwell), £120 000 on extensions of the transmission line to the south-west of the State, £50 000 for the Sugarloaf hydro-electric scheme, and £70 000 for an electricity project in Gippsland beyond Morwell.—*Reuter.*

Canada.

The engineers who investigated the possibilities of electrification of the Temiskaming and Northern Ontario railway, which is the property of the Provincial Government and serves the silver and gold mining districts of Cobalt and the Porcupine, have reported in favour of the undertaking, says Reuter. They recommend the electrification of the main line from North Bay to Cochrane (252·3 miles), of the Iroquois Falls sub-division (7 miles), and the Porcupine sub-division (33·1 miles) as providing a sound and self-supporting investment for capital funds of the Province in a further development of Northern Ontario. The estimated cost of the project is 11 215 000 dollars. The commission operating the system for the Government, however, will have further investigation made before starting work on the scheme. As a first step the Government will acquire a title to the undeveloped water power of several rivers along the route of the railway.

Straits Settlements.

An advance party of the Shanghai Tramway Co. has arrived in Singapore in connection with the TAKING OVER OF THE SINGAPORE TRAMS by that body. Nothing has been officially announced, but from a semi-official source it is understood that the whole system is to be changed to railless traction. This is probable, as the tracks are in bad condition and the nature of the ground is not suitable for the present system.—*Reuter.*

Tasmania.

Howe and Simmons (H. and S. Electric Lighting Co.), 70, Charles Street, Launceston, have secured the contract to INSTAL ELECTRIC LIGHT and POWER in the new woollen mills of Kelsall and Kemp, Launceston. The order includes the fixing of 255 lights of approximately 20 000 c.p., and the installation of ten electric motors from 40 H.P. Nearly five miles of cable will be required.

The Tasmanian Premier and Minister of Works has circulated a statement regarding the progress of the Government's GREAT LAKE HYDRO-ELECTRIC SCHEME. This shows that the actual total capital expenditure to June 30th last on the works was £2 786 957. The department expects that by June 30th, 1926, the total capital invested in the scheme will amount to £3 100 000. For the year 1922-23 it is estimated that the demand for power will be 46 450 H.P., with a saleable surplus of 10 080 H.P., while for 1925-26 it is estimated that the demand will be 52 750 H.P. and the saleable surplus 3 700 H.P. The Ministry entirely concurs in the General Manager's recommendation that the Upper Shannon portion of the Great Lake scheme should be put in hand immediately. This is expected to make available an additional 13 000 H.P., at a cost of £400 000.—*Reuter.*

Foreign Notes.

Argentina.

A HYDRO-ELECTRIC POWER STATION is to be erected at Belgrano under a concession granted by the Government of the Province of Córdoba to Senor Carlos Martinez. It is intended to supply electricity for light and power to the townships of Arguello, Belgrano and Tablada. Contracts for the machinery have already been placed.

China.

Mr. E. H. Berry, 3A, Mongkashaw Gardens, Shanghai, China, Consulting Electrical Engineer, informs us that he will be glad to receive literature relating to NEW ELECTRICAL GOODS, and, where possible, samples of the goods themselves. Anything novel, he states, is jumped at by the Chinese, and electric lighting is installed in places where one would expect to find nothing better than home-made tallow candles.

Spain.

Investigations by the Spanish Mines Department show that a large quantity of fuel is available in the Alhama lignite basin (Murcia). It is intended, says Reuter, to erect ELECTRICITY WORKS on the spot in order to use the lignite according to the American pulverisation method instead of by distillation, to which it does not lend itself.

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Electricity Supply.

Extensions and Developments.

A new 4 000 kW turbo-alternator was put into service at PORTSMOUTH last week.

GRIMSBY Electricity Committee is considering plant extensions at the electricity works at an estimated cost of £75 000.

A scheme for the extension of MARYLEBONE's electricity undertaking at an estimated cost of £300 000, was to have been considered by the Borough Council on January 18th, but was adjourned until a subsequent meeting.

LANCASTER Town Council has decided to purchase from the Disposal Board the power station, land, and specified electrical plant of the National Projectile Factory, Lancaster, at a cost of £30 000, as part of the scheme to supply electricity to the Lancaster, Morecambe, and Heysham area.

The CLYDE VALLEY ELECTRIC POWER Co. has just completed an important addition to its system of power mains which form a network throughout the industrial area of the West. The new line extends from Caldercruix to the vicinity of the Kirk of Shotts, a distance of almost four miles. It passes through a district which contains a large amount of undeveloped mineral wealth.

Loans Applied for and Sanctioned.

The Electricity Commissioners have sanctioned a loan of £10 000 at WILLESDEN for service lines.

EXETER is applying to the Electricity Commissioners for sanction to borrow £10 000 for mains, etc.

FAVERSHAM has borrowed £11 524 from the National Deposit Friendly Society for plant at the electric light works.

HASTINGS Town Council has applied to the Electricity Commissioners for loans of £10 000 for house services, and £1 000 for meters.

BASINGSTOKE Town Council is applying to the Electricity Commissioners for sanction to borrow £1 734 for defraying the cost of the proposed electricity extension to Sherborne St. John.

Alterations in Charges, Proposed and Actual.

EXETER Electricity Committee is recommending that charges for lighting, power and heating be reduced to 62½ per cent. above pre-war rates.

Dissatisfaction is expressed because of the high charges for electricity in BRECHIN. The Commissioners are to hold an inquiry into the matter on February 1st.

A reduction in the charges for electricity has been agreed upon by the ASHTON Corporation. The charges represent a reduction of ½d. to 1½d. per kWh, and are equivalent to £7 600 per annum.

LIVERPOOL Lighting Sub-Committee will shortly be asked to consider the question of making a substantial reduction in the charge for electricity supplied for shopkeepers for the purpose of shop window lighting for advertising purposes in cases where the lights are kept burning after closing hours.

The following motion was down to be moved at a meeting of the HACKNEY Borough Council on January 24th: "That it be referred to the Electricity Committee to consider and report as to whether or not it is possible further to reduce the prices charged for electricity for domestic and industrial purposes."

The North Metropolitan Electric Power Supply Co., has applied to the Electricity Commissioners for an order altering the maximum charges for electricity at WARE to a flat rate of 10d. per kWh for lighting, or for the equivalent of the first 100 hours' use per quarter of the maximum demand, 1s. per ½kWh and 4d. per kWh beyond.

Charges have been reduced by the St. James's and Pall Mall Electric Light Co. (LONDON) as follows:—Lighting—for the first 4 000 kWh consumed per annum, 6d. per kWh; for all consumption in excess of 4 000 kWh per annum, 4½d. per kWh; minimum charge 10s. per quarter. Power—1½d. per kWh, with a fixed charge of 9s. per rated H.P. per quarter. Heating—1½d. per kWh.

Tapping New Areas.

Electricity is to be used for street lighting at BOCKING, Essex.

LOCKERBIE Town Council Gas Committee is to consider an electricity scheme for the burgh.

It is hoped to supply electricity for lighting to HAYWARDS HEATH in about six months' time.

The area served by the GUERNSEY Electric Light and Power Co. is being considerably extended.

TRURO Town Council on January 17th approved an electric lighting scheme arranged with the Cornwall Electric Power Co.

Representatives of Crompton and Co. and Edmundson's Electricity Corporation have been asked to attend a special meeting of SHERBORNE Urban Council with reference to electric light for the town.

SOUTHAMPTON Town Council has, by 42 votes to 10, decided to apply to the Electricity Commissioners for a Special Order authorising the Corporation to supply electricity within the area of the Eastleigh and Bishopstoke Urban Council.

BRADFORD-ON-AVON Rural Council has decided to support the application of the Western Electricity Distribution Corporation for powers to supply electricity to parishes in the area of the Council. The Corporation proposes to obtain electricity in bulk from Bath.

TICEHURST Rural Council has referred to the Clerk a letter from the Parish Council relative to a proposal that electricity should be obtained from the Tunbridge Wells Corporation for Frant, Wadhurst and Ticehurst. It is proposed that a company should be formed to obtain electricity from Tunbridge Wells, and that the Council should guarantee a portion of the capital.

The Rushden and District Electric Supply Co., Ltd., is applying for a special order to extend the area of supply so as to include certain parishes in the North and North-West of BEDFORDSHIRE and a boundary line between the proposed areas of supply of the Bedford Corporation and the company has provisionally been agreed. Negotiations are proceeding for the supply of electricity in bulk to Biggleswade Urban Council, and the Bedford Town Council has included in its area 36 parishes in respect of which a Special Order is being applied for.

Miscellaneous Supply Items.

EPSOM Urban Council has entered into an agreement to supply electricity for five years to the station of the London and South Western Railway Co. at a flat rate of 4d. per kWh, with a minimum annual consumption of 4 000 kWh.

An "All-Electric" house has been erected in Northumberland Avenue, Gosforth, for the NEWCASTLE-ON-TYNE Electric Supply Co. It is filled with the latest electrical labour-saving appliances, and is open to the public every day from 2 p.m. to 8 p.m.

The cost of the Electrical Exhibition held by STOKE NEWINGTON Borough Council in October last was £140. Thirty-seven inquiries were received for cookers, and nine application forms for supply were signed. The number of kWh generated at the works has increased 16 per cent. since the Exhibition was held.

The London, Midland and Scottish Railway Co. is to take over the generating plant of HIGHTOWN (S.W. Lancs) Council. The Formby Council has accepted the company's offer to supply electricity for domestic use and street lighting, and a similar arrangement has now been made with Hightown. To the local lighting authority, the Little Crosby Urban District Council, is reserved the right to absorb the undertaking at any time by giving six months' notice.

Hydro-Electric Supply for Dublin.

Detailed Report by Swiss Engineer.

A Swiss engineer, Mr. Buchi, has submitted a report to the Dublin Corporation on the proposal to develop the water-power of the Liffey to supply the city with electricity. His suggestions are that:

(1) A storage reservoir be formed above Poulaphouca by constructing a masonry dam with a maximum height of 100 ft. across the gorge, giving an area of 4·7 sq. miles.

(2) That a power station be built above Ballymore-Eustace with a working capacity of 12 000 kW, and an annual output capacity of 28 600 000 kWh.

(3) That a small storage reservoir be made above Leixlip by constructing a dam across the narrow river valley.

(4) That a power station be built at Leixlip with a working capacity of 7 200 kW, and an annual output capacity of 17 500 000 kWh.

(5) That two overhead transmission lines, working at 50 000 V be run from Ballymore to a transformer house at Dolphin's Barn. One line will run direct along the Blessington road and the other will make a detour *via* Leixlip.

(6) That existing steam stations be used for peak and emergency loads.

The proposed works (on a twice pre-war price basis) are estimated to cost—Ballymore works, with reservoir, £740 000; Leixlip works, £270 000; Transmission line, £120 000; making a total of £1 130 000.

The cost per kWh delivered from transformers at Dolphin's Barn (including capital and running charges), when the scheme is being fully utilised, is estimated at—Water-power alone, 41 500 000 kWh—0.57d. per kWh. Water-power plus steam (for peak load), 51 000 000 kWh—0.74d. per kWh.

The present maximum load is 15 000 kW, and this is expected to increase to 22 500 in ten years.

The land required is mostly uncultivated, and power if necessary should be given to acquire it compulsorily.

The figures are definitely put forward as being approximate, and the development will depend on the political situation. The proposition is described as attractive.

Stainless Steel.

Material of which Turbine Blades are Made.

Lecturing before the SOCIETY OF GLASS TECHNOLOGY at Sheffield last week, Dr. W. H. Hatfield, head of the Brown-Firth Research Laboratories, outlined some of the advantages resulting from the use of stainless steel in engineering. Turbine blades, he said, had been successfully turned from it, and in this case the steel was brought into contact with steam at high temperatures. He showed pieces of turbine blades that had been in use eighteen months and still retained their properties. These he compared to blades of ordinary nickel steel which lost so much material that they had ceased to function properly. Practically all the turbine manufacturers had adopted stainless steel as being the most effective material for the manufacture of blades.

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Wireless News.

F.B.I. Urges Development by Private Enterprise.

The following resolution has been passed by a special committee of the Federation of British Industries, set up to consider the question of wireless communications.

"This committee urge his Majesty's Government immediately to grant facilities for the rapid development of long-distance wireless communication, and are strongly of opinion that this would be best accomplished by means of private enterprise."

A copy of the resolution has been sent to the Prime Minister and to Mr. Amery, the chairman of the Imperial Communications Committee.

The special committee of the Federation was composed as follows:—Sir E. Fitzjohn Oldham (chairman) (United Glass Bottle Manufacturers), Mr. D. A. Bremner (British Engineers' Association), Mr. James Halliday (Francis Morton and Co.), Mr. W. Turner MacLellan (P. and W. MacLellan), Sir Edgar Sanders (Lever Brothers), Mr. W. Skelsey (Cox Bros. and Skelsey), Sir George Sutton (W. T. Henley's Telegraph Works Co.), and Mr. W. J. U. Woolcock (Association of British Chemical Manufacturers).

The Federation feels that it is urgent that a definite decision should be taken as to the future of the wireless industry in this country. It holds that a system of cheap wireless communications is essential to the trade of the country, and that it cannot be developed if the delay which has already occurred is allowed to continue.

Prevention of Static Interference.

Prevention of STATIC INTERFERENCE IN THE RECEPTION OF RADIO SIGNALS has been solved, it is stated, by an invention of Dr. B. Galen McCaa, of Ephrata, near Lancaster, Pa., U.S.A. Two different systems have been developed, and in California this summer a static of 6 000 audibility was reduced to five, at which time commercial signals were received at 250 times the strength of the static. The second system has produced results superior to those obtained in California. Tests have been made with the latest scheme at 360 m., on which a broadcasting system is operated, and it is known that the device will operate on all radio systems at any wavelengths. The latest device is free from critical adjustments, and is absolutely stable in operation, requiring no attention. The fact that it operates on an aerial makes it applicable for use on ships at sea, and becomes another important factor in life-saving by assuring absolute communication between vessels in conditions in which they cannot now operate.

Wireless in Panama.

An attempt has been made to introduce on the Isthmus of Panama the practice of sending and receiving wireless messages by private individuals, and an association known as the PANAMA RADIO CLUB has been formed. So far its efforts to secure a broadcasting service have failed owing to the confusion caused to the naval radio stations, which have led to official intervention on the part of the United States Government and a consequent cessation of all private activities, at least for the time being; but in his recent message to the National Assembly the President pleads for a revision of the rules allowing to the United States supreme control of wireless installations in the Republic of Panama.

Miscellaneous Wireless Items.

An American company intends shortly to inaugurate a radiophone broadcasting service in SHANGHAI.

Direct wireless telegraphic communication between HOLLAND and the EAST INDIES was established last week by the new Dutch wireless station at Kootwyk with the Dutch East Indian station at Malabar.

The "Proceedings of the RADIO CLUB OF AMERICA," Vol. 2, No. 7, contains a full report of a paper on "Vacuum Tube Amplification," read before the Club on December 1st last by Mr. S. E. Anderson, engineer, Western Electric Co.

Leyland Motors Athletic Club are contemplating installing a WIRELESS SET in their clubhouse for the benefit of members. With this end in view they have had two demonstrations, one by the Western Electric Co., Manchester, and the other by the General Electric Co., Manchester.

The Post Office authorities intimate that holders of broadcasting receiving licences MUST NOT MOVE THEIR RECEIVING INSTRUMENTS from place to place. The licences are issued only in respect of one address, and movement is permitted only to agents of wireless firms, bona-fide lecturers and demonstrators.

Commercial WIRELESS COMMUNICATION BETWEEN THE UNITED STATES AND CHINA has now been established, says Reuter. The Federal Telegraph Co. has announced that a station at Hillsboro, Oregon, working on 8 400 m. is being heard regularly at Shanghai, where the company has erected an experimental station.

As a result of the installation of a new valve transmitter, the wireless station at BERGEN has repeatedly been in communication with American stations, whose signals have been distinctly heard. The Bergen station has also been equally successful in transmitting replies, the American stations reporting that the signals were very distinct.

Manchester Licensing Justices decided that a music licence is necessary where LISTENING-IN SETS ARE IN OPERATION ON LICENSED PREMISES, but that where houses held music licences listening-in during the hours in which music is permitted is quite legal. Houses not licensed for music must be licensed before listening-in to music of any kind can be legalised.

The French postal authorities have arranged for the sending from French post offices of "WIRELESS LETTERS" to the French Colonies and a number of foreign countries at rates very much below the existing cable charges. The object of this innovation is largely to secure for France a greater share of the overseas traffic which is now going to foreign cables, as well as to improve communication with the colonies. Wireless letters will be sent by post to and from the nearest wireless transmitting and receiving stations.

Lecturing recently to the Montreal Rotary Club, Mr. A. H. Morse, managing director of the Marconi Wireless Telegraph Co. of Canada, drew attention to the descriptive references to their own cities used by ANNOUNCING OFFICIALS AT UNITED STATES BROADCASTING STATIONS. Davenport (Iowa) was always referred to as "Where the West Begins," and Minneapolis as "The Pearl of the North." Mr. Morse suggested that it would be a good plan if Montreal announcers used some similar term to indicate the charms of their city. Any such descriptive slogan, however, should first receive the formal approval of the civic authorities.

Books Received.

"The Elementary Principles of Lighting and Photometry." By John W. T. Walsh. (London: Methuen and Co.). Pp. xvi+220 10s. 6d. net.

"Terrestrial Magnetism." Results of Magnetic Observations made by the United States Coast and Geodetic Survey in 1921. By D. L. Hazard. Issued by the Department of Commerce U.S. Coast and Geodetic Survey. (Washington: Government Printing Office). 5 cents. Serial No. 205.

"Twelfth Annual Report by the Director of the Bureau of Mines for the Fiscal Year ended June 30th. Issued by the Department of the Interior. (Washington: Government Printing Office).

"Mesothorium." By Herman Schlundt. Issued by the Department of the Interior, Bureau of Mines. (Washington: Government Printing Office). Technical Paper 265.

"Science Abstracts." Sections A. and B, Vol. 25, Part 12. December 30th, 1922. Issued by the Institution of Electrical Engineers, London. (London: E. and F. N. Spon).

"Mechanical World Year Book, 1923." (Manchester: Emmott and Co.). Pp. 348. 1s. 6d. net.

"Pitman's Radio Year Book, 1923." (London: Sir Isaac Pitman and Sons). Pp. 146. 1s. 6d. net.

Barnett House Papers No. 7. "Scientific Management and the Engineering Situation." Sidney Ball Memorial Lecture. By Sir William Ashley. (London: Humphrey Milford. Oxford University Press). Pp. 28. 1s.

"Metal Turning Made Easy." (London: Cassell and Co.). Pp. 152. 1s. 6d. net.

"The Golden Hammer and Other Engineering Stories." By A. W. Marshall. (London: Percival Marshall and Co.) Pp. 188. 3s. 6d. net.

"Telephone Erection and Maintenance." By H. G. White. (Third Edition.) (London: S. Rentell and Co.) Pp. 144. 3s. 6d. net.

"Text Book on Wireless Telegraphy. Vol. II.: Valves and Valve Apparatus." By Rupert Stanley. (Second Edition.) (London: Longmans, Green and Co.) Pp. 394. 15s. net.

"If Britain is to Live." By Norman Angell. (London: Nisbet and Co.) Pp. 128. 2s. 6d. net.

Two Useful Year-Books.

Pitman's Radio Year-Book for 1923, which is published by the firm of that name at 1s. 6d. net, should be in the hands of all those interested in broadcasting. It is divided into three sections. The first contains general information and data; the second a number of special articles on technical matters by well-known contributors; and the third is made up of commercial details which are likely to be useful to users, manufacturers and suppliers of wireless apparatus. To those who do not clearly understand what the rights and privileges of "broadcasters" are, we specially commend Mr. E. H. Shaughnessy's article. A short bibliography would be an advantage, and might be added in the next edition.

* * * *

The "Mechanical World" Year-Book, which is published by Emmott and Co., at 1s. 6d. net, has now reached its thirty-sixth year. It is a companion to the Electrical Year-Book issued by the same firm, and contains much useful information.

An employee of Metropolitan-Vickers Electrical Co. was at Manchester last week sent to prison for a month for STEALING A WIRELESS RECEIVING SET and amplifier from the firm.

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Electric Traction.

Two Profitable Tramway Undertakings.

The annual estimates of revenue and expenditure of the HULL Corporation Tramways for 1922–23 were presented at a meeting of the Committee on January 22nd. The net profit for the financial year 1921–22 was £43 020. The estimated revenue of the current year, 1922–23, is put at £329 300; the expenditure at £300 913; leaving a profit of £28 387. Mr. Rayne, the general manager and engineer, said that although the revenue last year was down approximately £16 000, they were able to show a profit of £43 000. The greater portion of this profit had been secured by decreased expenditure on track renewals, etc. There was an impression that much of the profit was due to the reductions in wages, but that was not so, as those reductions only accounted for £5 164. It was estimated that during the next two years it would be necessary to spend £240 000 on the renewal of track, at the end of which period it would be practically in as good a state as it had ever been. It was proposed to borrow £100 000 of the £240 000, and much of the balance would be taken out of reserve.

A satisfactory position is also disclosed at CARDIFF, where the Corporation tramways made a profit of £21 855 for the nine months ended December 31st. The statement was presented to the Tramways Committee on January 19th. Traffic receipts for the period amounted to £208 369, parcel service receipts £696, advertising on cars £2 526. Traffic expenses amounted to £89 933, parcel service £501, general expenses £18 567, general repairs £37 391, and insurance fund £1 562. The balance to net revenue account was £58 111; loan charges amounted to £42 716; income tax £7 851; and the sum of £21 855 represented the balance, being excess of income over expenditure.

Fare Reduction Proposals.

A reduction in tram fares is being urged at ACCRINGTON. The principal modification needed is the introduction of a penny fare.

BURNLEY Corporation General Purposes Committee has decided to recommend that the question of reduced fares be deferred for three months.

LEEDS Tramways Committee has again considered fare reductions, and is recommending to the City Council to make a reduction of ½d. per mile (excluding the first penny fare) on all ordinary fares. With regard to workmen's fares, it was decided to abolish the penny return ticket. It is recommended that children's fares be half the ordinary fares. If these proposals are approved they will come into effect on March 1st. It is estimated that revenue will be reduced by 11 per cent., or £104 000. This sum, however, would be reduced approximately to £80 000 by an increase of 3 per cent. in the number of passengers carried.

Tramway Extensions and Developments.

Schemes involving the construction of about half a dozen miles of new track are being mooted at LEEDS.

It is expected that the new tramway route between HUDDERSFIELD and BRIGHOUSE will be opened in March.

BELFAST Rural Council has consented to the extension of the City tramway system to Whitehouse, as proposed in the Corporation Bill.

By the agreed reduction (20 per cent.) in the assessment of BURNLEY tramways track, the department will save about £1 400 a year in rates.

LONDON tramways under "Underground" control earned £37 309 in the week ending January 13th, as against £40 100 in the corresponding week last year.

The whole of the administrative staff of the LONDON COUNTY COUNCIL tramways is to be accommodated in the old Education Offices, Victoria Embankment, pending constructional work at the County Hall.

Electric Railway Items.

Interpreters will be employed this summer on the LONDON "Underground."

JARROW Town Council is supporting the action of neighbouring authorities in urging the electrification of the Newcastle and South Shields railway.

The general manager of the London, Midland, and Scottish Railway Company has intimated to Hackney Borough Council that there is no intention on the part of the company at present to electrify the NORTH LONDON RAILWAY line from Broad Street to Poplar, but the question will not be lost sight of.

EPSOM Urban Council is to ask the local authorities between Croydon and Guildford, and Wimbledon and Dorking if they will appoint representatives to attend a conference to discuss the advisability of making joint representation to the railway authorities in favour of the prompt electrification by a single system of the line between the towns mentioned?

The third annual general meeting of the BRITISH ELECTRICAL DEVELOPMEBT ASSOCIATION INCORPORATED, will be held at the Hotel Cecil, W.C.2, on Friday, March 16th, at 12.0 noon, and will be followed by the annual luncheon at 1.0 p.m.

Municipal Electricity Accounts.

Details for Year Ended March 31st, 1922.

Further details of the accounts of various municipal electricity undertakings for the year ended March 31st, 1922, are given below. In every case the undertaking more than paid its way, and at BRISTOL a large contribution was set aside for the relief of the rates.

A Satisfactory Year at King's Lynn.

KING'S LYNN electricity undertaking had a successful year, being able to carry forward £3 922 as compared with £3 935 in the previous year. Income amounted to £17 760, and expenditure to £11 261, the gross profit being £6 499. £2 039 went in interest payments and £3 466 instalments of principal. The total of kWh generated was 959 359 as against 1 007 185 in 1921, which was a record year in the history of the undertaking. Consumption for private lighting showed an increase, but reduced sales for heating and public lighting account for the decrease in the total. Consumers numbered 1 228 as compared with 1 144 in the previous year.

Progress Maintained at Weymouth.

At WEYMOUTH also the total output was slightly less than in the previous year, amounting to 1 173 056 kWh as against 1 202 591. Income and expenses were both slightly higher at £29 467 and £22 810 respectively, leaving a gross profit of £6 657. Of this £1 321 went in interest and dividends and £3 387 in loan repayment and redemption fund, leaving a net profit to be carried to reserve of £1 949, as against £1 911 in the previous year.

Darlington's Double Record.

Reference has already been made to the gratifying year's working at DARLINGTON, for which Sir Charles Starmer, in presenting the Electricity Committee's report, claimed first place in the country with regard to cost of production and low selling charges. Last year the output was 10 million kWh, about two millions less than the previous year. The total income was £61 323 against £65 000, and the total cost was £57 000. After payment of interest and depreciation there was a surplus of £4 295 on the year's working. The price of electricity to consumers has been reduced to pre-War rates.

Bristol Undertaking's Big Contribution to Rates.

An excellent report was presented at BRISTOL, but users of electricity in the city may be inclined to grumble at the sum of £13 904 assigned for relief of the general district rate, thinking that charges might have been reduced during the year instead. Income for the year amounted to £345 139, and expenditure to £238 324, a gross profit of £106 815. Interest and dividends absorbed £34 242, redemption and sinking fund £41 312, new plant, etc., £12 700, rate relief £13 904, and £11 342 was carried forward. The number of consumers at March 31st, 1922, was 10 703, a net increase of 1 780 during the year. The number of kWh sold amounted to 37 079 702, an increase of 3 550 285. It may be noted that a correspondent of the "Bristol Evening News" on January 17th urged that the present charge of 2d. per kWh for heating in the city is too high.

Satisfactory Willesden Accounts.

Expenses at WILLESDEN for the year amounted to £74 112, and revenue to £101 967, a difference of £27 855. After paying interest on and instalments of loans, and other items, there remained a net profit on the year's working of £3 153. If to this is added the balance from the previous year's accounts (£10 874), there was a total available for carrying forward of £14 027. Sales amounted to 8 160 940 kWh as against 8 362 787 in the previous year. The number of consumers continued to increase, 588 new service cables being laid into premises during the year.

The Duke of York.

Visit to London Electric Wire Co. & Smith's, Ltd.

The DUKE OF YORK last week visited the factory of the London Electric Wire Co. and Smith's, Ltd., at Church Road, Lea Bridge Road, Leyton, in company with Mr. Robert R. Hyde, director of the Industrial Welfare Society. The Duke was received by Mr. Ernest Leete, managing director of the factory, and Mr. P. Hawke, works manager.

The Duke went first into the warehouse and inspected there various samples of the finished work turned out by the factory. He afterwards went into every one of the departments, and made a point of shaking hands with all the foremen and forewomen, and chatting with as many as possible of the workpeople, who number 800, and of whom about two-thirds are women and girls. He was very much interested in the various processes. First he saw the multiple winding of cotton intended for insulating the electric wire, and then passed in turn into the departments in which silk is wound for the same purpose, and yet another section where the wire is enamelled.

In all departments the Royal visitor asked many questions, explaining that he was anxious to see not only what work was done but the method of doing it and why it was done. In getting this information he relied largely upon the workpeople themselves, and was interested to learn that many of those with whom he conversed had upwards of forty years' service with the firm.

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Tenders Invited.

UNITED KINGDOM.

BELLE VUE CONSERVATIVE CLUB, WAKEFIELD. January 27th.—Electric light wiring and fitting. Particulars from the Steward.

ROCHFORD GUARDIANS, January 31st.—Steam plant, dynamo, switchboard, battery, and distribution system. Specifications, etc., from Christy Bros. and Co., Electrical Engineers, Chelmsford.

EASTBOURNE CORPORATION, February 10th.—Coal suction conveyor plant. Specifications from the Borough Electrical Engineer.

STOKE-ON-TRENT CORPORATION. February 7th.—Twelve months supply of a.c. and d.c. meters, also supply of two steam jet air pump equipments (contract 2 304 P) for two 1 500 kW turbine condensing plants. Specifications from the Borough Electrical Engineer, St. Peter's Chambers, Glebe Street, Stoke-on-Trent.

ILFORD URBAN DISTRICT COUNCIL. February 10th.—E.H.T. cables (section A), l.t. cables (section B), feeder pillars (section C), and stoneware ducts (section D). Specifications from Mr. Arthur H. Shaw, Electricity Works, Ley Street, Ilford.

LEEDS TRAMWAYS AND HIGHWAYS COMMITTEE, February 19th.—One year's supply of materials, including electrical sundries, engineers' furnishings, oils, paints, etc., and also for supplies of copper bonds and electrodes. Specifications from Mr. J. B. Hamilton, 1, Swinegate, Leeds.

AUSTRALIA.

MOUNT GAMBIER (SOUTH AUSTRALIA) CORPORATION, February 28th.—Supply of electricity in bulk to the Corporation, and supply of electrical energy for street lighting and to private consumers. Tenders to the Town Clerk, Mr. A. Shepherdson.—*Reuter's Trade Service.*

VICTORIAN RAILWAY COMMISSION, March 14th.*—25 dwarf electric signal mechanisms (contract 35 457).

SYDNEY (N.S.W.) CORPORATION, April 30th.—Protective apparatus for generating end of parallel feeders for Pyrmont power house.—*Reuter's Trade Service.*

VICTORIAN RAILWAY COMMISSION. March 28th.—Two sets of three-phase induction motors, with starting apparatus and accessories, for use on three-wire system at normal pressure of 440 V and periodicity of 50.—*Reuter's Trade Service.*

CHILE.

CHILEAN STATE RAILWAYS, February 10th.*—Air compressor, and three phase transformer. Tenders are to be presented in Paris.

CHILEAN STATE RAILWAYS, March 12th.*—Wire, copper, brass, lead, etc. (group 3). Packing, rubber goods, leather belting, etc (group 8). March 23rd.—Electric soldering, etc. (group 14). April 10th.—Electrical material (group 15). May 3rd.—Machinery and tools (group 12).

INDIA.

BENGAL-NAGPUR RAILWAY CO. February 2nd.—Fifteen-ton overhead electric travelling crane. Specification from the Company's offices, 132, Gresham House, Old Broad Street, London, E.C.2.

SOUTH AFRICA.

JOHANNESBURG CORPORATION, March 5th*—Tramcar spares.

CAPE TOWN CORPORATION. March 23rd.*—Two-phase oil-insulated, air-cooled induction voltage regulator, with tank operating gear and oil. The regulator is for use on 4-wire 2 450 V system, 50-periods. The regulator required for motor operation, the motor to work on 220 V d.c.

PORT ELIZABETH MUNICIPAL COUNCIL, April 16th.*—3 000 kW turbo-alternator (section A), boilers, coal hoppers, coal conveyors and boiler house (section B, part 1), steam and feed-water pipes, steam traps, etc. (section B, part 2).

NEW ZEALAND.

N.Z. POST AND TELEGRAPH DEPT., February 20th.*—3 000 switchboard plugs.

PUBLIC WORKS DEPARTMENT, WELLINGTON, February 27th.*—110 000 V insulators for the Mangahao electric power scheme (section 68).

PUBLIC WORKS DEPARTMENT, Wellington. March 20th.*—110 galvanised steel transmission line towers, with cross-arms, ground-stubs and accessories in connection with the Mangahao Electric Power Scheme (section 63). The towers are to carry two 3-phase 110 000 V lines. Eighty suspension type and thirty angle towers are required.

PUBLIC WORKS DEPARTMENT, WELLINGTON, March 27th.*—Lighting arresters (section 64) and 110 000 V switchgear for Mangahao power scheme.

WAIRARAPA ELECTRIC POWER BOARD, March 31st.—One 11 000 V switchboard. Particulars from the manager of the Board, Mr. F. H. Smith, Carterton, N.Z.—*Reuter's Trade Service.*

UNITED STATES.

SAN DIEGO ELECTRIC RAILWAY COMPANY.*—Steel rails, etc.

URUGUAY.

STATE ELECTRICITY WORKS, MONTEVIDEO, March 10th.*—66 000 metres (about 72 600 yards) h.t. cable and accessories.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO, March 15th.*—1 500 d.c. and 8 500 a.c. meters, and accessories.

* Particulars from the Department of Overseas Trade.

Tenders Accepted.

For the supply of cable to ILFORD URBAN COUNCIL the tender of the Hackbridge Cable Co., £625 3s. 4d., has been accepted.

For cables for the new Craigie sub-station, the tender of the Union Cable Co., at £734 17s., has been accepted by DUNDEE CORPORATION.

WEYMOUTH CORPORATION have accepted the tender of the Tudor Accumulator Co. for renewing a battery (exclusive of labour charges), at £116 6s.

The tender of the Windsor Electrical Installation Co. is recommended for acceptance by WORTHING CORPORATION for two motors and switchgear, £350.

The tender of Crompton and Co. has been accepted by SOUTHEND CORPORATION for a motor generator with accessories, for the Pier extension, at £344 13s. 6d.

The tenders of the D.P. Battery Co. and the Chloride Electrical Storage Co. for batteries for electric vehicles have been accepted by SUNDERLAND CORPORATION.

STAFFORD CORPORATION have accepted the tender of Callender's Cable and Construction Co. for supplying e.h.t. cable and laying same to Lotus factory at £3 435 4s. 9d.

The tender of the Pritchett and Gold and E.P.S. Company has been accepted by FAVERSHAM CORPORATION for renewing a battery at the electricity works, at £441 16s.

The tender of the Siemens and English Electric Lamp Co. has been accepted for six months' supply of electric lamps to the ABERDEEN LINE (Messrs. Geo. Thompson and Co.).

CHESTERFIELD CORPORATION have placed contracts with the Enfield-Ediswan Cable Co. for cable, £1 439, and the British Thomson-Houston Co. for a switch cubicle, £166 5s.

WEST HAM CORPORATION have accepted the tenders of G. and J. Weir for a feed pump, £690; British Thomson-Houston Co. for switchgear £1 396, and Herbert Morris, Ltd., for a crane, £2 449.

The tender of the Lancashire Dynamo and Motor Co., £675, is recommended for acceptance by HACKNEY (LONDON) COUNCIL, for the supply of two 5-wire 50 A balancers and a Kartret switchboard.

LONG EATON URBAN COUNCIL have accepted the following tenders: Tudor Accumulator Co., storage battery, £4 024 10s.; Electric Construction Co., booster, £926; Ferguson, Pailin Ltd., switchboard, £576.

DONCASTER CORPORATION have accepted the following tenders: Callender's Cable and Construction Co., cables, £1 361 5s.; Ferguson Pailin, Ltd., modification of high-pressure switch gear, £84 16s. Gwynnes Engineering Co., motors, switch gear and pumping machinery, for Holmes pumping station, £2 147.

The following tenders for service cables and l.t. mains are recommended for acceptance by HAMMERSMITH (LONDON) COUNCIL: Enfield Ediswan Cable Works, 2 500 yards 0·1 sq. in., £540, and 3 000 yards 0·05 sq. in., £448 10s.; Union Cable Co., 2 000 yards 0·3 sq. in. £952, and 3 000 yards 0·2 sq. in. £1 030. Eleven tenders were received.

TORQUAY CORPORATION have accepted the tender of the British Thomson-Houston Co. for converters for Newton Abbot power station and main substation at £6 177, and for the supply and laying of the cables required in connection with the new plant, at schedule rates. The accepted tender was the lowest comprising the whole of the material specified. Nine tenders were received.

The following tenders have been accepted by BRADFORD CORPORATION: National Rail and Tramway Appliances Co., 20 tons c.i. brake blocks, £240; Hadfields, Ltd., manganese steel crossings, £611; Hackbridge Electric Construction Co., two 300 kVA and two 600 kVA transformers; Metropolitan-Vickers Electrical Co., two 300 kVA transformers; British Electric Transformer Co., two 200 kVA transformers; English Electric Co., two 200 kVA transformers; Brush Electrical Engineering Co., two 250 kVA transformers.

MARYLEBONE (LONDON) BOROUGH COUNCIL are recommended by the Electric Supply Committee to accept the following tenders: (1) General Electric Co., Ltd., 12 500 kW turbo-alternator and condenser plant, £45 000, with Worthington-Simpson, Ltd., as sub-contractors for the condenser plant; (2) Ateliers de Construction Oerlikon, 12 500 kW turbo-alternator and condenser plant, £39 728, with Worthington-Simpson, Ltd., as sub-contractors for the condenser plant; (3) Babcock and Wilcox, two 60 000 lb., steel cased, marine boilers, including Underfeed Co.'s stokers, economisers, superheaters, mountings, steel chimneys, etc., £42 493; (4) Clyne Engineering Co., fan draught cooling tower and tank, £25 500; (5) Metropolitan-Vickers Electrical Co., 1 500 kW rotary converter, £5,549; General Electric Co., Ltd., three 2 000 kW rotary converters, £22 365. Recommendations (1) and (2) were put forward as alternatives for the Council's consideration. Twelve firms tendered for the turbo-alternator and condenser, the only German tender (£30 000) being considered unsuitable, as it included cast iron casing at high pressure end of turbine. The other tenders varied from £36 100 to £54 440. Seven tenders were received for the condenser alone from £12 750 to £14 185. For the boilers and stokers there were five tenders from £42 493 to £54 800; for the cooling tower and tank five tenders from £23 106 10s. to £26 025; and for the rotary converters ten tenders, the prices for the 1 500 kW machine ranging from £4 600 to £5 815, and for each of the 2 000 kW machines from £5 700 to £8 735.

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Shop Window Lighting.

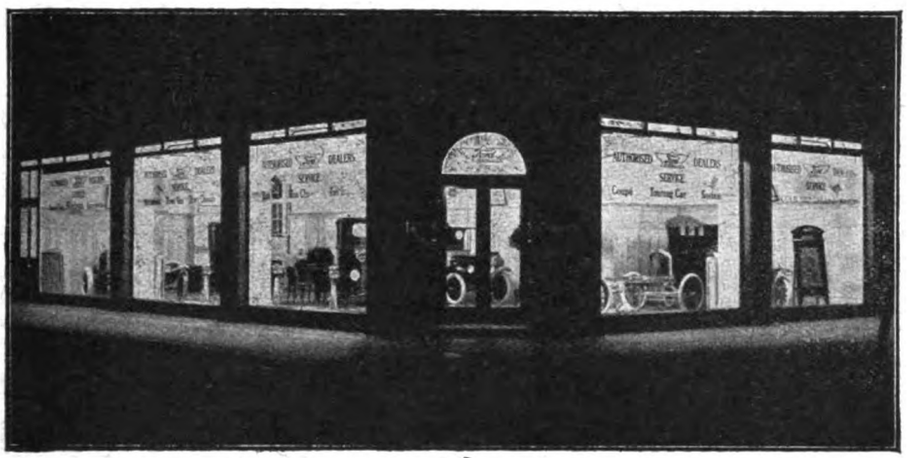
Colour Scheme Perfected by B.T.-H. Co.

Nobody will dispute the psychological value of coloured lighting. The only hindrance to its general adoption has been the lack of suitable apparatus. Hitherto, only makeshift methods such as the tinting of bulbs, etc., have been employed, and with admittedly poor results. Now, however, the BRITISH THOMSON-HOUSTON CO. have perfected a device whereby it is claimed the efficient illumination of shop windows by means of colour slides may be effected.

This device is the B.T.-H. X-Colour-Ray attachment, which is simple both in design and construction. The attachment consists of frame, slide and colour medium. The frame fits over a "Jove" or "Jupiter" X-Ray-reflector, and is attached to the reflector by means of four hooks which fix in the ventilation holes. The slide is made to hold the gelatine colour medium (the only medium that does not rapidly fade) supporting it by means of fine steel wires. Red, amber, blue and green are the standard colours provided, and the insertion or withdrawal of the slides is the work of a moment.

An important feature of the X-Colour-Ray attachment is that the colour of the lighting can be changed in a few seconds by the substitution of one slide for another. Thus, by keeping a few spare slides, the trader is able to alter the appearance of his display as often as he likes.

One of the latest and most effective installations of "X-Colour-Ray" lighting is in the windows of Wallace-Harmer Motors, Ltd., Kingsway. X-Ray reflectors equipped with Mazda gasfilled lamps and fitted with colour attachments are fixed at the top of the window behind the facia. The colours are changed frequently—an operation which only takes a few minutes; and it is thus possible to vary the night-time appearance of the display, without making any alterations in the material arrangements.



THE WALLACE-HARMER WINDOW WITH COLOUR LIGHTING.

The Future of British Trade.

Banker's Optimistic Views.

Amid a good deal of pessimism caused by the international situation it is a relief to find two well-known British bankers taking an optimistic view of the future of the country's trade.

Speaking at the annual general meeting of the Bank of Liverpool and Martin's, on Tuesday, MR. W. R. GLAZEBROOK said that last year the chief events in the money market had been a rapid reduction in the Bank rate and a continued rise in gilt edged investments. Though in the cotton industry manufacturers had not been able to sell at remunerative prices, in the woollen trade the position was more encouraging, while in modified form the same adjective might be applied to the coal trade, whose position would improve as the activities in the iron and steel industries became more manifest. Shipbuilding, rubber, wheat, and farming generally, had remained depressed, while timber had shown an improvement. From the observations he had made it might be inferred that the country was slowly recovering from the acute depression of 1921 and this was borne out by the recent comparative stability of prices and by the slight revival of export trade.

Greater Confidence Evident.

At the annual general meeting of Barclay's Bank on Tuesday Mr. FREDERICK GOODENOUGH remarked that there was a general feeling that we had reached the end of a very bad time and that we were entering upon a period of slow, but steady, improvement. There was greater confidence and as a consequence more orders were being placed.

The failure to bring about a settlement of the reparations problem still left the greater part of Europe in a condition of financial and political chaos and the Fordney Tariff Act recently passed in America might have a far-reaching effect on our trade by causing its diversion into new channels. It would serve to raise prices in America and hamper their industries.

Developing the Empire's Resources.

The effect of the tariff would be to compel us to seek new sources for the supply of foodstuffs and raw materials in our own Dominions and to cause the latter to send to America material they could not purchase themselves. In this way we could discharge our obligations to America and develop the Empire's resources. It was a reassuring prospect worthy of the ambitions and energies of our race. It would afford great opportunities for employment and an outlet to satisfy the natural desire for progress.

Municipal Contracts Going Abroad.

F.B.I. Letter to the Prime Minister.

In view of the present tendency for public contracts, both national and municipal, to be placed abroad, the Federation of British Industries has addressed a letter to the Prime Minister urging upon the Government the importance of placing public contracts in the United Kingdom. Work, it is pointed out, is thus provided for skilled men, who are not always provided for in unemployment relief schemes.

So far as questions of price and delivery are concerned, it is urged that British industry can now give earlier and more certain delivery than the majority of foreign manufacturers, while the differences in price have become substantially less, where they have not altogether disappeared.

The Federation are well aware, the letter continues, that public authorities may urge that they are custodians of public funds and thus bound, other things being equal, to expend those funds in the cheapest markets. In the case of municipal works, financed by loan, the burden on the rates caused by the necessity of raising the additional (and relatively small) sum required to cover any difference in price, is negligible, as it can be covered by a sinking fund payment spread over a period of years, and now that British prices are comparable with even the lowest foreign prices, this argument has lost much of its force.

Moral Effect on British Industry.

Even where foreign prices are still lower than British, the Federation are of opinion that the following considerations should be taken into serious account:—(1) Loss of prestige to British industry by the continued placing of orders abroad by British public authorities, persistence in such a course being likely to lead to the loss of many valuable foreign contracts which would otherwise have been secured by British firms. (2) The fact that the expenditure of public funds abroad means the direct importation of labour into a country where there is already a serious state of underemployment. The public authority, therefore, which places contracts abroad is paying double labour costs on the material purchased, since there is the labour cost abroad represented in the price of the materials and a second labour cost at home in the form of relief for the unemployed in this country. (3) The temporary advantage in competition conferred upon some foreign manufacturers by depreciated exchanges.

Dumfries Wants an Electrical Engineer.

But has Narrow Views as to His Salary.

DUMFRIES Town Council has now taken over the local electricity undertaking, and is looking for an electrical engineer. The question of the salary to be paid has been discussed, and one section of the Council wished to advertise the post at £450 a year, with free house, light and rates. It was eventually decided, however, to ask applicants to "state salary expected." One member of the Council thought it was a scandal and a disgrace to suggest that they were going to give the manager of a new department a salary (£450) which would be practically on a par with the salaries paid to other department managers who had been in the service of the Council for years. It is unlikely that the E.P.E.A. will agree with this sentiment, and the Association will doubtless keep its eye on the matter.

The Fire at Liberty's.

No Evidence that it was Due to any Electrical Fault.

The fire which took place on Saturday morning last at the premises of Liberty and Co., Argyle Street, London, W., was stated by certain newspapers to be due to "the supposed fusing of an electric wire" and "to a short circuit in the electric current used for the cranes."

Mr. J. W. Beauchamp, director of the B.E.D.A., informs us that after careful inquiry he finds that the fire originated at a point remote from the electrical work, and is generally believed to have originated in a mass of teak sawdust, possibly as a result of spontaneous combustion. A large amount of work in hardwood is being carried out on the site, and there are considerable accumulations of sawdust and shavings. An expert states that teak sawdust is very liable to spontaneous combustion. There was, he adds, no disturbance whatever on the electric supply system, or evidence to show that anything was wrong with the electrical gear.

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Companies' Meetings, Reports, etc.

Payment of the dividend on the preferred capital of the ENGLISH ELECTRIC CO. OF CANADA for the quarter ended December 31st has been postponed.

A final dividend at the rate of 7 per cent. per annum, making 5 per cent. for the year, has been declared by the DUBLIN UNITED TRAMWAYS. The final dividend for the preceding year was the same.

The following dividends are payable by MARCONI'S WIRELESS TELEGRAPH CO. on or after February 1st next :—7 per cent. on the cumulative participating preference shares, and an interim dividend of 5 per cent. on the ordinary shares.

The report of the UNITED PROVINCES ELECTRIC SUPPLY CO. (India) states that after writing off Rs.50 844, the amount remaining at the credit of profit and loss was Rs.92 929. A dividend of Rs.4 per share (8 per cent. per annum) free of tax was recommended, and Rs.37 085 was carried forward.

For the year ending December 31st, 1922, the LANARKSHIRE TRAMWAYS CO. made a net profit of £21 896, to which is added £2 183 brought forward. A dividend at the rate of 6¾ per cent. per annum for the half-year to December 31st is declared, and £1 801 carried forward. Revenue decreased by £32,163, and expenses by £35 962 as compared with 1921.

For the year ending October 31st, 1922, VULCANITE, LTD., made a trading loss of £4 269. To meet this £5 000 has been transferred from reserve, which makes, with the balance brought forward, after providing for income-tax and directors' fees, £7 267 available. After providing for the dividend on the 5 per cent. cumulative preference shares, the directors propose to write off the loss and carry forward £1 217.

For the year ended October 31st, 1922, the accounts of SUNDERLAND DISTRICT ELECTRIC TRAMWAYS, LTD., show a credit balance of £7 919, to which is added £928 brought in, making £8 847. After deducting interest payments on prior lien bonds and first mortgage debentures (£6 847) and sinking fund instalment (£500) there remains £1 500 to be carried forward. The directors are unable to recommend the payment of interest on the first and second income bonds, or any dividend to the shareholders.

The report of the EAST LONDON RAILWAY for 1922 shows that receipts totalled £82 624. Fifty-six per cent. of this amount gives the company £42 269 instead of the minimum rental of £30 000 per annum. This excess will be applied in reduction of interest accrued on the cost of electrifying the line. Last year application was made to the Railways Amalgamation Tribunal for compensation in respect of loss due to possession of the railway by the Crown during 1914–1921, and £133 367 was awarded. A scheme has been prepared by the directors for appropriation of this amount to holders of various classes of debenture stocks, and is now before the Court for its sanction and approval. Warrants for the six months' interest on £2¼ per cent. (Whitechapel extension), the First (3½ per cent.) and the Second Charge £4 per cent. Class A Debenture stocks, also for full interest for year on Second Charge £4 per cent. Debenture stock, Class B, were posted on December 30th.

New Companies.

YERA ELECTRICAL, LTD.—Private. Reg. Jan. 19th. Capital £100 in £1 shares. Electrical and general engineers, manufacturers of and agents for the sale of electrical and other fittings, etc. Reg. office : 104, High Holborn, London, W.C.1.

BRITISH OZONE APPLIANCES, LTD.—Private. Reg. January 17th. Cap. £2 000 in £10 shares. General, electrical and mechanical engineers and contractors, dealers in electrical apparatus, etc. Reg. office : 158, Norwood Road, London, S.E.27.

ELKAY ELECTRICAL MANUFACTURING CO., LTD.—Private. Reg. Jan. 17th. Capital, £1 000 in £1 shares. Manufacturers and repairers of and dealers in all kinds of electrical goods, etc. Registered office: 4, Southampton Row, London, W.C.1.

FRANK ROYLE, LTD.—Private. Reg. Jan. 19th. Capital £400 in £1 shares. To acquire the business of electrical and mechanical engineers carried on by F. L. Royle and G. Dane as " F. Royle and Co." in Liverpool. Reg. office :—39, Leeds Road, Liverpool.

AUTO-WELDING AND ENGINEERING CO., LTD.—Private. Reg. Jan. 13th. Capital £3 000 in £1 shares. Electrical and general welders, manufacturers of electric and other welding machinery, tools and general engineering plant, etc. Registered office ; 29A, Portpool Lane, London, W.C.1.

BELL'S RADIO AND ELECTRICAL CO., LTD.—Private. Reg. January 18th. Capital, £4 000 in £1 shares. To adopt an agreement with G. Bell, to acquire and turn to account the benefit of inventions connected with radio telegraphy and telephony, etc. Reg. office : 46, Blackett Street, Newcastle-on-Tyne.

BRITISH WIRELESS (1923), LTD.—Reg. in Edinburgh Jan. 16th. Capital, £7 000 in £1 shares (5 000 cumulative preference and 2 000 ordinary). To carry on business in Glasgow as wholesale agents, factors, warehousemen, makers and hirers of all kinds of scientific and electrical apparatus and appliances, etc. Registered office : 24, St. Vincent Place, Glasgow.

DRYCEL, LTD.—Private. Reg. January 17th. Capital, £2 500 in £1 shares. To acquire the business formerly carried on by Lyto, Ltd., at 172, Church Road, Mitcham, as manufacturers of and dealers in electric batteries ; also to acquire from W. H. Edridge a licence to manufacture electric batteries and in accordance with inventions of which he is the patentee. Registered office : 24, St. Mary Abbotts Terrace, Kensington, London, W.14.

BRITISH ARCA REGULATORS, LTD.—Private. Reg. Jan. 13th. Nom. cap., £60 000 in £1 shares. To acquire the rights for the British Empire in certain inventions relating to regulators or devices which prevent undesired or erratic variations of physical, mechanical or material conditions, and in particular patents No. 116 074 of 1919 and of 1920, and the British trade mark " Arca " ; to adopt an agreement with Aktiebolaget Arca Regulatorer, and to carry on either directly or by means of subsidiary companies the business of manufacturers of regulators, machinery, appliances, apparatus, accessories and fittings, mechanical, marine, electric and general engineers, etc. R. K. Morcom, Clock House, Bromsgrove, engineer, is a subscriber.

Business Items.

The telephone number of OLIVER PELL CONTROL, LTD., which company incorporates the Oliver Pell E. and M. Co., and the Varley Magnet Co., is now Woolwich 888.

The CHLORIDE ELECTRICAL STORAGE CO. are exhibiting " Exide " batteries on stand 206 at the Scottish Motor Exhibition which opens at Glasgow to-day (Friday). Mr. Donald Sinclair (Scottish representative), Mr. W. B. Thompson (North of England representative) and Mr. A. C. Stewart (service department) are to be on the stand.

A fire which occurred recently in the Ponders End Works of the Edison Swan Electric Co. served to show the robust qualities of the " Little Glutton " vacuum cleaner, which is manufactured by the Company. The machine illustrated was one of several stored in the building which was completely destroyed by the fire. This particular machine was subjected to sufficient heat to melt some of the metal parts, and to distort others ; in addition it was saturated by water. On its being placed on circuit it was found that the motor was in quite good running order, and the suction, as recorded on the water-gauge, had only decreased by half an inch from that originally recorded when the machine was new.

THE "LITTLE GLUTTON" AFTER THE FIRE.

MR. P. BAXTER, electrician, has removed his business from 29, Westgate, Grantham, to more central premises at 70, London Road.

MR. S. C. FRANKLIN has commenced business as a dealer in wireless apparatus, electrical fittings, etc., at Westminster Buildings, 2, Westminster Drive, West Cliff, Southend-on-Sea.

A business man at Geneva is desirous of being placed in touch with United Kingdom MANUFACTURERS OF ELECTRIC FITTINGS, with a view to undertaking their representation. He states that he is prepared to correspond either in French or English, and claims to cover the whole of Switzerland in the course of the year. He asks for a commission of 10 per cent., and a contribution towards travelling expenses. Particulars from the Department of Overseas Trade, quoting reference D.O.T. 17741/F.W./G.C.

Robson and Coleman's Social Evening.

At the invitation of Mr. Robson, of Robson and Coleman, Newcastle-upon-Tyne, the staff and employees with their wives, to the number of 130, held their annual social evening on January 19th at the Minories Assembly Rooms. Whist was played from 7 p.m. to 9.30 p.m., after which supper was served.

During the interval Mrs. Robson presented the prizes to the successful players and Mr. Robson also presented prizes to the students who had obtained the best results in the evening technical classes. After supper, dancing and a second whist drive prolonged the proceedings until 1 a.m. Mrs. Lowrey presented the prizes for the second whist drive. At the close a vote of thanks to Mr. and Mrs. Robson was heartily carried with musical honours.

Representatives of the Western nations of Europe are being invited by the French Government to take part in a departmental conference to consider a scheme for the LINKING-UP OF EUROPE BY TELEPHONE. The plan involves communication between England, France, Belgium, Switzerland, Italy, Spain, and Portugal. The Conference will deal with the purely technical matters which it is necessary to settle in preparation for an administrative conference, at which all the points of international policy and the methods of handling the system in an international sense can be developed.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

BARNETT (B.) (ELECTRICAL ENGINEERS), LTD., Whitechapel Road, electrical engineers. £35 2s. 5d. December 1st.

DUNN, Mr. A. E. (late trading as DUNN AND CO.), Birdlip Place, Bath Road, Cheltenham, electrical engineer. £12 9s. 11d. December 8th.

HEWITT, Mr. T., 424, Cheetham Hill Road, Manchester, master electrical engineer. £28 14s. 10d. November 25th.

JACKSON, Percy, 72A, Oldham Road, Failsworth, electrical contractor. £13 15s. December 9th.

NORTHERN CLEARING HOUSE CO., Jenkinson Street, Booth Street West, All Saints, Manchester, electrical engineers. £15 14s. 7d, November 28th; and £18 7s. 8d., December 5th.

SLATER BROTHERS, 25, Dickenson Street, Manchester, electrical engineers. £26 9s. 6d. November 29th.

Receivership.

ELCO ELECTRIC MANUFACTURING CO., LTD. J. P. Emett, of Gresham Chambers, 18, Nicholas Street, Bristol, was appointed receiver and manager on January 11th, 1923, under powers contained in debentures dated June 12th, 1922.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

BEUTTELL (A. W.), LTD., London, E.C., electrical engineers.—Registered January 12th, £674 2s. 11d. debenture, to A. W. Beuttell, George and Dragon Hotel, Cosham, electrical engineer; general charge. *Nil. September 22nd, 1921.

MIDLAND ELECTRIC LIGHT AND POWER CO., LTD., London, E.C.—Registered January 12th, £4 000 debentures, part of £20 000; general charge. *£30 000. March 8th, 1922.

Satisfactions.

MUSSELBURGH AND DISTRICT ELECTRIC LIGHT AND TRACTION CO., LTD., London, E.C.—Satisfaction registered January 11th, £1 100, part of amount registered November 30th, 1905, and May 12th, 1909.

SLOUGH AND DISTRICT ELECTRIC SUPPLY CO., LTD. Satisfaction registered January 13th, all moneys, etc., registered July 24th, 1919, and March 29th, 1921.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

GROOME, (J. A.), electrician, 17, Windsor Road, Willesden Green, London, N.W. A meeting of the creditors of the above was held recently at the offices of Messrs. Wrigley, Lord and Cregan, C.A., 4, Copthall Buildings, London, E.C. In the circular calling the meeting it was stated that the debtor had executed a deed of assignment which provided for a composition being paid to the creditors. Mr. H. Cregan, the trustee under the deed, stated that the liabilities, as far as could be ascertained, amounted to £650, while there were also preferential claims totalling £118. The assets were estimated to realise £353. The debtor commenced trading some two to three years ago with a small capital, but money was lent to him by a creditor who now appeared for £99. After discussing the position a resolution was passed in favour of the meeting being adjourned for 14 days in order to allow the debtor to find guarantors for a sum sufficient to pay a composition of 10s. in the £.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Companies Winding-up.

THE ASSOCIATED ELECTRIC TRADERS, LTD.—Meeting of creditors, February 1st, 11.30 a.m.; and contributories, February 1st, 12.0 noon; 33, Carey Street, Lincoln's Inn, London, W.C.2.

THE MODERN ELECTRICAL SUPPLY CO., LTD., 7 and 9, Whitecross Place, Wilson Street, Finsbury Square, London, E.C.2. Date of order, January 16th.

Company Winding Up Voluntarily.

HARRIS ELECTRO METALS CO., LTD.—B. L. Peace, 27, Slaithwaite Road, Thornhill Lees, Dewsbury, commercial clerk, appointed liquidator. Meeting of creditors at the offices of Messrs. Clough and Crabtree, solicitors, 1, Northgate, Cleckheaton, on Wednesday, January 31st, 1923, at 11 a.m.

Bankruptcy Information.

EMBURY, Henry John William, and EMBURY, Kenneth Stuart (trading as H. AND K. EMBURY), 110, Queen Street, and 29, Queen Street, Newton Abbot, Devonshire, electrical and mechanical engineers. First meeting, January 12th, 11 a.m., Office of Official Receiver, Exeter Bank Chambers, 67, High Street, Exeter. Public examination, February 15th (not 8th, as previously announced in "London Gazette"), 11 a.m., The Castle, Exeter.

GREATHEAD, Oswald, and GREATHEAD, Walter, carrying on business in co-partnership, under the style of GREATHEAD BROTHERS, 50, Burnley Road, Brierfield, electrical engineers and contractors. Receiving order, January 13th. Debtors' petition.

Notice of Dividend.

HILL, George, NOBLE, George, and COWLEY, Edgar, trading in co-partnership as GEORGE HILL AND CO., 22, Chantry Lane, Great Grimsby, electrical engineers. Amount per £, 5s. 5¾d., first and final. Payable January 30th, Official Receiver's office, St. Mary's Chambers, Great Grimsby.

Order made on Application for Debtor's Discharge.

ELLIS, William Charles, residing and carrying on business at Applegate Street, Leicester, electrician. Date of order, December 20th, 1922. Discharge suspended for one day.

Forty Years Ago.

"The Electrician," January 27th, 1883.

"WHOLESALE ELECTRICITY."—This is the somewhat novel title of an article in last Monday's "Times." The writer gave a brief review of the plan upon which Mr. Moulton has drawn up the provisional orders, which were entrusted to his care. As we have already treated this subject in our columns we need not refer to it at any length here.

ELECTRIC LIGHTING IN COLLIERIES.—We recently mentioned that Messrs. Bell Brothers had adopted incandescent lighting for their Page Bank Colliery in South Durham. The whole of the lights were successfully started last week. They are worked on two circuits—the "long-hour" or all night, and the "short-hour" or day circuits, comprising 37 and 64 Maxim incandescent lamps respectively. The current is supplied by two dynamos. Messrs. Harle (manager) and Clough (engineer to the colliery) have also had a few lamps fitted in their houses. The work has been carried out by the Maxim-Weston Electric Company, of 47, Cannon Street, E.C.

Prices of Metals, Chemicals, etc.

TUESDAY, January 23.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£68 0 0	10s.	—
Electro Wirebars	,,	£71 10 0	15s.	—
H.C. Wire, basis	per lb.	10 1/16d.	⅛d.	—
Sheet	,,	10 5/16d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2 3/16d.	⅛d.	—
Brass 60/40—				
Rod, basis	,,	7d.	—	—
Sheet, basis	,,	9¼d.	—	—
Wire, basis	,,	10½d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£4 16 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£18 0 0	—	—
Lead Pig—				
English	,,	£27 15 0	—	5s.
Foreign or Colonial	,,	£26 10 0	—	7s. 6d.
Tin—				
Ingot	,,	£182 5 0	17s. 6d.	—
Wire, basis	per lb.	2s. 5¼d.	¼d.	—
Aluminium Ingots	per ton	£100 0 0	—	—
Spelter	,,	£35 10 0	10s.	—
Mercury	per bottle	£11 0 0	—	5s.

Sulphur (Flowers)—Ton £9 *Sodium Chlorate*—Per lb. 2⅛d.
,, (Roll-Brimstone)—,, £8 10s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.— ,, £26 per ton, £7 10s.
Boric Acid (Crystals). ,, £55 *Sodium Bichromate*.—Per lb. 4¼d
Rubber.—Para fine, 1s. 4¼d. plantation 1st latex 1s. 5⅜d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Company.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by Mewburn, Ellis and Co., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

188 583 Buchanan, C. B., and Johnson, C. C. Current collectors for electrically-driven vehicles. (5/1/22.)
174 359 Metropolitan-Vickers Electrical Co., Ltd. Electrical protective relay apparatus. (20/1/21.)
185 084 Westinghouse Brake and Saxby Signal Co., Ltd. Devices for indicating the failure of electric lamps. (24/8/21.)
188 595 Henley's Telegraph Works Co., Ltd., W. T., and Dunsheath, P. Sealing the ends of electric cables. (1/2/22.)
188 603 Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). Electrical speed regulator systems. (15/2/22.)
188 613 British Thomson-Houston Co., Ltd. (General Electric Co.). Automatic electric motor starters. (22/3/22.)
177 545 Reiniger, Gebbert and Schall Akt.-Ges. Stand for Röntgen tubes or the like. (26/3/21.)
178 815 Scher, L. S. Telephone mufflers. (21/4/21.)
181 374 Skywing Aircraft Corporation. Electric ignition devices for internal-combustion engines. (1/12/20.) (Divided application on 172 308.)
181 709 Snijders, G. C. Telephone exchange systems. (14/6/21.)
181 387 Skywing Aircraft Corporation. Electric ignition devices for internal-combustion engines. (1/12/20.) (Divided application on 172 308.)
188 624 Davis, A. L. Electric plug-and-socket unions for lamps. (5/7/21.) (Divided application on 188 357.)
188 625 Davis, A. L. Aircraft lamps. (5/7/21.) (Divided application on 188 357.)
188 108 General Electric Co., Ltd., and Gossling, B. S. Electron discharge devices. (23/8/21.)
188 117 Pride, H. C. Electric light fittings with bowl shades or reflectors. (28/8/21.)
188 131 British Thomson-Houston Co., Ltd. (General Electric Co.). Electric switches. (5/9/21.)
172 930 Kindlimann and Co. Portable electric heating apparatus with accumulation of heat. (13/12/20.)
188 138 Western Electric Co., Ltd. (Western Electric Co., Inc.). Telephone exchange systems. (13/9/21.)
188 144 Cubitt, A. S. Electric switches. (16/9/21.) (Cognate Application, 16 459/22).
188 150 Hill, E. P., and Metropolitan-Vickers Electrical Co., Ltd. Synchronous dynamo-electric machines. (22/9/21.)
169 454 Soc. Generale "Le Promethee." Electric radiators. (22/9/21.)
188 161 Rombach, T. Portable electric battery lamps. (6/10/21.)
181 672 Poirier, R. E. Wall plugs or the like. (16/6/21.)
188 172 Tracy, P. Electrical connection. (13/10/21.)
188 175 Hailstone, J. E. Locking switches for magneto circuits of vehicles driven by internal-combustion engines. (14/10/21.)
188 189 Tucker and Co., Ltd., J. H., and Line, W. J. Electric fuses. (24/10/21.)
188 190 Lepine, L. J., and Denner, F. D. Wall and like plugs for electric lighting and power circuits. (24/10/21.)
188 219 Ellis, A. J., and Vines, J. C. Electric heat radiators. (21/11/21.)
188 235 Sibils, J. R. Incandescent electric lamp holders. (8/12/21.)
188 263 Stevenson, A. H. Boxes for carrying electric lamps. (25/1/21.)
174 609 Trotzer, Z. Electric water-heaters. (24/11/20.)
188 268 Cable Accessories Co., Ltd., Reeves, F. H., and Davis, P. W. Electric switches. (1/2/22.)
188 280 Mummery, C. S., and Ever-Ready Co. (Great Britain), Ltd. Inert cells. (14/3/22.)
178 866 Ellinger, O. Combined electric couplings and switches. (23/4/21.)
188 001 British Thomson-Houston Co., Ltd., and Fitzgerald, A. S. Protective devices for electric circuits. (22/4/21.)
188 006 Holden, F., and Measurement, Ltd. Electric meters. (2/5/21.)
188 009 MacGregor, R. Electrically-propelled ships. (13/3/22.)
169 143 Bethenod, J. Radio-telegraphic transmitting stations. (14/9/20.)
188 021 Smith, P. F., and Powell, P. V. Electrically braking motor vehicles. (28/6/21.)
188 024 Creed and Co., Ltd., and Lenaghan, T. Telephone systems. (1/7/21.)
188 027 Pouchain, A. Electric accumulators. (21/7/21.) (Addition to 170 618.)
167 167 Gessler, A. de. Electric switching devices of the cartridge fuse type. (22/7/21.) (Convention date not granted.)
188 039 Coleman, H. S. Electrically illuminated advertising devices. (27/7/21.)
188 041 Laycock, H., and Laycock, E. Girder or beam attachment for electrical conduits, gas or water pipes, and the like. (28/7/21.)
188 042 Thatcher, C. J. Process and apparatus for electrolytically oxidizing or reducing substances. (28/7/21.)
188 048 British Thomson-Houston Co., Ltd. (General Electric Co.). Control for dynamo-electric machines. (28/7/21.)
188 050 Steinhardt, A. Construction of ceramic vessels with electric heating. (28/7/21.)
188 053 Cox, F. B. Electric switches. (29/7/21.)
188 056 Thatcher, C. J. Electrolytic cell. (29/7/21.)
188 068 Marschner, E. Electrode seal and support for mercury vapour arc rectifiers of glass. (30/7/21.)
188 076 Cozens, W. H. Automatic safety locks for electrically controlled lifts. (3/8/21.)
188 082 British Thomson-Houston Co., Ltd. (General Electric Co.). Wireless signalling systems. (5/8/21.) (Cognate Applications, 20 942/21 and 21 473/21.)

APPLICATIONS FOR PATENTS.

January 8, 1923.

569 A. C. Brown. Wireless tuning coils, etc.
597 O. Orling. Telephone receivers.
599 C. V. Morris. Aerial wires for radio reception.
600 E. Potter and C. Kinsley (Pernot, Kinsley and Cole). Storage batteries.
613 F. P. di Cassibile and C. Hering. Microphones, etc.
636 O. T. Banks. Bell pushes, etc.
637 Metropolitan Vickers Elec. Co., A. P. M. Fleming, A. O. Rankine, M. S. J. Nightingale and J. W. Buckley. Radio-frequency transmission systems.
639 R. M. Wilmotte. Electric converters, transformers, etc.
640 H. E. Bunn and T. E. C. Wheeler. Crystal detectors.
644 M. Isaacs and W. Smith. Electric transmission at a distance.

January 9, 1923.

690 T. Leah. Locking devices for incandescent lamps.
702 F. Nunes. Devices for electric control of pianos, etc. (9/1/22, Germany.)
710 F. Matheson. Electric push buttons.
712 E. G. Danby. Electric furnaces.
738 J. A. Mendenhall. Electric heater or vaporiser for internal combustion engines.
766 F. Peri. Vacuum tubes. (7/11/22 France.)
767 F. Peri. Vacuum tubes. (7/10/22 France.)
768 Automatic Telephone Manufacturing Co., C. Gillings and W. O. Passmore. Telephone systems.
770 Stirling Telephone and Electric Co., and F. G. Bell. Wireless telegraph receivers.
776 J. B. Kramer. Wireless apparatus.
778 General Electric Co., Ltd. Internal combustion engines.
783 British Thomson-Houston Co., and A. P. Young. Magneto-electric machines.
795 P. G. P. McCulloch and W. E. Marshall. Electric head-lamps, etc.

January 10, 1923.

812 O. J. Wootton. Electric lamp reflectors or shades.
834 W. H. Murad. Crystal-holder for wireless receiving instruments.
853 W. T. Coulson. Electric hand lamps.
857 A. Green. Electric motors.
865 E. Hole. Apparatus for erecting telegraph poles, etc.
880 A. F. Sykes. Electro-magnetic apparatus for recording sound.
885 P. H. Coursey. Insulation of high potential terminals, conductors, etc.
888–889 M. L. Magneto Synd. and E. A. Watson. Magneto-electric machines.
898 C. Lorenz Akt. Gas. Transformers for amplification. (11/2/22 Germany.)
899 W. H. Scott. Electric motors.
915 R. Velut. Coiling of electric machinery.

January 11, 1923.

926 F. T. O'Hanlan. Electric lamps.
938 D. S. B. Shannon. Amplifying apparatus for wireless telegraphy, etc.
939 D. S. B. Shannon. Grid leak fittings for wireless telegraphy, etc.
940 D. S. B. Shannon. Receiving apparatus for wireless telegraphy, etc.
942 W. H. Eccles. Insulators.
961 R. W. R. Twelvetrees. Holders for crystals of wave detectors for wireless receivers.
977 F. W. Austin. Burglar alarms.
1 003 Metropolitan-Vickers Electrical Co., and L. H. A. Carr. Synchronous motors.
1 007 E. A. Ashcroft. Electrolysing fusetl salts of metals and recovering metals and acid radicles.
1 009 F. P. di Cassibile and C. Hering. Microphones and telephones.
1 035 British Thomson-Houston Co. (General Electric Co). Switches.
1 045 A. W. Empson. Apparatus for determining di-electric strength.

January 12, 1923.

1 051 A. R. Baker. Commutator.
1 082 Coventry Automatic Telephones, Ltd., and E. C. Puckette. Ringing and signalling apparatus for telephone systems, etc.
1 090 M. W. W. Mackie. Dynamos.
1 111 A. Glazier. Magnetic contact maker for electric circuits.
1 115 Callender's Cable and Construction Co., and W. Lulofs. Protective systems for electric cables.
1'127 W. W. Drury. Variable electric condensers.
1 128 C. R. Jones. Lamps, and bulbs therefor.
1 133 Callender's Cable and Construction Co., and J. B. Gall. Armoured cables.
1 136 Ross, E. H. and J. W. Hasselkus. Arc lamps for kinematographic purposes.
1 145 G. B. Riley, G. S. Booth and S. C. Peacock. Amplifiers for wireless telephony, etc.
1 153 L. F. Barnes. Crystal detectors.

January 13, 1923.

1 187 F. Sandler and E. Stein. Fuse devices for electric circuits.
1 217 F. J. Plain. Electric plug and socket couplings.
1 220 British Thomson-Houston Co., A. P. Young, H. W. H. Warren and L. Griffiths. Batteries.
1 221 C. H. F. Muller. Cathode-ray apparatus. (14/1/22 Germany.)
1 232 P. G. A. H. Voigt. Radio receiving circuits.

Arrangements for the Week.

FRIDAY, JANUARY 26th (To-day).

Physical Society of London.

5 *p.m.* At the Imperial College of Science, South Kensington, S.W.
1. "A Supposed Relationship between Sunspot Frequency and the Potential Gradient of Atmospheric Electricity," by Dr. C. Chree.
2. "A Further Improvement in the Sprengel Pump," by Mr. J. J. Manley.
3. "Null Methods of Measurement of Power-factor and Effective Resistance in Alternating Current Circuits by the Quadrant Electrometer," by Dr. D. Owen.

A Demonstration of an Electro-Capillary Relay for "Wired Wireless" will be given by Major C. E. Prince.

Junior Institution of Engineers.

7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette entitled "K.V.A. and Its Measurement" (Demonstrations) by Mr. G. F. Shotter.

Edinburgh Electrical Society.

8 *p.m.* At Philosophical Institute, 4, Queen Street, Edinburgh. Lecture on "Internal Combustion Engines," by Mr. J. Hastie.

SATURDAY, JANUARY 27th.

West Yorkshire Metallurgical Society.

At the City Museum, Leeds. Symposium of papers on casting of metals.

TUESDAY, JANUARY 30th.

Institution of Electrical Engineers (East Midland Sub-Centre).

6.45 *p.m.* At the College, Loughborough. Paper entitled "The Transmission of Power by Underground Cables at 100 000/150 000 V," by Major A. M. Taylor.

Paisley Association of Electrical Engineers.

7.30 *p.m.* At the Palace Tea Rooms, 99, High Street, Paisley. Lecture on "Testing of A.C. and D.C. Motors," by Mr. G. P. Rutherford.

WEDNESDAY, JANUARY 31st.

Industrial League and Council.

7.30 *p.m.* At Caxton Hall, Caxton Street, London, S.W.1. Lecture on "Industrial Liberty," by Sir Arthur R. Holbrook.

THURSDAY, FEBRUARY 1st.

Institution of Electrical Engineers.

6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London. Ordinary meeting. Lecture on "The Maintenance of Voltage on a D.C. Distribution System by Means of a Fully Automatic Sub-station," by Mr. P. J. Robinson.

Institution of Mechanical Engineers (North-Western Branch).

7 *p.m.* In the Memorial Hall, Albert Square, Manchester. Lecture on "Mule Spinning Machinery," by Mr. J. H. Hardman.

Chelmsford Engineering Society.

7 *p.m.* In the East Anglian Institute of Agriculture, Chelmsford. Lecture on "The Electrification of Railways," by Mr. H. Burge.

Silvanus Thompson Memorial Lecture.

7.30 *p.m.* At the Technical College, Leonard Street, London, E.C.2. Lecture on "The Basis of Wireless Communication," by Sir Oliver Lodge.

FRIDAY, FEBRUARY 2nd.

Electrical Power Engineers' Association.

7 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Lecture entitled "Characteristics, Operation and Maintenance of Underground Cables," by Mr. A. I. Tracey.

British Electrical Development Association.

7.30 *p.m.* Salesmanship Conferences. At Caxton Hall, Caxton Street, London, S.W.1. Lecture on "Portable Accessories: Irons, Fans, Small Cookers, etc.," by Mr. C. S. Davidson.

Junior Institution of Engineers.

7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette entitled "Ventilation and Lighting of Factories," by Mr. P. J. Waldram.

Royal Institution of Great Britain.

9 *p.m.* At the Institution, Albemarle Street, Piccadilly, London. Lecture on "Fact and Phantasy in Industrial Science," by Mr. C. F. Cross.

The Editorial, Advertisement and Publishing Offices of "The Electrician" are at 8, Bouverie Street, London, E.C.4. Telegrams: Benbrotric, Fleet, London. Telephone: City 9852 (6 lines).

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THE ELECTRICIAN

ESTABLISHED 1861.

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CONTENTS.

Notes of the Week	109	Municipal Contracts Going Abroad	123
Power Station Politics	111	Electric Furnaces for Brass Melting	123
The Inefficiency of Steam Boiler Plants. By David Brownlie	112	Publication of "The Blue Book" Delayed	123
A Bridge Method of Determining the Effective Resistance of an Inductance Coil or Condenser. By H. V. Higgitt. Illustrated	114	Mr. W. T. Kerr Arrested	124
More About the "Electrician" House	114	Brighton Electricity Department	124
Manufacturer—Factor—Retailer. By "A Spectator"	115	Personal Items	124
Correspondence	116	A Large Turbo Rotor Forging	124
The Value of Advertising	117	Business Items	124
The Nuisance of Fuses. Illustrated	118	Electricity Supply	125
A New Type of Phase Advancer for Induction Motors. Illustrated	118	Institution Notes	125
Get into Europe Quickly. By Sir Ernest Benn	119	Foreign Notes	126
British Empire Exhibition	119	Imperial Notes	126
The World's Electrical Consumption	119	Electric Traction	127
Merchandise to Sell and Profit By. Illustrated	120	Wireless News	127
Diesels at Southend	122	Companies Meetings, Reports, etc.	128
East Midlands Inquiry	122	New Companies	128
Wages Reductions	122	Tenders Invited	128
Mullard Valve Litigation	123	Commercial Intelligence	129
		Forty Years Ago	129
		Prices of Metals, Chemicals, etc.	129
		Patent Record	130
		Arrangements for the Week	130

Notes of the Week.

Municipalities and Foreign Contracts.

During the last few days letters have been addressed by two important industrial organisations to Ministers on the subject of the award of municipal contracts to foreign firms. The communication of the Federation of British Industries to the Prime Minister insists on the loss of prestige to industry incurred by such action, to its harmful effect on employment, and to the small advantage gained in the long run by the erring local authority. The whole tone of the letter is one more of sorrow than of anger. The communication of the British Empire Producers' Organisation to the President of the Board of Trade is a much more positive document. It descends to figures, and points out that differences in price from 5 to 15 per cent. mean a loss of wages to this country of from 40 to 80 per cent., and that the result is a heavier burden on local authorities from doles than is compensated for by the lower price. This is a point well made. But the letter goes further; it suggests that a tenderer using Empire material and employing only British labour should rank as regards price below any foreign tenderer unless that foreign tenderer's price is at least 15 per cent. lower than the British tenderer's price. We rather doubt whether this would have the desired effect.

From the Municipal Point of View.

The arguments of the industrialists are so cogent that it is only right that the views of the other side should be expressed. Local authorities argue with some justice that they must accept the lowest tender, and that their political and financial limitations prevent the use of the long-sighted methods suggested by the F.B.I. Apart from this, however, they are quite willing to give preference to British goods provided they are treated fairly by British manufacturers. An uneasy feeling exists, however, that manufacturers are prone to take advantage of municipalities; that trade associations and "rings" know how to look after themselves, and that the ratepayers suffer in consequence. We are not concerned with the truth and justice of these statements. The fact that they exist is more important, and the arguments put forward by both the Federation of British Industries and the British Empire Producers' Organisation will rather inspire their continuance than bring about their disappearance. We are all for the stimulation of British trade, but stimulants have their dangers.

Once More Into the Breach.

In an article which we publish on another page of this issue Mr. David Brownlie returns to the charge. Of 400 boiler plants that he has examined, he tells us, the average efficiency is only about 58 per cent., and this figure may by inductive reasoning be taken as representing the condition of the boilers in use in this country as a whole. He ascribes this low figure to inefficient design and equipment, to such details as excessive consumption of auxiliary steam, lack of draught, faulty flues and brickwork, feed water troubles, shortsightedness in the use of economisers and superheaters, and general neglect of scientific control of the working of the plant. This is a formidable indictment, but there is no reason to suppose that it is exaggerated. In generating stations fuel is probably used as economically as anywhere, but every electrical engineer could point to some horrible example of waste which continuously occurs for one or other of the reasons outlined by Mr. Brownlie. Conditions in other industries are generally worse; his, therefore, is a crusade which is greatly needed.

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Where Direct Current Can be Used.

THOSE who think with Mr. CREEDY that the alternating current variable speed motor is the solution of future industrial problems will be interested and perhaps a little perturbed by an example of the movement in the other direction which has recently come to hand from America. In that country, as is well known, a.c. motors are much more generally used than with us. But in a large sugar refining plant where the aggregate power required is 8 000 H.P. direct current has been adopted for more than one reason. Speed variation is one. Another is that the material used stiffens quickly after even a brief shut down, and the power required at starting may be ten times that at full load. The refining processes, being continuous and interdependent, must run smoothly from raw material to finished product, and close speed regulation on about 80 per cent. of the motors is required. Direct current has therefore been adopted, in spite of its higher first cost. It looks as if there is still a chance for that unpopular machine.

Experimental Electric Traction.

A DIFFICULTY that all parties to the question have in deciding whether to use electric traction on a particular section of railway is that the decision has to be based on estimates or on comparisons with what has been done on other lines where the conditions are not exactly similar. In a report to the Railway Board at Simla, Mr. T. A. F. STONE, assistant locomotive superintendent of the North Western Railway, suggests a method of overcoming the difficulty by providing a self-contained steam-electric locomotive which shall enable what sections of line are suitable for electrification to be determined beforehand. Unfortunately the results obtained from such a locomotive would only tell part of the story. As the "Railway Gazette" points out, the comparison would not be fair to the steam locomotive on the basis of adhesion weights, nor to the electric locomotive on the basis of fuel consumption. Other difficulties would arise with regard to shunting and no account either bad or good is taken of the overhead or third rail equipment. We should prefer to see an experimental length of track installed as has been done between Lancaster and Heysham in this country. This would give much more certain results.

Electrically Produced Steam.

THE system of obtaining steam from water power plants by using some form of electrically heated boiler seems to have passed out of the experimental stage into real engineering. The system has, of course, been used extensively both on the Continent and in the United States, but not on the scale now recorded from Niagara, where a 18 000 kW boiler has been installed. This boiler is heated by three-phase current at 12 000 V and 25 cycles, and evaporates 54 000 lb. of water per hour at a pressure of 125 lb. It occupies a space of 21 ft. by 10 ft. 3 in. by 22 ft. Its thermal efficiency is said to be 99 per cent. and a full head of steam can be raised from cold in about half an hour. Situated as we are with regard to fuel the question cannot be of more than academic interest in this country, but it indicates that, given sufficiently cheap power, there is no technical difficulty in providing either steam or hot water by electrical means.

The Electric Vehicle—A Complaint.

IN spite of its success, both practical and theoretical, the electric vehicle hangs fire. Yet it could be usefully employed, as it is being employed in some cases, in many phases of town transport. The real difficulty, it must be admitted with regret, lies in the refusal of many supply departments either to make suitable tariffs for the load or to provide facilities for carrying on the charging. It is sufficient to remark that in Illinois alone there are 197 charging stations, and any reader who cares to do so can calculate the comparative figures for this country. It would not take him long. It is usual, when it is suggested that the domestic load should be developed, for the reactionary element to frame excuses, mostly specious, why this cannot be done. Most of these excuses are not applicable to the vehicle load, and the reactionary element therefore remains dumb. On the other hand, there are the facts that electric vehicle charging is an off-peak load, would produce, if properly advertised, abundant revenue, and requires little capital expenditure to start. We hope therefore that this inexcusable stagnation will soon be replaced by activity.

The Task Before Us.

AT the last salesmanship conference Mr. R. S. DOWNE said that 50 per cent. of the consumers on the mains of his undertaking were using electricity for lighting only. Now, as we all know, his is an exceptionally well-developed area, and we therefore begin to wonder what the figures of some of the other undertakings must be like. The "Electrical World" has been conducting a sort of supply census, and, making allowances for errors, estimates that the consumption of electricity per head in 1920 of the world population was 57·8 kWh. Switzerland led the way with 700 kWh per head, followed by Canada with 612 kWh, Norway with 493 kWh, and the United States with 472 kWh. The figures for this country were 139 kWh, closely approximated by France with 147 kWh and Germany with 141 kWh. In the British Isles it is estimated that 16·9 per cent. of the population live in electrically-lighted houses, a figure which is far behind the United States and Canada, but compares favourably with other European countries. If we allow ourselves to be optimistic we shall say that we have plenty of work yet to do, and in a less cheerful frame of mind we shall add that it is time we started to do it.

Minor Uses of Outdoor Staff.

A SHORT time ago we commented on the possibilities of taking advantage of the numerous occasions when the outside staff (meter fixers, wiremen, etc.) were brought into contact with consumers of making such staff act as propagandists for extending the uses of electricity. Mr. SAMUEL INSULL, president of the Commonwealth Edison Company, tells us of another way in which he has utilised the potential energies of these staffs. During and since the war, finding a difficulty in financing his big organisations, he adopted the expedient of trying to get a large number of small stockholders rather than a few big ones. It was felt that in addition to the benefit to the company it was also to the good of the community at large to secure the widest possible ownership of the securities. On consumers of electricity particularly Mr. INSULL cast a covetous eye to convert them to stockholders and enlisted the services of his outside staff accordingly. In this respect he is loud in praise of the value of the ordinary "repair man" as having most successfully peddled these securities. This method probably would not commend itself to most large supply companies; at the same time there are numerous small companies which, even if they do not adopt his actual methods, might take a hint from Mr. SAMUEL INSULL and try to convert consumers into shareholders. This would certainly be one of the best ways of getting fresh capital and of spreading business and—tranquillity.

Broadcasting and Public Houses.

"BROADCASTING" has got itself involved with the licensing laws. This is hardly surprising considering the fearful and wonderful ways in which these laws are made and the discrepancies in their application that exist not only between different parts of the country, but between different parts of the same town. It occurred to a Manchester publican that it would entertain his customers and increase his receipts if he arranged for "listening-in" on his premises. But our rulers have decided in their wisdom that before music can be performed in a public house a special licence must have been obtained and the Man-

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chester justices have with some logic ruled that "broadcasting" is music. On the other hand, a public house where it is the custom for a cornet player to protrude the "loud speaking" end of his instrument through the door requires no licence, presumably on the grounds that cornet playing is not music. It is a little difficult to see why music should be singled out for such treatment; but there it is, and scientifically inclined publicans will therefore have to add a music licence to their responsibilities before they can indulge their bent or entertain their customers.

Harmful Propaganda.

In the electrical industry, as in other industries, there is propaganda and propaganda. Some of it is undertaken to make the electric idea known more widely to the general public and some to sell particular goods. Both of these have their proper spheres, and in those proper spheres may be legitimately carried on with energy, and either collectively or individually. But we feel, so far as the first of these divisions is concerned, that it is more important, and incidentally more lucrative, that the public should be educated in electrical generalities than that they should be called upon to decide between the relative merits of similar apparatus. For that reason we read with misgiving an article that recently appeared in one of the daily papers. This article may be described as both bad and selfish propaganda. It talks about electrical phenomena in a pseudo-scientific jargon which is confusing when it is not incorrect, and takes the opportunity to "boost" particular equipment in a way which cannot be too largely condemned. We hope the electrical industry will do its utmost to stamp out this kind of thing. At its best it will do our cause no good.

Power Station Politics.

We are now in a position to add something to the history of the events which have resulted in the virtual dissolution of the National Joint Board for the Electricity Supply Industry, and so introduced ill-feeling and suspicion where there ought to be good-will and co-operation. In a leading article in our issue of December 22nd, 1922, we recorded what was then publicly known about the course of the negotiations that had been taking place for some time on the schedule and wages questions. We specially recorded that the employers had taken exception, on the high grounds of discipline, to certain agreements that had been made between the E.P.E.A. and the manual workers' unions, and that in spite of explanations they had decided to withdraw their representation from the Joint Board.

The Breach Widening.

Since that date there have been fresh developments which, we fear, will tend rather to widen the breach than to bring about agreement. We understand that after the decision to withdraw had been taken, the employers' representation circulated a memorandum giving their side of the case, and accompanied this by a letter urging employers to use influence to ensure that the ballot of the E.P.E.A. members should be in favour of the cancellation of the obnoxious agreements. To this memorandum and letter the E.P.E.A. replied, and we have seen a copy of the reply. Unfortunately all these communications consist mainly of direct contradiction and *ex parte* statements; and to arrive at a judicial decision, were that our duty, would therefore be extremely difficult.

Should Agreements be Submitted.

The employers seem to have been under a misapprehension about the ballot, and as that point has been satisfactorily cleared up we need say no more about it. Another of their grievances was that copies of the agreement had not been supplied in accordance with an arrangement made in 1921. The reply of the E.P.E.A. is that this arrangement was not general, but referred to a particular case, and actually, even in that particular case, was not carried out owing to the opposition of the Electrical Trades Union. This contention appears to be borne out by the copies of the minutes we have seen.

Fettering the E.P.E.A.

Objection was also taken by the employers to the E.P.E.A. engaging in negotiations with organisations not represented on the Board on staff questions, and so being compelled to take action injurious to the employers' interests. To this the E.P.E.A. replied that such matters were outside the purview of the Board. This particular contention, of course, refers to agreements which had been entered into with the manual workers' unions. The E.P.E.A. argue that these will have a restraining effect, and as time alone will show whether this is true or not, the employers have been not a little precipitate. At Pontypridd, for instance, the effect of E.P.E.A. intervention was certainly peaceful. We cannot, therefore, support the employers' argument that these agreements would "be bad for all concerned" or that they will be subversive of discipline. This statement is much too general.

Wages in the Background.

We have all along had an uneasy suspicion that these disputes were not unconnected with the great salaries question. The E.P.E.A. deny this, and state that the agreements were formulated for their own protection, and owing to the necessity of dealing on a constitutional basis with the circumstances that arise in industrial disputes. On the other hand, they also deny, as the employers aver, that the salaries question was nearly settled, and remark that this matter of the agreements could not in any way jeopardise the negotiations on salaries. Here, then, are important questions, all requiring the proper presentation of evidence, but questions upon which with goodwill it should not be impossible to achieve agreement. Unfortunately the National Joint Board has dissolved itself, the Ministry of Labour is apathetic, and there the matter remains.

The Pontypridd Case.

An immediate example of what may be expected to happen if the National Joint Board cannot be re-established is to be found at Pontypridd. A number of unions were involved in a dispute with the local authority over wages, and the E.P.E.A. referred the matter to the District Joint Board, which, however, following the example of the National Joint Board, had ceased to function. A meeting of employees determined to cease work at two hours' notice, but on the intervention of the E.P.E.A. representatives this was extended to seven days. The E.P.E.A. argue with some weight that this action proves their pacificatory tendencies.

This Pontypridd incident has had another effect on the situation. The E.P.E.A. informed the South Wales Electric Power Distribution Co. of the course of events, and requested them to cease giving bulk supplies. Rather unwisely they added a threat, but subsequently, when the Pontypridd dispute had been settled, they made their peace with Mr. Chamen. The correspondence has, however, been published, and is being used to allege that the pacificatory protestations of the E.P.E.A. are protestations and no more.

A Serious Question.

If the evidence available in this dispute is removed into a cooler atmosphere than that in which it was written, and if it is stripped of unnecessary verbiage, two tasks we have tried to perform, it resolves itself into a series of apparently unimportant items. But that is not how it must be regarded. It is a most serious question, and we only hope that before it is too late its seriousness will be realised by all concerned. The employers especially would do well to follow the example of the E.P.E.A. and expose their case in detail to examination and criticism.

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The Inefficiency of Steam Boiler Plants.

Some General Causes Examined and Analysed.

By DAVID BROWNLIE, B.Sc. (Hons.) Lond., F.C.S., A.M.I.Min.E., A.I.Mech.E., Mem.Am.Soc.M.E.

In view of the increasing attention that is at last being given to efficient steam generation it will not be without interest to indicate the general causes of the present deplorable average results and the methods that should be adopted to effect an improvement.

First of all, with regard to the figures of the prevailing average performance, I have on various occasions given the results of detailed tests carried out during the past fifteen years on 400 different boiler plants in forty-one industries, representing 1 513 boilers (mostly of the "Lancashire" type), with a coal bill of 3 250 000 tons per annum. I will merely repeat, therefore, that the true net working efficiency of all these 400 plants averages 58 per cent.—that is, of course, of the plant complete (boilers, superheaters and economisers) after deducting the steam or power used auxiliary to the production of steam, and the plants can be divided as follows :—

Nett Working Efficiency. (Boilers, economisers and superheaters.)	No. of Plants.
1. 80 per cent. and over	2
2. 75 per cent. and over	9
3. 70 per cent. and over	17
4. 65 per cent. and over	58
5. 60 per cent. and over	69
6. 55 per cent. and over	96
7. 50 per cent. and over	80
8. Below 50 per cent.	69
Total	400

A Good Average Figure.

It is possible, of course, that these 400 plants are not a true average of the boiler plants of Great Britain, representing as they do, from the point of view of coal consumption, about 3¾ per cent. of the plants of the country. However, until someone else comes along with the results of several hundred tests, there seems to be no option but to take them as, at any rate, a general guide to the true state of affairs. I may say I am convinced myself that they are a very good average, because I have inspected, without testing, about 2 000 plants with a coal bill of about 15 000 000 tons per annum, or 17 per cent. of the whole of the boiler plants of the United Kingdom, and all these plants are working on the same general lines. We can say, therefore, until further data is available, that about 90 000 000 tons of coal per annum are being burnt under the steam boilers of the United Kingdom, at an average efficiency of 58 per cent., with individual plants anything from 32½ per cent. to 82½ per cent., and as, under proper conditions, the figure should be 75 per cent., the avoidable loss is no less than 20 000 000 tons of coal per annum. These tests only include about half-a-dozen large modern water-tube boiler plants, but even on these few plants the net working efficiencies varied from 60 per cent. to 81 per cent., and I should estimate that the efficiency of the boiler plant of the average electricity station does not exceed about 67½ per cent.

The general causes—which can conveniently be divided into two groups—of these low figures, based on the above experience, are, in my opinion, as follows :—

LACK OF EFFICIENT DESIGN AND EQUIPMENT.

Excessive Grate Length.

In hand-fired plants the grates are almost invariably too long, averaging 6 ft., although many individual plants have grates over 6 ft., and in a few cases even as long as 7 ft. 6 in. In general a 6 ft. grate means a hollow fire at the back, with excess air passing and low CO_2, averaging about 7½ per cent. only. The shorter the grate the better, so that the fires can be kept thick and filled at the back to cut down the excess air. The trouble, however, is aggravated by lack of draught and inefficient flues. It may be stated also that the same difficulties arise with most mechanical stokers for cylindrical boilers, and, to a lesser extent, with water-tube boilers as well.

Steam Jets and Auxiliary Steam.

One of the commonest causes of lack of efficiency of steam boiler plant is the large amount of steam consumed auxiliary to the production of steam by accessories such as coal and ash handling plant, mechanical stoking or moving bar mechanism, steam jets, mechanical draught, boiler feed-pumps, water softening plant, economiser scrapers, soot cleaners, and other similar apparatus. Thus, for example, in a water-tube boiler plant 5 per cent. of the coal bill is soon swallowed up in this way when the usual small non-condensing steam engines or electric motors are used, whilst in a cylindrical boiler plant the figure may easily reach 10 per cent. to 12 per cent. if steam jets are used. Thus in both types of boiler plant 1 per cent. of the coal bill is soon absorbed by the boiler feed pumps, 0·75 per cent. by mechanical coal and ash conveyors, 1½ per cent. to 2¾ per cent. by mechanical draught, and so on. Apart from steam jets, the remedy is to utilise to the fullest extent the non-condensing steam engine combined with the feed-water heater, so as to recover the latent heat of the steam used. The worst feature is that of steam jets as worked with many types of hand and mechanically fired furnaces for cylindrical boilers. Thus of the 400 plants no less than 153, or 38 per cent., were fitted with steam jets, and the amount of steam taken by these jets averaged about 6½ per cent., whilst individual plants varied from 0·5 per cent. to 21½ per cent. On the plants so fitted, and quite apart from whether steam jets are advantageous or not, it can be stated that at least 3 per cent. of the coal bill is being wasted, since a proper steam jet equipment should not consume more than 3 per cent. to 3½ per cent. of the steam production.

Lack of Draught.

One very common cause of inefficiency is lack of draught, the average being equivalent to about 0·35 in. W.G. in the side flues of a "Lancashire" boiler. This is not sufficient to give the best results, that is to work with a short grate, thick fires, and high radiant heat, combined with absence of CO and little excess air, giving high CO_2. This general inefficiency of draught is due in the first place to the continued use of the chimney (natural draught), which is an out-of-date contrivance depending on waste of heat in the chimney base to obtain a draught, in addition to the fact that even for natural draught many chimneys are far too small and cramped in design. Probably only about 15 to 20 per cent. of the plants of the country are equipped with mechanical draught, and the remedy is therefore obvious, although it is very necessary to work the plant on right lines when equipped, as otherwise there may be little or no saving as compared with natural draught.

Faulty Design of Flues and Leaky Brickwork.

A very usual trouble is faulty design of flues, and it is really extraordinary how many boiler plants are working under almost impossible conditions in this respect, with cramped and twisted flues, often wet, and in many cases originally designed for two or three boilers and now working five or six, extra boilers having been put down at intervals without the slightest regard to flue area. Leaky brickwork is almost universal, even in power stations, and must be the cause of at least 3 to 5 per cent. loss in the national coal bill, and probably a drop of at least 3 per cent. in the CO_2. The only remedy is constant attention

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Feed-Water Troubles.

A considerable loss of efficiency is caused by feed-water troubles. Thus something like 60 per cent. of the plants of the country are more or less troubled with scale, and only about 30 per cent. can be said to be quite satisfactory.

The average hardness of the boiler feed-water of the United Kingdom is about 11 grains per gallon, corresponding to over 2 000 tons of scale deposited in the boilers per week. A very large number of water-tube boilers are in continual trouble with scale, just as are economiser plants, and, of course, this state of affairs means increased wear and tear on the boiler plant, and a lowering of efficiency because of the non-conducting character of scale. The remedy again is obvious, a water-softening plant in efficient operation for medium and large plants, and some simple method of direct treatment for small plants.

The Effect of Deficient Economisers.

One of the chief causes of the loss of 20 per cent. or so of the national coal bill is lack of sufficient economisers. I should say in the first place that about 25 per cent. of the boiler plants of the United Kingdom are not fitted with economisers at all, and of the remaining 75 per cent. the average saving in the coal bill is only 11 to 12 per cent., corresponding to, say, 7 to 8 per cent. for the whole country. The correct figure ought to average about 17½ per cent., so that, allowing for numbers of very small plants that it would hardly pay to equip with economisers, the national loss in this direction is about 8 per cent. of the coal bill, or, say, 7 000 000 tons of coal per annum, calculated direct as apart from any other saving. Certainly hundreds of boiler plants, including some of the largest in the country, could save a further 5 per cent. of their coal bill by a reorganisation of the economiser plant.

In the detailed figures of 250 typical tests the average saving obtained by the economisers was 7·1 per cent. of the coal bill, and excluding 95 plants not fitted with economisers at all, the saving in the remaining 155 plants was 11·4 per cent. of the coal bill. Only 24 plants, that is 9½ per cent., were saving over 15 per cent., in spite of the fact that the economiser makers advertise a saving of 15 to 20 per cent. The remedy in most cases is more economiser tubes, so that for example, taking feedwater at the hot well temperature of 100° F., the water going into the boilers should be raised to over 270° F. for ordinary pressures, combined with better design of the installation, especially in the way of flues and proper attention, particularly absence of scale and the efficient working of the scrapers.

Little Use Made of Superheaters.

Very little use is made of superheaters, either for partial superheating to 75 to 100° F., to dry the steam and prevent condensation losses in the steam pipe circuits, or for full superheat, say 200° F., to increase the efficiency of the steam engine or turbine. My experience has been that only about 10 per cent. of the boiler plants of the country are completely equipped with superheaters, although probably another 20 to 25 per cent. are partially equipped, and I should say that at least 5 per cent. of the national coal bill is being lost on this account.

Boiler and Pipe Covering.

A very serious loss, probably equal to at least another 5 per cent. of the coal bill, is caused by lack of efficient boiler and pipe coverings, although of course this is mostly a matter somewhat apart from steam generation. In the first place much of the covering used is of cheap and inferior quality, and steam users in general do not realise the much better value of high-class material such as 85 per cent. magnesia, slag wool, or a good class asbestos mixture, with or without diatomite. It is astonishing the amount of inferior work that exists in this direction even in power stations. Secondly, the covering is allowed to get into a bad state of repair, and little attempt is made to cover the front of the boilers, whilst the absence of flange covers is almost universal, in spite of the fact that each 6 in. flange is wasting about 1 ton of coal per annum.

The Place of "Lancashire" Boilers.

Finally, as regards two very important sections of boiler house equipment, the boiler and the mechanical stoker, I do not think very much coal is being lost, because by far the greater proportion of the 90 000 000 tons per annum is still being burnt in cylindrical boilers. Thus under proper conditions of equipment and control, a "Lancashire" boiler plant will work at 75 to 77½ per cent. as compared with, say, 79 to 82 per cent. with a water-tube boiler plant, nett working efficiencies. The saving of, say, 5 to 6 per cent. in the coal bill by the use of water-tube boilers for small and medium sized boiler plants is soon swallowed up by increased wear and tear, the necessity of better purification of the feed-water and various other items. We have also got to remember, in connection with the suggested scrapping of small boiler plants and the substitution of electric drive, that about 20 000 000 tons of coal per annum is required for low pressure process steam alone. All such plants, by generating at fairly high pressures and using a pass-out engine or turbine, can generate power at a fraction of the cost of a super-station because there is no latent heat of steam loss.

Mechanical Stoker Limitations.

As regards mechanical stoking, probably about 25 per cent. of the steam coal of the country is fired by mechanical means, and on cylindrical boilers much the greater proportion of the coal is hand fired. I cannot see, however, that much loss of efficiency is caused on this account, as my experience has been that hand fired cylindrical boiler plants are slightly better and most certainly equal to mechanically fired plants. In a paper read on March 19th, 1920, before the Institution of Mechanical Engineers, I gave the average efficiency of 80 different cylindrical boiler plants mechanically fired as 59 per cent., whereas 350 plants hand fired were nearly 62 per cent.

There are various other items in the way of equipment such as air heating, feed-water regulators, steam driers, economiser circulators, feed-water heaters, etc., which could be considered but for lack of space, but I think the above covers the main items.

LACK OF METHODS OF SCIENTIFIC CONTROL OF THE WORKING OF THE PLANT.

Scientific methods of control consist essentially in working the boiler plant on a modern system of costing, taking as a minimum for all but the very smallest plant a continuous record of the water evaporated to steam, the weight and analysis of the coal burnt, and the amount of auxiliary steam or power. For medium and large sized plants other items are a continuous analysis of the flue gases by means of automatic gas analysing machines, and the recording of the temperatures at many points on the plant, together with draught, steam pressures, etc.

Universal Waste.

It is only by adopting such methods that the highest efficiency can be obtained, and yet at least 95 per cent. of the boiler plants of the country, including a very large proportion of power stations, are working almost entirely in the dark as regards the essential figures of their performance. Thus I should estimate that 90 per cent. of boiler plants are being worked without efficient feed-water meters in continuous operation, 95 per cent. without CO_2 recorders, and 99 per cent. without steam meters. Once again the remedy is obvious, and taking all these various factors into account, both lack of equipment and lack of scientific methods of control, I think it will be clear why the average saving to be obtained is over 20 per cent. of the coal bill, a state of affars which, it may be stated seems to be universal throughout the world.

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A Bridge Method of Determining the Effective Resistance of an Inductance Coil or Condenser.

By H. V. HIGGITT.

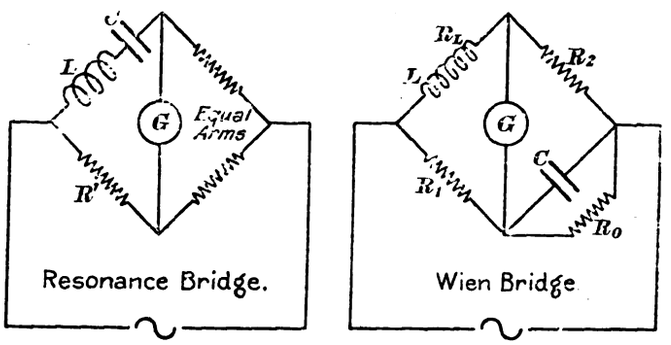
The very common Wien bridge method of measuring the effective resistance of an inductance coil requires, for accurate results, a knowledge of the losses in the condenser, which data have to be determined by comparatively elaborate means.

The scheme here described allows the losses of the inductance coil and condenser to be separated by making use of two different forms of bridge.

Details of the Method.

The inductance and capacity are first joined in series in one arm of a bridge, the other three arms of which are non-reactive resistances, one of the adjacent arms being adjustable, and the other two it would usually be most convenient to make equal. This bridge is hereafter termed the "resonance bridge." Either the inductance, capacity, or frequency must be finely adjustable.

A balance having been obtained on the "resonance bridge," another bridge is formed in which the inductance coil and condenser, unchanged in values, become the opposite arms, the other two arms being non-reactive resistances, of which one must be adjustable. A resistance



DIAGRAMS OF THE RESONANCE AND WIEN BRIDGES.

shunt is to be provided over the condenser, and a balance obtained at the same frequency as before by adjusting this shunt and the adjustable arm. This bridge will be termed the "Wien bridge."

Let L=inductance in henrys, C=capacity in farads, $\omega=2\pi\times$frequency, R_L=effective resistance of inductance, g=leakance of condenser in mhos, R_C=effective resistance of condenser, R_1R_2=resistance arms of Wien bridge, R_o=condenser shunt of Wien bridge, R'=apparent resistance of inductance coil, assuming a pure capacity, with resonance bridge, R''=apparent resistance of inductance coil, assuming a pure capacity, with Wien bridge. All resistances being in ohms.

With the resonance bridge,

$$R' = R_L + R_C$$

$$R_L = R' - R_C \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

With the Wien bridge,

$$R_L = R_1 R_2 \left(\frac{1}{R_o} + g\right)$$

but

$$R'' = \frac{R_1 R_2}{R_o}$$

Therefore

$$R_L = R'' + R_1 R_2 g$$

$$R_L = R'' + R_1 R_2 \frac{R_C}{R_C^2 + \left(\frac{1}{\omega C}\right)^2}$$

For condensers having an angle less than one degree from a right angle, R_C^2 is quite inappreciable compared to $\left(\frac{1}{\omega C}\right)^2$, so that

$$R_L = R'' + R_1 R_2 R_C (\omega C)^2 \quad \ldots\ldots\ldots\ldots \quad (2)$$

But $R_1R_2C = L$ and $\omega L = \frac{1}{\omega C}$

Therefore $R_1R_2(\omega C)^2 = 1$ ..... (3)

From (1) (2) and (3),

$$R_L = \frac{R' + R''}{2},$$

that is, the effective resistance of the inductance coil is the arithmetic mean of the results obtained by the two forms of bridge, assuming the capacity to be pure in each case.

In a similar way it can be shown that

$$R_C = \frac{R' - R''}{2},$$

allowing the angle of the condenser to be very simply obtained.

Frequency Must be Constant.

It is essential to have a steady frequency throughout the test, the most convenient means of obtaining this being by using oscillating valves. If the inductance contains any iron, its value, and its losses, will be a function of the current strength, so that in this case it is necessary to ensure that the current through it is the same in each bridge.

More about "The Electrician" House.

Some Words to the Wise.

A month has gone by since we published the drawings of and conditions for THE ELECTRICIAN "All-Electric" House competition, and we are awaiting with interest the first efforts to obtain an adequate solution of this important problem. There is no doubt that the competition has aroused great interest in the electrical industry and among architects and builders. The applications we have received for copies of the drawings and conditions have been numerous, and we are glad to see that many of them are from those who have yet to make their mark in their profession, and that they include some of the gentler sex. This is as it should be. No better way of taking the first step towards eminence could be devised than by winning or obtaining mention in this competition. The "All-Electric" house is essential to electrical progress. Some figures we publish elsewhere are guarantee of that. At the same time an immense amount of uphill work has to be done, and though standardisation would not be wise at the moment, a wiring scheme that has been selected from many others by competent judges cannot fail to receive wide adoption. Two months remain before the competition closes. There is still ample time for those who have not made themselves acquainted with the conditions to write to us for the particulars.

We may remind our readers that the "All-Electric" House Competition is only one of a series. In the same way with the help of others we hope to do our share towards solving the hot water problem and crystallising a good deal of information about illumination. The electrical industry is progressing, but all the same it can afford to neglect no field for development. Many things are necessary in order that that development may be satisfactorily rapid. And among the most important are technical soundness and economical construction and erection.

Reporting on an accident which occurred at Retford, on the Great Northern Railway, on November 24th last, Major G. L. Hall states that although the system of signalling adopted appears to be adequate, "the advantages of a system which supplements by more or less automatic apparatus the safeguards prescribed by regulation are generally recognised. In cases of this kind, particularly where it is necessary for train-connecting purposes to bring two trains into one platform under all weather conditions, it is for consideration whether the most efficient signalling arrangement is not provided by a CALLING-ON SIGNAL IN COMBINATION WITH TRACK-CIRCUITING of the platform road; the occupation of the track circuit being designed, by selection or otherwise, to lock the running signal and to release the calling-on arm."

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Manufacturer—Factor—Retailer.

By "A SPECTATOR."

In the previous article I attempted to lay out the conditions as they are, and it will help the discussion if in this article I state the general opinion of the Manufacturer—Factor—Retailer.

The Manufacturer.

When referring to a manufacturer I am speaking of those who, large and small, can be legitimately placed under the heading of electrical apparatus makers. Speaking generally, it is the earnest wish and policy of all manufacturers to distribute their goods through the retailer; also through the factor, provided this section is prepared to function somewhat on the lines I shall elaborate at a later stage. The greatest stumbling block that the manufacturer with a good line is always up against is, that the retailer is not alive to its selling possibilities. It is not a question of the manufacturer being a facile optimist as to the possibilities of his product. I am speaking exclusively and deliberately of cases where the manufacturer *knows* that the market needs his apparatus, but in deference to the conventions of his relations with the retailer he cannot offer his goods direct to the public.

Musty and Cobwebby Ideas.

All the notions of the average retailer of selling goods to the consuming public are musty and cobwebby. His selling campaign, if he attempts one, is far too shortsighted to cover the field and secure the turnover which the manufacturer so greatly needs to bring down his costs. The contractor is ever ready to criticise the high price of apparatus, and he will persist in shutting his eyes to the fact that costs, and consequently selling prices, can only be brought down by a large quantity turnover. Coupled with this failure to conceive a large merchandising idea and consequently lack of enthusiasm and energy, is the urgent necessity of a drastic reconsideration of the type of salesman a retailer should employ. Too long retailers have carried on and attempted to sell goods by means of men who are canvassers as distinct from salesmen. The manufacturer feels that while he is always expected to make a fair and square deal with the retailer, he (the retailer) does not seem to accept it that he, too, must work on the principle of a square deal. He is far too ready to throw aside the manufacturer who has given him every consideration on credit, showroom supplies on sale or return, and over-printed publicity matter, in favour of a tempter with a larger discount, a discount which is, of course, only secured and possible at the expense of quality and results in a poor device. Another indictment is that he is ever ready to join with the factor in the questionable practice of sharing the preferential discount which the factor gets from the manufacturer. This practice is a cause of much annoyance and irritation.

The Retailer's Case.

It would serve the purpose of this article much better if space permitted me to lay out verbatim a symposium of the many opinions I have heard from the retailer's point of view. The grievances are many. First and foremost, however, is the question of the manufacturer selling direct to the public. I have tried to find and lay down some definition of what is really meant by the retailer when he says this. Simply explained, it is that the manufacturer, by the very plan of his selling, as is instanced by elaborate showrooms in prominent streets in all big towns, is getting (whether he wishes it or no) a large amount of business direct from the public. It is argued that these large and attractive showrooms attract the public, and the manufacturer, in spite of all assurances to the contrary, is not able to work through the retailer. It is admitted that some firms have a scheme whereby the trade discount on a transaction made direct with the public is credited to the retailer, but it is argued the plan has many faults.

The Question of Discounts.

The question of discounts to what is known as trade users is one which the manufacturer and the retailer must settle. The retailer's argument is so well known that it hardly needs stating. Briefly put, the argument is that there is no justification that a trade user, simply because of some academic definition that he is a trade user, say because he has a wireman on his staff, should enjoy trade terms as generous as those offered to the contractor. It is felt keenly that if a user of electrical apparatus (outside the definite domestic buyer) has a handyman who can do odd wiring work he is at once classified as a trade user. The contractor or retailer admits the difficulty of defining what a trade user is, but even after he has been defined, it must be accepted that his discount, if he must be allowed a discount, should not be so high as the discount to the retailer.

The Problem of the Departmental Store.

Another point on which he feels keenly, and which he thinks is a problem that the manufacturer should help to solve, is the problem of the large departmental stores. As is well known, large stores having an electrical department are a thorn in the flesh of the electrical retailer. Many of these stores are running a so-called electrical department which, in reality, is just a small section of their ironmongery department. Prices are cut even on proprietary lines, and if one has any knowledge of costs, it is perfectly obvious that many lines are being sold at a small margin of profit. The general feeling is that the large departmental stores sell electrical apparatus as novelty lines to attract business for their more staple lines of merchandise. Included in these large departmental stores are the large numbers of furnishing houses who are to-day advertising in the daily Press fittings and other electrical appliances at knock-out prices. It is the frank declaration of these houses that novelty lines in electrical apparatus attract buyers for other goods. The retailer admits that the problem of the departmental store is a difficult one, but the general feeling is that the attitude of the manufacturer is one of *laissez-faire*.

The Problem of the Architect.

The present trading relations between the retailer or contractor and the architect or consulting engineer need straightening out. The contractor feels that he suffers too much from the dictation of the architect or consultant as to the profits which he should be allowed to make on a transaction. He feels that the manufacturer should stand with him in demanding that the architect should adopt the manufacturer's prices without stipulating that he (the manufacturer) must quote a net price (that is, list prices less trade discount), and then the architect dictates to the contractor as to what profit, or, to use a better expression, commission, he will allow him. This question has, of course, intimate relation to the question of discounts to trade users.

An Indictment of the Factor.

The problem of the factor is the greatest one to be solved. Taking the factors as a body as they are constituted and function to-day, it is the general opinion that they are the stumbling block to the greater progress and development of electrical merchandise. I say this with great deliberation. That the factor properly constituted and organised can play a great part in the development of electrical merchandise is admitted, but to reiterate—his present methods mean deadlock. Following my plan the manufacturer has no faith in the factor as a means of selling, or as a source of distribution for his goods. He is simply an order taker instead of an order maker, and it is just by chance and rule of thumb that he secures an order. The manufacturer argues that he does not *create* the business, he simply picks up the orders after the decision has been made to buy, and the mere fact that he takes the order costs the manufacturer the preferential discount which he has to allow him. The manufacturer argues that he has to put a selling force of his own on the market to create business, therefore his own selling organisation can pick up the orders.

The argument that the factor plays an economic part in the distribution of goods by the fact that he holds stocks ready for immediate delivery, and thus relieves the manufacturer of this heavy stock charge, has no substance in fact; the factor does not carry stocks to any value that can be counted, and, in fact, his general practice is to buy from hand to mouth as and when he gets the order. When he is successful in "taking" an order and passes it on to the manufacturer he demands factor's terms. He will accept no argument that the word "factor" means that he should buy in factor's quantities—that is to say, he should perform his function and stock goods on his own account. This is the simple reason why the factor's preferential discount is allowed—it is allowed on the basis that he will hold stocks. If it were really intended that he should only be an order taker, then the manufacturer could arrange some terms with him on a commission basis.

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Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment, and are requested to keep their communications as short as is consonant with their argument.

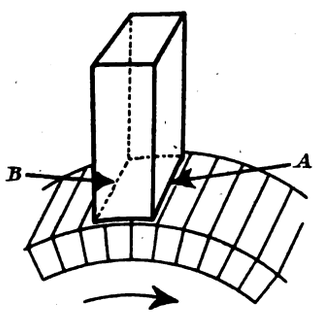
NOMENCLATURE AND BRUSHES.

To the Editor of THE ELECTRICIAN.

SIR,—The "length," "width" and "thickness," as well as various other terms relating to carbon brushes, have recently been officially defined by the B.E.S.A. (No. 96/1922) but there remain two terms especially important in problems concerning commutation which have not been authoritatively defined and about which there is great diversity of practice. I refer to the terms used in defining the edge of a brush with which the segment breaks contact and also the opposite edge (*vide* sketch). Steps have recently been taken to ascertain the usual practice in this country and the table below, giving the results, bears eloquent testimony to the need for some general agreement upon this point. The practice of most of the leading firms manufacturing electrical machinery is included in this table, which may therefore be accepted as fairly representative.

Firms or Individuals Consulted.	A (Edge which breaks contact with segment).	B (Opposite edge).
Four use	Trailing	Leading
Three use	Leading	Trailing
Three use	Toe	Heel
Two use	Heel	Toe
One uses	Front	Back
One uses	Back	Front
Two use	Leaving	Meeting
Two use	Leaving	Entering

When fixing nomenclature the first essential is to select a term free from ambiguity and secondly one that is self-explanatory. The expressions "leading" and "trailing" which appear to be in commonest use stand self-condemned as there is no agreement upon the meaning to be attributed to these words. "Heel" and "toe," "front" and "back" stand condemned for the same reason. There remain "leaving" and "meeting," also "leaving" and "entering." The reason for the confusion of terms appears to be that sometimes the commutator is regarded as moving with respect to the brush and sometimes the brush with respect to the commutator. It is suggested that the terms "leaving" for edge A and "entering" for edge B might be universally adopted with advantage. Whichever way the problem is regarded and whatever the angle of the brush to the commutator there can be no ambiguity about these expressions and they are self-explanatory.—I am, etc.,



P. HUNTER-BROWN.

London, S.W.
January 27th.

WIRELESS LANGUAGE.

To the Editor of THE ELECTRICIAN.

SIR,—Is it necessary that the special language of "wireless" should be as mystifying to engineers in other branches of electrical work as it is at present? The mystification seems to originate in the technico-commercial region, the language of the scientific people concerned is usually intelligible to any catholically minded engineer, up to his limits of mathematical knowledge.

The particular provocation to this epistle is the explanation(?) given of the transmission methods used in the very striking demonstration of transatlantic wireless telephony published in THE ELECTRICIAN of January 19th.

I quote some of the dark passages :—

". . . the band of frequencies employed should be as narrow as possible. Intelligible speech requires the use of about 2 000 cycles, and it is important in modulating a carrier to produce signals that a greater range than this is not occupied. . . . The use of the minimum frequency range may be secured by transmitting only one "side band" of the complete modulated wave instead of both side bands and the carrier wave. . . . At most only one third of the power is needed in the system as compared with one in which the complete modulated wave is transmitted. . . . At the receiving end the missing carrier frequency component is introduced by means of a local vacuum tube oscillator and the complete signal is then detected. . . . "

Having succeeded only in making a number of incoherent guesses at the meaning of these sentences, I would ask some competent person who knows the language (or shorthand) to put it into the general language of the electrical engineer.

Articulate speech, we know, ranges up to about 2 000 cycles, with an average of about 800 cycles, but this can hardly be the meaning. Is it that the carrier must be a "spectrum" with a range of 2 000 cycles? If so, why, and how many separate wave lengths are utilised within that spectrum? The "carrier wave," it is implied, is not transmitted, but only one "side band." But surely, whatever is transmitted *is* the carrier wave. And how does the receiving oscillator which supplies the missing component modulate that component? All the modulation received is that of the transmitted wave. Is the arrangement really a form of heterodyne?—I am, etc.,

HENRY M. SAYERS.

London, S.W.16.
January 24th, 1923.

[We are inclined to sympathise with Mr. Sayers's mystification. Engineers, and scientists too, are too prone to invent nomenclature, and, what is more deplorable, to use words in senses divorced from their usually accepted meanings. The culprits in this case might for ever plead extenuating circumstances. They have penetrated into a field of science which has been little explored and which has had no language. Working there in the usual obscurity they have discovered an important practical application of their researches. They explain it in the only way they can. They find that their explanation is not generally understood even by scientists and technologists. We have no doubt that we shall receive for Mr. Sayers's benefit all the explanations he requires. In the meantime we recommend him to study Mr. E. H. Colpitt's and Mr. D. B. Blackwell's paper on "Carrier Current Telephony and Telegraphy," a long abstract of which appeared in THE ELECTRICIAN for April 15th, 1921, and the two following issues. This will remove a great many of his difficulties.—ED.]

We referred Mr. Sayers's letter to "Headquarters," and have received the following letter from Mr. H. V. Nichols, Director of the Research Laboratories of the American Telegraph and Telephone Co. and the Western Electric Co.

To the Editor of THE ELECTRICIAN.

SIR,—In order to clear up some of the "dark passages" complained of by Mr. Sayers in his letter of January 24th, the following, in addition to the reference you have quoted, may be useful.

By the "carrier" is meant the original *single frequency* current which is modulated with speech. In the usual method of transmission a wave of this frequency goes out from the antenna even when no speech is being sent. There is a waste of power for this reason, and for others which will appear.

Modulation of the carrier consists in varying its amplitude in accordance with the signal to be transmitted : thus, if the carrier frequency is c, and that of a simple signal s, the carrier current may be represented by $\sin 2\pi ct$, and the signal by $\sin 2\pi st$. Modulation or variation of the amplitude of the carrier produces a resultant current $I=(1+\sin 2\pi st)\sin 2\pi ct$ if the modulation is complete. This is the same thing as

$$\sin 2\pi ct+\tfrac{1}{2}\cos 2\pi (c-s)\,t-\tfrac{1}{2}\cos 2\pi (c+s)\,t$$

which shows that the process of modulation with a single frequency broadens the single line spectrum c of the carrier into three lines, c−s, c, c+s, which are called the "lower side-band," "carrier" and "upper side-band" respectively.

If the signal, instead of being a single tone of frequency s, is a group or band of frequencies, such as that required for the transmission of intelligible speech (perhaps 200 to 2 500 cycles), the spectrum of the modulated current will be :

1. A lower side-*band* extending from c−2 500 to c−200.
2. A single *line* at c.
3. An upper side-*band* extending from c+200 to c+2 500.

Most of the power is in the central line, *which contains no element of signal*, and the remainder is divided equally between the two side bands. It should be noted that a current of frequency c is present while speech is going on—that is, the *unmodulated* carrier is also present after modulation.

The total range of frequencies occupied by the spectrum is 5 000 cycles, or more than twice that of the speech band,

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whereas it seems reasonable to expect that only 2 300 cycles should be required in an efficient system.

Now in the transmitting apparatus used by the American Telephone and Telegraph Co. in the recent tests this complete modulated current is produced at low power, and all but the upper side-band filtered out so that only currents in the range c+200 to c+2 500 are present. This band is then amplified and radiated from the antenna. Two great advantages are secured in this way. The amplifiers need handle only one-fourth or less of the power which would be required to produce the same signal strength if currents at the carrier frequency were amplified, and less than one-half the frequency range occupied in the usual method is required for this method—a very important point for long distance operation for which low frequencies are needed.

At the receiving end simple detection of the received currents will not produce intelligible signals since the carrier frequency component of the modulated wave is not present, but if a local source of sustained oscillations of frequency c is used to introduce this component into the receiving antenna, the input to the detector will contain all the elements necessary for the reproduction of the signal. To save space I omit the proof of this statement.

I think the whole difficulty is due to the possibly unjustified use of "carrier" to mean only the *single frequency* current upon which modulations are to be impressed, for, as Mr. Sayers argues, it certainly is possible to regard the aggregate of radiated high frequency waves as the carrier of the signal.—I am, etc.,

H. W. Nichols.

MUNICIPAL CONTRACTS GOING ABROAD.

To the Editor of THE ELECTRICIAN.

Sir,—The articles appearing in various publications on this subject during the last few days could not fail to draw the attention of importers of foreign goods into this country. At first glance the claim that British orders for all sorts of goods (the writer is specially interested in electrical plant and apparatus) should be placed with manufacturers in Great Britain, especially during times of acute unemployment, seems to merit a reply in the affirmative, but at first glance only.

The Right Hon. R. McKenna, chairman of the London Joint City and Midland Bank, stated last week :—

> Our commerce is distinguished from that of any other country by its large proportion of foreign trade, which, it is safe to say, before the War absorbed one-third of the labour of our people, whether in production, transport, or clerical work.

If it is conceded that Great Britain is mainly and essentially a manufacturing country for export business, and if it is realised that certain foreign countries, among others Switzerland, purchase very large quantities of raw materials, semi-manufactured parts, also manufactured goods in Great Britain, and that without these exports Great Britain would be economically ruined within a very short space of time, it must be admitted, not only by free traders, but even by tariff reformers and imperialists, that anything done to interfere with these exports is harmful to the highest interest of Great Britain.

My own company has for years past purchased and is still purchasing large quantities of raw material, semi-manufactured parts, machine tools, etc., in this country. If British clients and authorities, during these times of stress and unemployment, were to take the direct route of not placing any orders in Switzerland, we should be prevented from placing such orders with British firms. For the sake of assisting one particular British industry a number of other industries would be harmed, and probably to a greater extent in total effect. Not only this, but the mere knowledge that a particular industry can count upon the users not placing any orders abroad will undoubtedly raise the prices of British manufacturers against British users. The harm done appears, therefore, to be twofold :—

(*a*) The British consumer loses money directly as the consequence of the enhanced prices by letting it be known that he places his orders only within the borders of his own country, and

(*b*) He harms the other industries by taking away from the foreign buyers the ground upon which they alone are justified and enabled to place the orders with the British manufacturers.

I appreciate that arguments against placing British orders with countries having a depreciated exchange have a real *raison d'être*, as these countries, due to the low value of their currency and the consequently low wages they pay to their workmen, are unfair competitors.

Switzerland has up to now, and for some years past, however, suffered from the fact that its currency has appreciated as compared with that of Great Britain ; consequently Swiss manufacturers find it extremely difficult to sell their goods to neighbouring countries, including Great Britain.

When it is further considered that Switzerland has no raw materials of its own, that its manufacturers have to import raw materials and semi-manufactured parts from abroad, and to an increasingly large extent from Great Britain, these imports entailing very heavy freight and railage expenses ; when it is also appreciated that the finished goods cause similarly large outlays until they reach their destination, it will be understood what a severe fight that country has to encounter against adversity.

I hope I have succeeded in demonstrating that orders going to Switzerland cannot be compared with orders placed with low-currency countries, and that Great Britain's position as an exporting country is best secured by assisting Swiss industries and thereby enabling Swiss manufacturers to place orders with British manufacturers and producers.—I am, etc.,

Oerlikon, Ltd.,
G. Wuthrich,
General Manager and Chief Engineer.

London, W.C.2.
January 29th.

HIGH VOLTAGE POWER TRANSFORMER AT 66 000V.

To the Editor of THE ELECTRICIAN.

Sir,—The writer desires to thank, through your press, Mr. Ellis for his generous remarks and to say that, due to the unusual (etc.), connections of delta/star—delta on the 110 000V side—for such a kVa capacity and voltage, the writer had already, because of his uncertainty, taken necessary steps to investigate this matter, but no reply has yet been received.

With reference to the other matter mentioned by Mr. Ellis, the writer regrets to say that it does not alter the requirements and facts as each phase-winding in series is designed for $110\,000/\sqrt{3}$ operating voltage with any two complete phase-windings *in series* for 110 000 V. It is of course very interesting to know that transformers are so well designed that they withstand, nominally a great deal higher test voltage than customary or according to Standard requirements.—I am, etc.,

William T. Taylor.

London, N.10.
January 27th.

The Value of Advertising.

A Lesson to be Learnt from Day and Martin.

It is announced that the well-known business of Day and Martin is to be sold. The reason assigned by Mr. Burlison, the managing director, is worth the attention of all heads of businesses. "Up till 1894," he says, "Day and Martin had the world at their feet through advertising. From that time they omitted to keep telling the public about their goods, with the result that they are in the market. You have to advertise and go on and on and on." This is by no means the only case, says "The Chemical Age," in which the mistake of relying too much on an established reputation has been realised after the mischief has been done. Advertising has this subtle quality about it—you can never tell precisely what untraceable advantages are produced by it, nor what untraceable losses may arise from its neglect. In either case the effects are cumulative and do not show immediately. It is here that the shorter sighted class of people so often make their mistake. If business is not going strongly they are apt to turn to the advertising allotment as the one that can most easily be cut, with the inevitable effect that the chances of pulling up are diminished instead of being increased. If they are doing particularly well, some smart financier says, "Let's save this expenditure on advertising now that we have as much business as we **want**." And then the inevitable happens—business gradually drifts away from the firm in the background to the firms that are constantly before the trade. Once lost the position is very difficult to regain, and often the loss is not discovered until it is too late to be made good. It is economy, therefore, as every authority on the psychology of publicity will tell one, to make sure of keeping the machine running well, instead of risking a stoppage.

Tables have been compiled by the Central Council for Economic Information showing the net profits made by 555 representative industrial companies during the years 1920, 1921 and 1922. The total decrease since 1920 amounts to £42 436 881. Twenty-six representative electric light and power companies made a total profit of £1 742 441 in 1921 and £1 834 322 in 1922. Fourteen tramway companies made total profits of £379 261 and £530 170 in the two years. In most other industries there were large decreases.

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The Nuisance of Fuses.

[COMMUNICATED.]

ANY man who has ever had to crawl under the stairs in his dress clothes to replace the main fuse by his hostess's hairpin possesses a keen appreciation of the nuisance of fuses. Yet he has not suffered any loss; he has only experienced a little inconvenience. But the factory or workshop owner who still relies upon fuses suffers loss when a fuse blows; often much more serious loss than he realises. The cost alone of replacing fuses generally amounts to a considerable sum per annum, but that is small compared with the loss of output

FIG. 1.—"U-RE-LITE JUNIOR" WITH COVER.

and the disorganisation which result from the stoppage of machines. In many factories a more or less careful record is kept of the amount spent on the purchase of fuses, but in how many is an account taken of the loss of time involved, and the resulting reduction of output? Everybody detests fuses, but if employers really ascertained the annual cost of fuses plus attendant expenses much more earnest attention would be given to securing a less costly safety device.

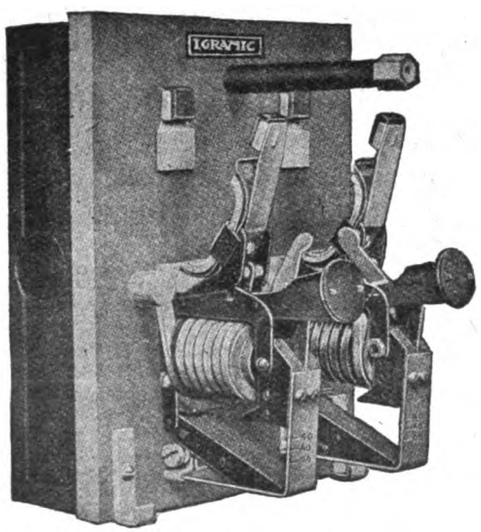


FIG. 2.—"U-RE-LITE JUNIOR" WITH CASE REMOVED.

An appreciation of these facts has led to the introduction by the IGRANIC ELECTRIC CO. of the "U-re-lite," a device that gives real protection and eliminates the losses. The "U-re-lite" is a simple but thoroughly reliable circuit-breaker, so designed that it can be adjusted to open positively on a known current, and which cannot be tampered with or altered or circumvented by any unauthorised person. It has a loose-handle feature, so that it cannot be held closed in face of a current in excess of that for which it has been adjusted. It is contained in a lock-up steel box which prevents unwarranted interference and protects it from mechanical damage. Where the "U-re-lite" is used its opening by a temporary overload causes no inconvenience and nothing more than a temporary stoppage. The workman immediately recloses it and resumes work. Unless improper conditions exist, it stays closed. If the overload persists, the workman cannot reclose it until he has first removed the cause of the overload; but having done that, he can reclose it and proceed with his work. If a short circuit has caused the opening, or any condition has arisen which is really dangerous, an investigation is compelled.

Fig. 1 shows the "U-re-lite" in its steel box, and Fig. 2 shows it with the front cover removed.

A New Type of Phase-Advancer for Induction Motors.

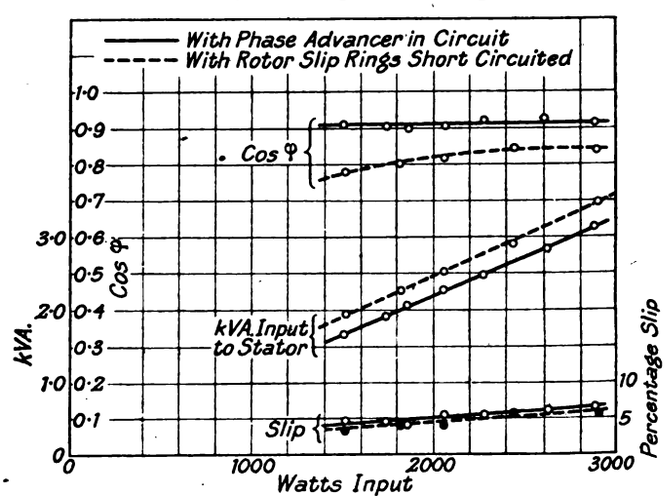
In the course of the discussion on the paper, "The Improvement of Power-Factor," by the late Dr. Kapp, which was read before the North Midland Centre of the Institution of Electrical Engineers at Leeds on November 24th, Dr. T. F. WALL gave some experimental data and technical details of a new type of phase-advancer which he has recently developed and which is specially suitable for small and medium-sized induction motors from about 100 H.P. downwards.

The principle of action of this device may be briefly stated as follows: Suppose two lead grids of the type used in secondary batteries are pasted with red lead (Pb_3O_4), immersed in dilute sulphuric acid and connected in circuit with an alternating current. During one half-cycle the red lead paste of, say, plate A, is oxidised to lead peroxide, and the paste of the other plate is reduced. That is to say, the two plates become in effect a charged secondary cell and a certain amount of electricity is stored in the form of the chemical energy of the paste. During the next half-cycle of the alternating current the stored energy is released and the cell becomes charged in the opposite direction.

A True Electrical Condenser.

The arrangement is therefore a true electrical condenser in the strict sense of the term, viz., a means for storing electricity.

In the case of such a condenser, the energy is stored in the form of *chemical energy* in the paste of the plates and not in



PERFORMANCE OF THE ELECTRO-CHEMICAL CONDENSER.

the form of dielectric strain as is the case in electrostatic condensers. For this reason this new type of condenser is to be clearly distinguished from all such electrolytic condensers as the aluminium cell in which the energy is stored in the dielectric formed by a film of gas on the surface of the plates. The aluminium cell type of condenser is therefore merely a form of electrostatic condenser, whereas the new type of condenser now described may be more correctly termed an *electro-chemical condenser*.

The electro-chemical condenser has a very large specific capacity and provides a very suitable means for phase-advancing in induction motors by connecting a balanced arrangement of such cell in circuit with the rotor slip-rings.

The attached blue-print, which is now published by special permission of the Sheffield Corporation Electric Supply Department, shows the performance of one of these phase-advancers which is in daily operation in the Suffolk Road factory of the Sheffield Corporation Electric Supply Department. The test data was taken after the phase-advancer had been in circuit for 3½ weeks, the motor running throughout under normal factory conditions.

The results show clearly the advantages which may be obtained by the use of this phase-advancer. In the case of consumers who are charged for electricity on the basis of a kVA maximum demand, the saving in the electricity bills will very quickly pay for the initial cost of installation.

We regret that in the article on "The Automatic Control of Motors," which appeared on p. 94 of our last issue, Fig. 3 (Section of the Contactor) was inserted upside down.

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Get into Europe Quickly.

By SIR ERNEST BENN.

"It is an ill wind that blows nobody any good," and, whatever may be our views of the political situation as between France and Germany, there can be little doubt that for the moment the unfortunate state of affairs on the Ruhr does give to our trade and commerce opportunities which were not available a few weeks ago. The rush from the Continent for English coal is a matter of common knowledge, but coal is only one of a thousand things which Europe has been buying from the Ruhr, and which for the moment are no longer obtainable from that source.

Our daily papers keep us in a state of excitement with a wealth of ghastly detail about the troubles that have arisen in various little places as between a French general and German magnates, and we become so engrossed in these matters as to forget that the thousand million people of Europe have, somehow or other, to get through the day and live and eat and have their being, notwithstanding the decisions of the Reparations Commission. If these people cannot secure what they want from the Ruhr, they will get it somewhere else—or, at least, try to.

Excellent Trade Prospects.

The politicians, especially the Labour politicians, are never tired of telling us that our trade is bad because of the condition of Europe; they argue that our customers are bankrupt and cannot buy, and therefore we must have unemployment and lack of prosperity. This very feasible and easy argument is accepted far too widely; but it will not bear examination in the light of fact. The real truth is, that our export trade, and even our European trade, is wonderfully good considering the difficulties; and, further, that if we would put a little energy into it, it might be much better still.

The Board of Trade Returns for 1922, which are now complete, give the lie direct to those who argue that export business is impossible. Our manufactured exports for 1913 amounted to £413 000 000; in 1922 the figure jumped up to £569 000 000; so that, notwithstanding currency troubles and political upheavals, which we are so constantly assured have spoilt our markets, the overseas buyers actually paid us no less than £155 000 000 more in sterling than they did before the war.

We did not deserve this business; it came to us out of the sheer necessity of the overseas buyer. There is, I think, little doubt that had we been prepared to give better value for money, had we shown just a modicum of our pre-war enterprise and desire for business, we might, in 1922, have done a very much bigger volume of trade than actually came to us.

The Facts of the Case.

What are the facts? While we were receiving three millions a week more in sterling from the foreigner, we were sending to him something like 60 per cent. of the pre-war quantities of goods. The Board of Trade index figure for prices of manufactured exports is 199. The corresponding figure for re-exports—that is, foreign manufactures which we buy and sell again at a profit—was 116; our own trade at home was done at about 160. It will thus be seen that we have fleeced the foreigner pretty thoroughly, and that he is paying the highest price for what he buys. When it is further remembered that in many cases, in order to provide us with the sterling required for our goods he has to sacrifice much bigger sums in his own currencies, it is seen how absurd it is to talk about foreign trade being bad.

The export position can be summed up very simply in this way. If in 1913 we had three factories manufacturing for export and all fully employed, in 1922 we have shut up one of the factories, reduced our output by a third, and sold the balance to the unfortunate foreigner at twice the price we charged in 1913. That is exactly the position. How is it possible in the face of such a statement to talk about bad trade, or to grumble at unemployment? All that we have done is to put one factory out of commission in order to provide the other two with exorbitant prices.

If our export trade for 1923 were to reach the highest point in quantity—it has, of course, already reached the highest point in money—if we were to return to the most prosperous condition we have yet known, and we were to present the whole of the receipts for the extra business to the unemployed, if nothing were reckoned for materials, or for any of the other costs of manufacture, the wage-earners would still not receive as much as they now get in doles.

Business Waiting in Europe.

But I started out to talk about Europe, and have been led on to rather wider considerations. My concern is to show that it is largely nonsense to say that the condition of Europe is responsible for our troubles at home; we are only misleading ourselves and blinding ourselves to our own faults. Europe and the world generally are employing us to a very extraordinary extent, and to a far greater extent than prices and figures would appear to warrant.

To leave general considerations and deal with the needs of the moment, it is evident that we have been misled as to the real trading situation abroad, and it is imperative that we should realise this to-day and make an extra push quickly and without delay, in order to supply some of the added demand which is now appearing in every market owing to the dislocation of affairs in the industrial districts of Germany.

British Empire Exhibition.

B.E.A.M.A.'s Offer of Power Station and Plant.

It would seem that the electrical industry would be well represented at the British Empire Exhibition at Wembley in 1924. Prospective exhibitors in the engineering and electrical sections have, it is officially stated, made such large demands for space that an additional area of 70 000 sq. ft. is likely to be added to the Machinery Hall. This extension will be used to house the entire group of exhibits relating to sea and land transport.

This group will include railway and tramway rolling stock and material, motor vehicles, road material and sea transport. Provision will be made for demonstrations of the working of tramcars and their brake power. All the mechanical engineering exhibits are being organised by the B.E.A. and the electrical engineering exhibits by the B.E.A.M.A. It is stated that in respect of each of the big engineering industries the exhibition is already an assured success, fifteen months before the date of opening.

The Machinery Hall, when extended, and the already extended Industrial Hall, which originally occupied a combined area of 800 000 sq. ft., will cover 889 415 sq. ft. The two halls stand opposite to each other, east and west of the Grand Avenue. The Industrial Hall is to be divided into a number of sections, among which may be mentioned: Chemicals, rubber, lighting, heating and ventilation, decoration and furniture, glass and pottery and scientific instruments.

The electrical section in the Machinery Hall has an area of 200 000 sq. ft., and will comprise, it is officially stated, a mile of gangway for the visitor to walk and nearly two miles of stand frontages. A special feature is to be made of electric labour-saving devices for the home, including cookers, kettles, irons, etc. The whole exhibit should bring home to members of the public the technical ability and manufacturing capacity of the electrical industry, and public interest in electricity should be stimulated accordingly.

A New Use for Condensed Steam.

The Council of the B.E.A.M.A. have offered to supply to the Exhibition a temporary power station, the value of the plant for which amounts to about £130 000. They are also prepared to supply additional generating plant, if required, amounting in value to over £50 000. This plant will be lent to the Exhibition on terms representing only a small fraction of its value.

We are officially informed that enough steam will be evaporated in the power station to flood the stadium to such an extent that the cup finalists would have to play the game up to their knees in water!

An Annual Event.

The proposal that the Exhibition should be the inaugural event of an annual series of similar functions has been made to Sir William Joynson-Hicks, M.P., Parliamentary Secretary to the Department of Overseas Trade, by the Canadian Chamber of Commerce in London, with which is associated the Dominion of Newfoundland.

The Chamber stated that it is strongly of opinion that, in order to secure the full benefits of the great efforts and expense of the Exhibition in 1924, and in the interests of the whole Empire, it should be followed by an annual exhibition of the same nature. The Chamber suggested that the present British Industries Fair should be enlarged and developed along the lines of the Canadian National Exhibition—a proved commercial and financial success—to achieve this object.

The World's Electrical Consumption.

Great Britain's Low Figure per Head of Population.

The "Electrical World" gives some interesting comparative figures of the energy consumption per inhabitant in the various countries of the world. In 1920 it is estimated that 99 456 300 000 kWh of electrical energy were consumed, or at the rate of 57·8 kWh per inhabitant. Of this amount 15·3 per cent. was consumed for lighting and 84·7 for industrial activities, including traction. It is estimated that only about 0·5 per cent. of the world's inhabitants live in electrically lighted dwellings. Of the total amount of electrical energy generated 65·4 per cent. is obtained from fuel and 34·6 per cent cent. is obtained from water power.

The consumption of electrical energy in the United States in 1920 was almost exactly equal to the consumption of all the remaining nations of the world combined. This figure amounted to 49 802 000 000 kWh, of which 13·8 per cent. was consumed for lighting and 86·2 per cent was used for power purposes, including railways. Switzerland, however, leads the world in consumption per inhabitant with 700 kWh. Next comes Canada with 612 kWh, Norway with 493 kWh, and the United States with 472 kWh. In the United Kingdom and Ireland consumption per inhabitant is 139 kWh, being slightly less than France and Germany, with 147 kWh and 141 kWh respectively. Italy's consumption is only 85 kWh, while Portugal closes the list for Europe with 3·1 kWh. Of the countries of the world distinctly labelled, India's consumption is lowest with 0·8 kWh, though "Miscellaneous" in Africa fell as low as 0·1 kWh.

The industrial load of the United States is stated to be 19 207 429 H.P., of which nearly 5 000 000 are used for the production of iron and steel. It is pointed out that there are several other primary industries which are more highly electrified by central station energy.

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Merchandise to Sell and Profit By.

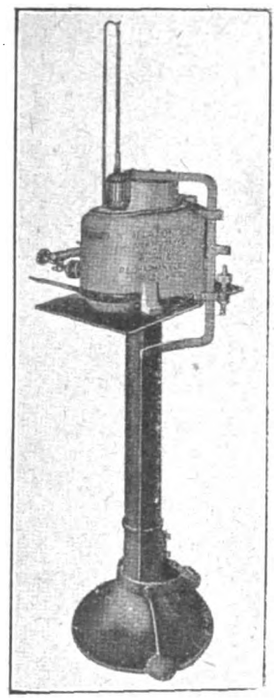
In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

A Commutator Soldering Machine.

Details of an interesting commutator soldering machine have been received from Mr. P. E. CHAPMAN. It is intended for soldering all the segments of a small commutator in the time usually taken to solder one by ordinary means. The commutator is placed in position upon a suspended bar with the connections just above the solder in a container. The depression of a pedal raises the level of the solder and this performs the work. The solder container



THE CHAPMAN COMMUTATOR SOLDERING MACHINE.

is provided with a jacket, which protects the operator from the heat of the fire or flame. The machine is made in two sizes. The smaller will take commutators of maximum and minimum diameters of 2 in. and ¾ in. up to 2 in. long. The capacity of the larger size is for diameters ranging from 2 in. to 4 in., and a length of 3 in. Mr. Chapman's British agent is the IGRANIC ELECTRIC CO.

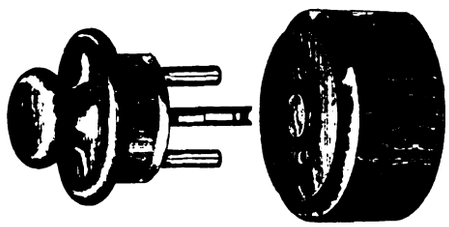
A Complete Table Lamp of Distinction.

Designs in table lamps, as in many other devices, are typical of the country of manufacture. The retailer is served with many wares from many markets of the world, and one of the most typical is the range of "Miller" lamps from U.S.A. and distributed on the English market by L. G. HAWKINS. The range has many pleasing designs. The one selected for our illustration is L2701, listed at £5 19s. 6d. *complete* and finished in antique brass. The specification of "complete" has much significance and meaning for the retailer. In the "Miller" line it does mean that the device is wired and ready for fixing by the domestic consumer. It is unfortunately a well-grounded grievance of retailers that so many English manufacturers offer domestic devices which are not complete in the real sense of the word, and have to have a considerable amount of assembly work on them, thus considerably increasing overhead charges.

THE LATEST MILLER TABLE LAMP.

A Neat Design in Switch Plugs.

The WANDSWORTH ELECTRICAL MANUFACTURING CO. are the makers of the combination switch plug shown in our illustration. Comparison of the design with others will at once reveal an excellent feature—neatness. It is accepted that the first principle of a device of this nature must be electrical, that is to say, the electrical details must come first, but there is a tendency to overlook the fact that a neat design is necessary for

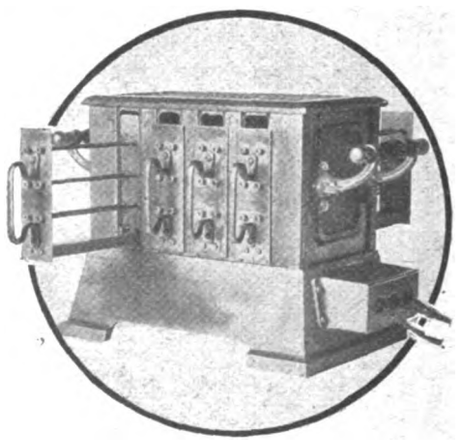


A NEAT SWITCH PLUG.

domestic work. It is hard work persuading a lady "domestician" that she must fix in her drawing-room for the electric fire a plug which has the appearance of an ironclad industrial switch and would be more suitable for the cellar. With the "Wandsworth" switch plug this difficulty will not occur. The device is neat, and is built with every consideration for the switch action. A variety of patterns are made, in 5A and 15A ratings, and each pattern can be fitted with an earth connection.

A Device to Pull Restaurant Business.

Retailers who listened to the E.D.A. salesmanship conference when the subject was "Large Cookers," will remember that the opener proved that a large field awaited reaping in selling cooking apparatus to hotels and restaurants. Among the many excellent devices offered by the manufacturer to retailers to sell is the "Creda" multiple toaster. It is essentially built for heavy service and to toast the maximum number of pieces of bread per hour. In



THE "CREDA" MULTIPLE TOASTER.

the case of the 4-way toaster (which we illustrate) the number is 250 pieces per hour. The same design is applied on an 8-way toaster. This will toast 550 pieces per hour with a loading of 4 050 W. The heating elements are easily detachable—a very necessary detail for the contractor to study to enable service charges to be kept to a minimum. It is manufactured by the CREDENDA CONDUITS CO.

An Interlocking Switch Plug for the High-class Job.

It is not always price which prevents the use of a first-class product on any particular job. It is lack of knowledge as to the best device and where to buy it. This is excusable in the case of many devices, because the range offered is so multifarious. Particularly is this so where it is necessary to select an ironclad interlocking switch plug, hence contractors should keep the SIM-

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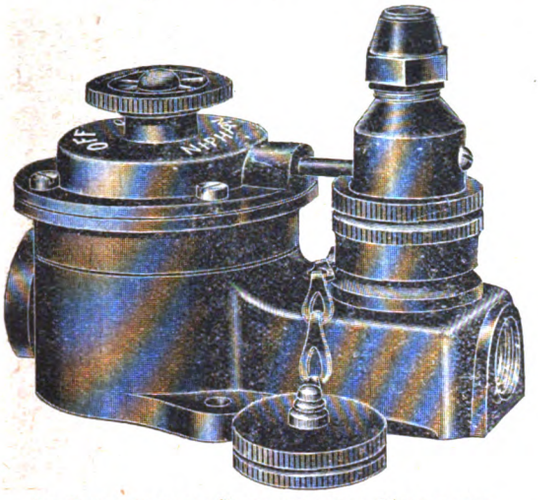
MONDS BROS.' product prominently indexed, so that when a first-class interlocking switch plug is required they will know where to go for it. The illustration which we publish is typical of the N.940

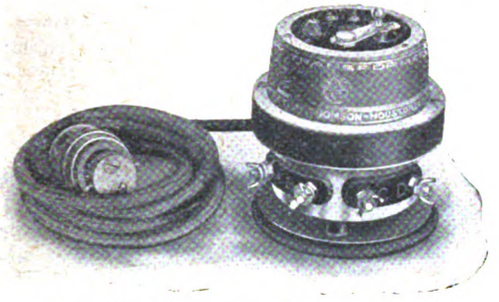


AN INTERLOCKING PLUG FOR THE HOUSEHOLD.

interlocking switch plug in 5A and 10A capacity respectively. It will be seen that the plug cannot be operated independently.

Small Transformers for Amateur Engineers.

The recent exhibition held at the Horticultural Hall was proof (if further proof be necessary) that there is a very big field of amateurs who require some simple and compact device in the way of a transformer so that models and toys can be run off the lighting circuit. The needs of the amateur are for a "universal" device with a wide variation of secondary voltages, and it is with this requirement well in mind must the device be selected. Retailers who cater for a.c. circuits will find a quick turnover in the line of transformers manufactured by the BRITISH THOMSON-HOUSTON CO. The illustration



A B.T.-H. "AMATEUR" TRANSFORMER.

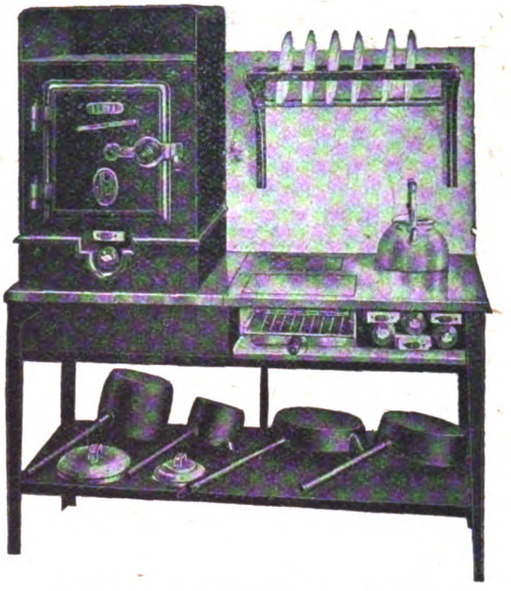
is typical of a complete range made for high and low voltages on the primary side, with secondary voltages, from 22 V, dropping down by a simple switch control to 4 V. The actual variation of secondary voltages to be obtained by the switch control is 4, 6, 8, 10, 12, 14, 16, 18, 20, 22. This transformer is one of the few really *complete* lines offered to the retailer. It is complete and ready to sell over the counter, and this feature is still further enhanced by the fact that a combined switch plug-adaptor is fitted. This permits of the transformer being connected to a wall plug or lamp-holder circuit. Stocks are held by all B.T.-H. local offices, and to help secure business an attractive folder is supplied in quantities overprinted with retailer's name and address.

A "Jackson" Range to Attract Cooks.

We illustrate a new cooker by the JACKSON ELECTRIC STOVE CO. As will be seen, the design of the new range has been made on the lines of the American models, and this point is particularly interesting because in the past contractors and supply companies have criticised the lack of initiative on the part of the English manufacturers to market a cooker more on the lines of the American range. From the illustration, it will be obvious that the new model is one which will appeal to the housewife if only for the reason that it has a thoroughly kitchen-like appearance, and is replete with many conveniences. If all other selling talk fails, it must be put to the housewife that this range will secure a cook who will live happily in the kitchen ever after.

Having thus stated the pyschological effect of the design upon the housewife, we can now briefly elaborate the more technical details of the equipment.

The design, it is claimed, offers many advantages, the chief among them being that there is no necessity to stoop to work at the oven. Additional space is provided for food and plate warming by means of a plate rack and hood fitted at the top of the oven, while utensils may be stored on the rack beneath the range. Efforts have been made to standardise elements as far as possible, for it is the Jackson Co.'s experience that it is necessary to offer a range of cookers with ovens of various sizes in order to deal economically with the various households, and the standardisation of elements helps considerably to simplify the question of stocks on the part of electrical contractors and supply companies.

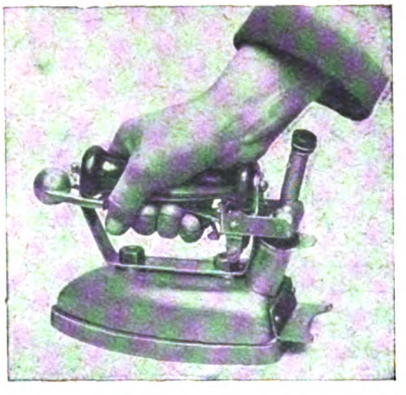


THE LATEST ATTRACTION FOR COOKS.

We understand that the new list fully describing this new range was circulated by the manufacturers early in January, but should there be any contractor and supply company who did not receive a copy, the Jackson Electric Stove Co. will be only too pleased to forward a copy on application.

The "Ortosafe" Electric Iron.

Recently the lay Press was agog with reports of a fire which, it was alleged, was due to the fact that an electric iron had been left on circuit, and had set alight to the table and then to the floor. This story has probably created in the minds of many housewives a fear that the electric iron is an unsafe device, and it is therefore necessary for retailers to have handy a device which they can demonstrate and so assure the housewife that it is a perfectly safe appliance. Stocks should therefore be kept of the "Ortosafe" electric iron manufactured by BERRY'S ELECTRIC. As will be seen from the illustration,



THE "ORTOSAFE" IRON.

the iron has an automatic switching device which at once switches off current whenever the handgrip on the handle is released. The switching gear has a quick-break action. Our illustration shows the iron with the switch action on. It may be noted that the current may be either on or off at will whilst the iron is being used, as is also true when the iron is standing on its heel.

Leaving aside any argument as to whether an electric iron is an unsafe appliance to use, the "Ortosafe" iron with the automatic switching device is undoubtedly an excellent piece of apparatus to demonstrate and sell to those who cannot be persuaded out of their prejudice.

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Diesels at Southend.

Local Criticism at Inquiry.

An inquiry was held at Southend last week by Col. T. C. EKIN, Chief Engineering Inspector of the Electricity Commission, relative to the application of the Corporation for sanction to borrow £40 000 for the purchase of Diesel plant for the purposes of the Corporation's electricity undertaking. The Town Clerk said the loan was needed for the installation of Diesels in London Road station and the Leigh sub-station. The need for extensions was imperative, as the Commissioners already knew and had themselves clearly recognised, for he need hardly remind the inspector that on November 2nd the Commissioners issued their formal sanction to the installation of Diesels in three stations. The only question which, he understood, was before the Inspector that day was the question of the type of Diesel plant to be installed at London Road and Leigh. He took it that he had to satisfy the Inspector that, having regard to the consent already given, the type of plant the Corporation proposed to instal was suitable, and the cost reasonable.

It was proposed, the Town Clerk continued, to purchase the engines from Mr. J. R. Wright, of Gillingham. They had been inspected on behalf of the Corporation. They were absolutely new; they had never been installed on a ship; and they had come straight from the test bench. They were handed over to the British Government by Germany at the conclusion of the Armistice. As far as could be ascertained, they were in perfect condition, and they were undoubtedly of high-class workmanship. The electrical engineer, Mr. R. Birkett, had given consideration to the installation of land type of Diesels, but the question of time was of paramount importance, and the Corporation had to take steps to provide for the installation of additional plant by the beginning of next autumn. The effect of installing the plant proposed would be to increase the existing plant sufficient to carry on for the years 1923 and 1924.

New Consumers at the Rate of 2 000 a Year.

Mr. R. BIRKETT, the borough electrical engineer, giving evidence, said since the outbreak of the war over 7 000 consumers had been put on, out of a present total of 12 000 consumers. At the present time they were adding consumers at the rate of a little over two thousand per annum—greater than any other town in Great Britain.

Asked by the Inspector whether he had any guarantee as to the efficiency of the engines proposed to be purchased, Mr. Birkett said they could not have a guarantee because they were not dealing with the makers, but with an agent, who, he did not expect, would give a guarantee for that which he had not made himself. Mr. Birkett added that Mr. Wright's tender for engines was "lowest in price, best in delivery and biggest in capacity."

In reply to Mr. R. C. MAXWELL, who appeared on behalf of certain ratepayers, Mr. Birkett said that at one time he recommended turbines. Mr. Wordingham, the consulting engineer, was called in by the Corporation on his advice.

Mr. Maxwell: It is fair to say that the result of Mr. Wordingham's advice and the considerable fee the Corporation paid him has been nil—none of his recommendations have been accepted?—His recommendations have not been accepted.

Mr. Maxwell said this was the first opportunity the people of Southend had had of expressing their views on this scheme. Something should be done to stop the scattering of Diesel engines all over the place, with unlimited possibilities of claims for the nuisance and from unsatisfactory production of electricity, according to the views of practically every expert.

The Inspector: I am afraid we must confine ourselves to the subject matter of the application. I cannot allow you to re-open the large question of steam as preferable to Diesels or vice-versa.

Alternative Scheme Urged.

Later, in answer to the Town Clerk, Mr. Birkett said it was quite possible that the engines which it was proposed to purchase would serve the Corporation's purposes. This statement was commented on by Mr. Maxwell as being "exceedingly weak," seeing that it was proposed to commit the town to an expenditure of £40 000. Mr. Maxwell also urged that the wording of the notice of the inquiry was such as to make the question of an alternative scheme relevant. He hoped the Inspector would represent that view to the Commissioners, and perhaps some of them might have the privilege of seeing the Inspector there again.

The Town Clerk said that the Council would not perhaps put these engines in to-day if they could obtain the land-type engines which would satisfy their requirements in time for next autumn. With regard to the point raised by Mr. Maxwell, he said if it had been known that the principle of Diesels was to be questioned there would have been a large representation of ratepayers to speak in favour of the principle. The great weight of opinion in the town was in favour of Diesels.

The inquiry then closed.

A very successful SOCIAL EVENING was held on January 22nd by members of the Siemens Works Social Club attached to the Stafford establishment of the English Electric Co.

A return issued by the London County Council shows that at March 31st, 1921, the net DEBT ATTRIBUTABLE TO LONDON ELECTRICITY SUPPLY UNDERTAKINGS was £5 838 535, an increase of £401 011 on 1920.

East Midlands Inquiry.

Mr. Wordingham's Evidence at Nottingham.

The inquiry by the Electricity Commissioners into the proposed new East Midlands Electricity Supply Area—the opening session of which was reported in our last issue—was continued at Nottingham on January 24th, and concluded on the 26th.

Mr. C. H. WORDINGHAM, as expert witness for the Nottingham Corporation, said that although the ultimate development of the proposed scheme would be much larger, the first stage of it would consist of the extension of the Nottingham station to 40 000 kW; of the Leicester station to 30 000 kW; of the Derby station to 20 000 kW, and of the Burton station to 4 500 kW, with the utilisation of the Spondon station. The first stage would include the shutting down of stations at Long Eaton and Mansfield, and Burton and Derby would be linked together with a distributing main to Ripley, while Nottingham would be connected with Mansfield, Ilkeston and Long Eaton. For the Coalville district a main would be run from Leicester.

Apportioning the Area.

The "backbone" of the second stage of the scheme would be a line running from Nottingham to Loughborough and Leicester, a line linking Derby with Burton, and a line connecting Burton with Coalville, so affording a through connection between Derby and Leicester. The scheme proposed, in broad terms, that Leicester should supply the southern part of the district, Derby and Spondon the western part, and Nottingham the north-eastern and central parts. The total capital expenditure was now estimated at £3 357 000, and the estimated annual charges were £264 511. Mr. WORDINGHAM maintained, in cross-examination by counsel for the Derbyshire and Notts Power Company (to whom the Spondon station belongs), that Mansfield and Ilkeston could be eventually supplied more cheaply from Nottingham than from Spondon. He expressed surprise when counsel put it to him that Spondon was capable of extension to 70 000 or 80 000 kW.

Nottingham v. Spondon.

The last two days of the inquiry were mainly taken up with arguments by counsel and examination of witnesses on the relative merits of the new Nottingham station and the Spondon station of the power company, and on the question of the allotment between the municipalities and the power company of certain thickly-populated parts of the proposed area. On the concluding day Mr. CRAIG HENDERSON (for the Derbyshire and Notts Power Co.) said the idea in the mind of Mr. WORDINGHAM seemed to be that of a municipal scheme rather than what he (Mr. HENDERSON) would call an electricity district scheme. It was too soon to lay down the exact route of the principal mains, and there were two years in which the advisory committee could draw up proposals as to the best method of development in the areas without a supply. The inquiry then closed.

Wages Reductions.

Arrangements in North-West and West Midlands Areas.

The 10 per cent. reduction in the wages of employees in the electricity supply industry agreed to by the District Council of the North-west Area will affect the Corporations of Birkenhead, Blackburn, Bolton, Bootle, Burnley, Liverpool, Manchester, Oldham, Salford, Stockport and Stretford. The alteration is on the "all-in" rates now payable, and takes effect as follows: 5 per cent. on February 1st, 2½ per cent. on May 1st, and 2½ per cent. on August 1st. In addition to these reductions, a new sliding scale has been agreed upon as a means of governing further wage movements. There are to be no further wage alterations until the increased cost of living falls to 66 per cent. above that of August 1914. If the cost of living rises above 84 per cent. over pre-war costs, there will be an increase of ½d. per hour in wages.

In accordance with the unanimous decision of the District Industrial Council for Electricity Supply No. 5 (West Midlands), Area approved by the National Council, there will be a reduction of 2s. 6d. per week in the rate of wages paid to all grades in the district whose wages are regulated by the Council, as follows: 1s. 3d. per week to take effect from the first pay day in February, and 1s. 3d. per week from the first pay day in April. The national sliding scale agreement of November 4th, 1921, which adjusts wages on the cost of living basis, will continue in operation in all respects with the carry-forward figure of 84 (C.O.L.) as at January 1st, 1923.

Proposed Reductions at Glasgow.

Glasgow Corporation proposes to reduce the wages of semi-skilled and unskilled employees by 2s. weekly from the first pay day in February until the end of March, when a further revision becomes due. Employees in the electricity department are affected. In the case of skilled workers who were not affected by the 5s. 6d. cut made in the engineering trades on September 25th the wages of these men will also be reduced by 2s. weekly. With reference to the clerical, technical and administrative staffs, it is recommended that the bonuses in these grades should be reduced. The union representatives have urged that the present wage should remain stationary, as the cost of living has not decreased since the last reduction on wages. In their opinion there is no occasion for the proposed decrease at the present time, especially in view of the fact that the tramway workers in other parts of the United Kingdom are to have their rates maintained for the next three months.

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The Mullard Valve.

Appeal Against Chancery Judgment.

The case of Marconi's Wireless Telegraph Co. *v.* The Mullard Radio Valve Co. came before the Court of Appeal on January 24th and the following days. The plaintiffs appealed and the defendants cross appealed against the judgment of Mr. Justice P. O. Lawrence in the Chancery Division. (See THE ELECTRICIAN, October 27th, p. 488.)

The plaintiffs brought the action for an injunction to restrain the defendants from infringing their letters patent Nos. 28412 of 1913 and 126658 of 1916 and for delivery up of the articles made in alleged infringement of the letters patent and also for damages. Plaintiffs are registered owners of the patent granted to them and Mr. Henry Joseph Round of an invention relating to wireless receivers, and also of a patent granted to Michel Péri and Jacques Biguet for an invention relating to vacuum tubes.

Defendants denied the alleged infringement. They admitted that they sold and manufactured considerable numbers of thermionic valves, but they alleged that in fact such manufactured sale was by them as agents or contractors of H.M. Government and in particular the Admiralty on written authorisation in their behalf, and they denied that such valves constituted an infringement of either of the patents. Defendants also pleaded that at all material times the plaintiffs' letters patent had been invalid by reason of anticipation.

The Round Patent.

The main object of Round's patent was to shape the two electrodes in such a manner as to shield the glass from the cathode stream and thus to prevent it becoming electrified. The Mullard valve was a hard valve which contained a grid in the form of a loose open-ended cylinder placed round the hottest part of the filament. Hard valves first came into use some time after the date of Round's patent.

Mr. Justice Lawrence, in a considered judgment, said that in his opinion the particular form of grid described in the claim and of Round's patent was one of the essential elements of that claim, and that unless a valve contained a grid in that particular form it did not infringe even although it contained the other two elements—viz., a hot filament and a cylindrical anode. He came to the conclusion that none of the documents relied upon by the defendants as anticipations disclosed either Round's invention or Péri's, and that in both those the inventions were both used and useful and that in both there was good subject matter, and that the defendants' attack on their validity failed. He thought that Péri's patent was a combination patent claiming a novel and ingenious method of shaping and arranging the various parts of the valve. His lordship held, however, upon the evidence that what the defendants had done did not constitute an infringement of either of the plaintiffs' letters patent, and upon that issue he dismissed the action and directed that the plaintiffs should pay the general costs of the action and the costs of the issue of infringement, the defendants to pay to the plaintiff company the costs involved by the attack on the validity of the letters patent of the plaintiff company. He also granted a certificate of validity of Round's patent limited on the third claim and also a certificate of validity of Péri's patent of which the plaintiffs were the registered owners.

Mr. J. Hunter Gray, K.C., Mr. Jas. Whitehead, and Mr. Trevor Watson appeared for the plaintiffs; and Sir Duncan Kerly, K.C., Mr. R. Moritz and Mr. Courtney Terrell for the defendants.

Grounds of Appeal.

It appeared from the opening statement of Mr. Gray that claim 3 of the specification of the patent of 1913, No. 28413, read as follows: "A vacuum tube containing a hot filament, a grid formed as a closed cylinder completely surrounding the filament and a third electrode in the form of a cylinder surrounding the grid substantially as described." The plaintiffs' second patent, No. 126658, contained the following clause: "A vacuum apparatus intended to serve as relay or generator of maintained oscillations in which the filament, the grating and the plate are concentrically arranged and fixed directly to the wires served as conductors, these wires being sealed in the same glass tube soldered to the opening of the bulb, the filament placed in the centre of the system being stretched between two conductors having a certain elasticity and the grating formed of a spirally rolled wire supported by its two ends, the plate being cylindrical and surrounding the two other elements by its two ends, the said plate being attached to the conductor by one or two hooks."

Plaintiffs' case was that defendants in what they had done had manufactured, used and sold vacuum apparatus or valves made in accordance with the invention claimed in clause 3 of the specification of the letters patent of 1913 and in all the claiming clauses of the specification of the letters patent of 1916.

Defendants, while pleading that the plaintiffs' patents were invalid for want of subject matter, contended as to the specification of the letters patent of 1913 that their grid, which was a loose, open-ended cylinder, did not infringe the plaintiffs' device disclosed in claim 3 of the patent; and as to the second patent, defendants contended that the substance of the alleged invention there lay in the details, and that in their valve the details were different from those claimed.

In the course of his address Mr. Gray said that Marconi's invention first came on the market in 1896.

On Tuesday, at the close of the appellant's case, Sir Duncan Kerly, on behalf of the respondent in support of the judgment of Mr. Justice Lawrence on the issue of infringement, said the proposition that Round had before him was to have such a cover as would prevent the glass being electrified. He wanted to remove the troubles caused by the incalculable action of the possible ions. He did not say that his apparatus was directed to any new principles. He said that von Lieben introduced something which he (Round) was going to improve upon and to invent a better valve than von Lieben had. In von Lieben there was no part of the glass which was protected from electrification, and there was not in Round any grid at all which would be a protective grid for the glass. Appellant's case was that he had a claim for a principle, that the respondents had made use of it, and that their apparatus was within their claim. Round's apparatus was wholly useless for the conditions then in use.

Municipal Contracts Going Abroad.

Views on the F.B.I. Letter.

The letter addressed by the Federation of British Industries to the Prime Minister on the subject of public contracts being placed abroad has led to much discussion on the matter. On January 25th "The Times" published a list of municipal contracts recently placed abroad, most of which were for electrical equipment or tramway supplies.

The "Yorkshire Post," of the same date, gave the views of several prominent Yorkshire men on the subject. Alderman C. H. Wilson, leader of the Leeds City Council, and Mr. J. B. Hamilton, general manager of the Leeds Corporation, agreed in saying that no public body ought to tie its hands as suggested by the F.B.I. At the same time, they both pointed out that Leeds contracts were almost always placed in this country. Members of large engineering firms emphasised the need for placing contracts in this country, and particular stress was laid on the artificial advantage of depreciated exchanges. So far as rings or combines were concerned, Mr. T. F. Braims, of T. F. Braims, Ltd., Hunslet, said it must be remembered there were rings in other countries which, after exploiting their own people, sold their surplus production in other countries at lower prices than the manufacturer of those countries could afford to take. Such competition could only be met by combines in these other countries.

Empire Producers Protest.

A letter dated January 26th has been addressed to the President of the Board of Trade by the British Empire Producers' Organisation urging that public contracts should only be placed with firms employing British Empire labour and materials. The Organisation suggests that an Empire tenderer, using Empire produced material to at last 75 per cent. of the total used, and employing only British Empire labour, should rank, for the purposes of acceptance of the tender, below any foreign tenderer or one not fully complying with the conditions specified, unless that foreign competitor quoted a price at least 15 per cent. lower than the British tenderer referred to.

Brass Melting.

Theoretical Advantages of Electric Furnaces.

The theoretical advantages gained by melting brass in electrical furnaces have been summarised as follows: (1) Melting may take place in a neutral or reducing atmosphere, thus minimising loss of metal by oxidation and improving the quality of the product through freedom from oxides. (2) Metal of crucible quality may be obtained without the use of crucibles. (3) Melting may take place in a tightly closed chamber, or at least in one free from the constant passage of the products of combustion of fuel, and thus losses of volatile metals, such as zinc and lead, may be reduced. Contamination by sulphur from fuel is avoided. (4) In some types of electric furnaces the temperature may be more readily controlled than in fuel-fired furnaces. (5) In some types of furnaces the molten metal is thoroughly stirred, thus giving a uniform product, even with large heats. (6) There is no handling or storage of fuel, such as coke, coal or oil, and no ashes have to be removed. The cost of power can be accurately predicted over longer periods than the cost of fuel. (7) Working conditions about the furnaces are less dangerous to health and safety of workmen, provided suitable types of furnaces are chosen. (8) The above advantages may be obtained in furnaces of larger capacity than can be used satisfactorily in the fuel-fired crucible types, with resulting greater uniformity of product, lower labour cost, and increased production.—"The Engineer."

The Blue Book.

Publication Delayed by Bookbinding Trade Dispute.

We regret that the publication of the "'Electrician' Electrical Trades Directory and Handbook, 1923," is delayed owing to a dispute in the bookbinding trade. The edition has been printed and binding was in progress when work was stopped. As soon as the dispute is settled, binding will be completed and copies dispatched in a very short space of time.

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Mr. W. T. Kerr Arrested.

Charge Preferred by Hereford Corporation.

Mr. Walter Talbot Kerr, formerly chief electrical engineer to the Hereford Corporation, was arrested last Friday on a warrant by the Hereford Chief Constable. He is charged with converting to his own use two sums of £90 and £810 respectively, the property of the Hereford Corporation, between June 22nd and September 23rd, 1921.

He was brought before the Hereford Bench on Saturday, and remanded until to-day (Friday), bail being allowed, himself in £1 000 and two sureties of £500 each.

The Chief Constable stated that the two sums named in the charge amounted to £900, representing the price received by the accused from the Western Engineering Co., Swansea, for a 60 kW Bellis Dick Kerr generating set. The £90 was the 10 per cent. deposit and the £810 was the remainder of the purchase price. The accused wrote to the Corporation that he had obtained £620, whereas the sum was £900. He had neither paid the £620 nor the £900.

Formal evidence of arrest was then given.

Major Capel, who appeared for Mr. Kerr, said he had no questions to ask at that stage.

Brighton Electricity Department.

Mr. John Christie Thanks His Staff.

The annual dinner of the Brighton Corporation Electricity Department, Municipal Employees' Association, took place on January 20th Mr. JOHN CHRISTIE, engineer and manager, responding to the toast of "The Management," spoke enthusiastically of the great strides made by the electricity undertaking. He thanked the staff for their general assistance, especially those who had one or two anxious moments during the heavy winter load. Such moments were now practically done with, due to the efficiency of the working. Finally, he suggested the formation of an organising committee to arrange during the next season a dance and social for the staff and their friends to be held at the Royal Pavilion.

Personal Items.

We learn with regret that, at the moment of writing, Mr. MARK ROBINSON is seriously ill.

Mr. F. G. BRISTOW, general secretary of the Commercial Motor Users' Association, was called to the Bar on January 26th.

Mr. H. S. BRYANT, who is leaving to take up an appointment as telephone and telegraph engineer in Ceylon, was presented by the Exeter Post Office Engineering staff last week with a silver cigarette case.

Col. A. BAIN has relinquished the appointment of Honorary Colonel of the London Signal Companies (T.A.) which he has held from July, 1912. Col. Bain has seen much service in various parts of the world.

It is intimated that Mr. J. E. EDGECOMBE has resigned the directorship of the Electric Lamp Manufacturers' Association, and that Mr. C. W. SULLY, of Siemens Bros. and Co., has been appointed in his place.

Sympathy will be generally felt with Sir CHARLES PARSONS, whose elder brother, the Hon. Richard Clere Parsons, has died after a short illness. The late Mr. Parsons was a well-known engineer, among his chief works being water and drainage schemes at Buenos Aires. The funeral took place on Monday at Brookwood.

Mr. OLIVER STUBBS has been appointed Chairman of the Executive Committee of Council of the British Cast Iron Research Association, and Mr. F. J. COOK has been appointed Chairman of the Research Committee. Messrs. E. C. DICKINSON and H. J. SIMCOX has been appointed research assistants to work at Sheffield and Birmingham Universities respectively.

Mr. W. H. U. NAPIER has been appointed Deputy-controller of the London Telephone Service, succeeding Mr. W. A. Valentine, the new Controller. Mr. J. F. EDMONDS, formerly Assistant Controller, has been appointed Chief Inspector of Telegraph and Telephone Traffic in the Secretary's office, and Mr. M. C. PINK becomes Assistant Controller in his place. Mr. W. D. STEWART has been appointed Inspector of Telegraph and Telephone Traffic in the Secretary's Office.

The "Industrial Australian" contains the following announcements:—Mr. T. W. BRIDGER has been appointed electrical engineer to the Brisbane Metropolitan Water and Sewerage Board. Mr. H. S. DIX has retired from the post of manager of the Melbourne and Metropolitan Tramways Board. Mr. T. MALCOLM RITCHIE, managing director of the Electrical Equipment Manufacturing Co., South Melbourne, has been elected for a second year as President of the Electrical Federation of Victoria.

Mr. J. A. ROBERTSON, who has held the position of Borough Electrical Engineer of Salford during the last nine years, relinquished his duties as from February 1st, to devote the whole of his time to his consulting practice. He is retained by the Salford Corporation as consulting engineer for the new power station and transmission system at Agecroft, and is also consulting engineer to the Preston Corporation for the new power station on the Ribble. His offices are at Brazennose House, 20, Brazennose Street, Manchester.

A Large Turbo Rotor Forging.

For Nechells Power Station Extensions.

We are able to reproduce herewith a photograph of the rotor for the 22 500 kVA turbo-alternator which the General Electric Co. are manufacturing at their Witton Engineering Works for the extensions at the Nechells power station, of which Mr. R. A. Chattock is the engineer, and Mr. C. P. Sparks the consulting engineer. The illustration shows the forging for the rotor being transported from the works of Walter Somers, at Halesowen, to the Witton Engineering Works. The weight of the rotor is 34 tons, and the overall length 22 ft. 6 in. The maximum rating of the machine is 22 500 kVA, 5 250 V, 25 cycles at 1 500 revs. per min.

THE FORGING EN ROUTE.

Business Items.

The London office of HEENAN AND FROUDE, LTD., has been moved to Blackfriars House, New Bridge Street, E.C.4.

MR. FRANK A. SMITH has opened offices and showrooms as consulting wireless engineer at 90, High Street, Stourbridge.

Messrs. H. BARON and DOUGLAS HOWE, electrical engineers, have been elected members of Blackburn Chamber of Trade.

Mr. Harry Hancocks is now manager of the London branch of the CONCORDIA ELECTRIC WIRE Co., in place of Mr. R. W. Belcher, who has resigned.

Mr. Walter L. Keightley, senior representative of MARSHALL, SONS AND CO., Gainsborough, lately residing in Nottingham, has now removed to 78, London Road, Reading.

MAWDSLEY'S, LTD., have appointed Abbot and Hawkins, 50, Charles Street, Cardiff, and Mr. Horsburgh, 217, Coles Lane, Sutton Coldfield, to represent them in South Wales and the Midlands respectively.

CARBIC, LTD., have taken over the patent rights, etc., of Mr. Otis C. F. King, who has become a member of their staff. They will place his pocket calculators on the market in the course of two or three weeks.

The D.P. BATTERY Co. have received a repeat order from Weston and Westall, Eastcheap, for one of their "Kathanode" traction batteries. The order was placed without competition. Both these batteries are in use on Garrett 2-ton vehicles.

A branch depot has been opened at 17, Clare Street, Dublin, by the RUNBAKEN MAGNETO Co. A full stock of accessories will be kept, and a repairs department is included. Mr. W. E. Martlew, late of the firm's Birmingham branch, is in charge. The telephone number is 706.

An agent in Wellington wishes to be put in touch with BRITISH MANUFACTURERS OF ELECTRICAL GOODS, particularly apparatus for amateur wireless operators, with a view to representing them for the whole of New Zealand. It is understood that representation on a commission basis is preferred, but that the agent is willing to consider the question of representing firms on an indent purchase or consignment basis. A London reference is supplied. Particulars from the Department of Overseas Trade, quoting reference number 85.

The latest catalogue of scientific and technical books issued by SIR ISAAC PITMAN AND SONS covers a great number of technological subjects. Text-books on electricity are well to the fore, 17 pages being devoted to a summary of the contents of over 50 volumes dealing with every phase of electrical engineering. The firm also publish various works on telegraphy and telephony. Numerous books on electrical subjects are also included in their "Technical Primer" series.

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Electricity Supply.

Extensions and Developments.

KINGSTON is spending, with the consent of the Electricity Commissioners, £15 507 on new plant.

BATTERSEA is to spend nearly £5 000 in electricity extensions and developments, including a new showroom.

The STEVENAGE Lighting and Power Co. has applied to the Electricity Commissioners for consent to establish a generating station in the town.

ROCHFORD (Essex) Board of Guardians has applied to the Ministry of Health for a loan of £3 300 for an electric lighting installation at the Poor Law Institution.

ST. PANCRAS Electricity Committee recommends the purchase of two 1 000 kW motor converters for the King's Road Station. The estimated cost is £11 300.

The Borough engineer has submitted to PLYMOUTH Electricity Committee an estimate of £20 968 for providing a new high tension cable from Armada Street station to St. Budeaux.

All the plant at the new BLACKBURN electricity Station at Whitebirk is now working, and the old works in Jubilee Street are to be closed as a generating station. In future they will be used as a transforming station.

A proposal is on foot for a power scheme on the river Bann (ANTRIM). It is stated that enough energy can be produced to light up the whole of the six counties and supply every factory with cheap power. A Bill is shortly to be introduced into the Northern Parliament.

CARDIFF Finance Committee has approved the recommendations of the Electricity Committee for the expenditure of £78 100 for the purpose of putting in new machinery at the Roath Power Station and the Hayes sub-station; and for cables and gear to the docks for the G.W.R. supply.

LIVERPOOL Lighting Committee has decided upon the laying down of thirty extensions into streets not hitherto supplied with current. The committee has also approved the building of a new sub-station at Knotty Ash, through which the electric light will be introduced to a new district.

The opening of an "all-electric" house by the NEWCASTLE-ON-TYNE Electric Supply Co. was noted in these columns last week. The equipment of the house is very complete, comprising cooker, meat chopper, egg-whisk, dish washer, heaters, clothes washer, vacuum cleaner, toasters, irons, etc., all of which are demonstrated in actual operation daily. The lighting arrangements have also been tastefully carried out. No coal fires are to be seen, their place being taken by various types of electric heaters. The wiring has been carried out on the Johnson and Phillips' system, using a twin core cable with a seamless lead sheath forming the external protection. The use of such a cable avoids the necessity for providing any other form of protection such as tubing for the wiring.

Alterations in Charges, Proposed and Actual.

Reductions in the charges for electricity for all purposes are foreshadowed at MANCHESTER.

LEEDS Corporation states that the practice of allowing 5 per cent. discount off electricity accounts for prompt payment is a success.

A meeting at BRECHIN has passed a resolution protesting against the charges made for electricity by the North of Scotland Electric Light and Power Co.

Following complaints by users, PENARTH Lighting Committee is to go into the question of charges, with a view to a reduction on the present rate of 9d. per kWh.

The STALYBRIDGE, HYDE, MOSSLEY, and DUKINFIELD Tramways and Electricity Board propose to reduce the charges of electricity for lighting and power from April 1st.

Charges have been reduced at CARDIFF from 5¾d. to 5½d. per kWh (lighting), and from 2¾d. to 1¾d. per kWh (flat rate for power). Reduction is made in heating charges. Lighting charges are now just over 50 per cent. above pre-war rates.

KINGSTON-ON-THAMES Lighting Committee recommends the Council to reduce lighting charges from 8d. to 7½d. per kWh for the first 3 000 kWh per annum, to 7d. for the second 3 000, to 6½d. for the third 3 000, to 6d. for the fourth 3 000, and to 5½d. for all above 12 000. Power, heating, and cooking charges are reduced to a flat rate of 2½d. per kWh.

Tapping New Areas.

Work is shortly to be started with the laying of mains at CROWBOROUGH.

TENBY Town Council is discussing an electric lighting scheme with the Gas Company.

It is proposed that MUSSELBURGH shall be supplied with electricity from the Portobello power station.

It is stated in CHORLEY that the supply of electricity to the borough by the Lancashire Electric Power Co. has been guaranteed by September next.

The scheme of the Chester Corporation for the supply of electricity to HOOLE and district is making great progress. It is hoped that the work will be completed in about six weeks' time.

At a meeting of the Rochford (Essex) Rural Council on January 23rd, a letter was received from H. B. Underwood and Co., of Southend-on-Sea, stating that they were considering the question of supplying electricity to CANVEY ISLAND.

Miscellaneous Supply Items.

It is pointed out by SWANSEA Electricity Committee that but for the recent reduction in charges, £10 000 could have been contributed to rate relief. It is gratifying to see the profits of the undertaking rightly applied.

WIRRAL Rural Council has decided to apply to the Electricity Commissioners for the electric lighting powers granted to the Heswall Power Co., to be annulled, owing to the works authorised not having been carried out.

LIVERPOOL AND BOOTLE Corporations are in negotiation concerning the charge to be made to Bootle for lighting the street lamps, to which Liverpool is to supply electricity under the new order. Liverpool asks 35s. per lamp per year, Bootle suggests 14s.

HULL Corporation Electricity Committee has disapproved a recommendation from the Finance Committee to give £15 000 to the relief of the rates. It was stated that the reserve funds would be about £35 000, and that this would not be sufficient, having regard to the enormous capital involved in the electricity undertaking.

The Minister of Transport has revoked the powers of the WESTGATE and BIRCHINGTON GAS AND ELECTRICITY COMPANY in regard electricity supply in Westgate-on-Sea and Birchington, and has also ordered that the powers of the Company in regard to electricity supply in Wood (otherwise Acol) and Saint Nicholas-at-Wade shall cease.

The Shropshire, Worcestershire, and Staffordshire Power Co. have informed UPTON Urban Council that they are applying for powers to supply electricity in the urban area. The Malvern Urban Council have asked Upton to support them in an application for similar powers, and an Electricity Committee has been formed to consider what action should be taken in the matter.

Institution Notes.

Mr. Harry Brearley recently read a paper on "Stainless Steel" before the CHELMSFORD ENGINEERING SOCIETY.

The second annual dinner of the YORKSHIRE ASSOCIATION of the INSTITUTE OF CIVIL ENGINEERS was held at Leeds on January 25th. Col. W. M. Bidder presided.

A meeting will be held at the London School of Economics under the auspices of the INSTITUTE of INDUSTRIAL ADMINISTRATION on Tuesday, February 13th, at 8 p.m. Mr. Frank Mott will give a lecture entitled "Practical Hints on Buying and Selling," and a discussion will follow. Mr. Charles E. Musgrave will be in the chair.

As already announced, the annual dinner of the INSTITUTION OF ELECTRICAL ENGINEERS will take place on Tuesday next, February 6th. Those who intend to be present but have not already applied for tickets should do so without delay, as otherwise they will run the risk of finding that the whole of the seating accommodation has been allotted.

The annual general meeting of the OPTICAL SOCIETY will be held at the Imperial College, South Kensington, London, S.W.7, on February 8th, at 7.30 p.m. The Council has nominated the following as candidates for election:—President, Prof. Archibald Barr; vice-president, Sir Frank Dyson; members of Council, Prof. F. J. Cheshire, Messrs. H. H. Emsley, P. F. Everitt, W. M. Brett and Miss L. M. Gillman.

A sub-branch of the ELECTRICAL CONTRACTORS ASSOCIATION was officially inaugurated at Ealing on January 24th. Mr. A. G. Mead was elected chairman, and Mr. J. E. Honar secretary and treasurer, the Committee consisting of Messrs. Paul, Honar, Geoffrey and Hutt. Officials from the Central Office of the E.C.A. were present, as well as Mr. J. D. Knight, borough electrical engineer. The proceedings terminated with a dinner at which the Ealing contractors entertained the president and other members of the central office.

The FEDERATION OF BRITISH INDUSTRIES has for some time past been the object of attacks on the ground that it is conducting a campaign for the lengthening of working hours and the reduction of wages. In view of these attacks the Federation wishes to state categorically that any such suggestion is utterly untrue. The Federation is precluded by its constitution from taking any part in regulating the relations between employers and employed. It deals solely with commercial, financial and technical questions.

The annual meeting of the IRON AND STEEL INSTITUTE will take place on May 10th and 11th at the Institution of Civil Engineers, Great George Street, London, S.W.1. The annual dinner will be held on May 10th at the Connaught Rooms. Subject to final arrangements with the Associazione Fra Gli Industriali Metallurgici Italiani, the autumn meeting will be held in Milan in September. On its conclusion it is proposed that visits should be paid to the principal metallurgical centres and hydro-electric power stations in Italy.

The Council nomination list of the INSTITUTION OF MECHANICAL ENGINEERS is as follows:—President, Sir John Dewrance; vice-presidents, Sir Robert A. Hadfield and Mr. H. A. Ivatt. Members of council, Mr. Daniel Adamson, Mr. W. F. Cully (associate member), Prof. W. E. Dalby, Engineer Vice-Admiral Sir George Goodwin, Mr. R. E. Maunsell, Mr. E. W. Moss (associate member), Lieut.-Col. R. B. Pitt (associate member), Mr. William Taylor and Mr. Richard Williamson. Additions were made at the last meeting as follows:—Mr. H. Richardson, of Manchester (associate member), Captain A. H. Whittaker, of London (associate member), Mr. E. C. R. Marks and Mr. Charles Day.

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Foreign Notes.

EUROPE.

Electric Tramway Projected in Sweden.

Mr. D. F. S. Filliter, H.M. Consul at Stockholm, reports that a company with a minimum capital of 750 000 kronor is stated to have been formed at Sundsvall for the CONSTRUCTION OF AN ELECTRIC TRAMWAY from the town of Sundsvall to the suburb of Gangviken. Requirements for the line will be advertised in the local press. It is expected that the work will be taken in hand sometime this summer, and completed in about two years' time. Further information can be obtained by British firms on application to the Department of Overseas Trade.

French Railway Electrification Plans.

The question of the ELECTRIFICATION OF THE WHOLE OF THE FRENCH RAILWAY SYSTEM is being studied by the Parliamentary Commercial Committee, presided over by M. Levy, Senator. Stress is laid on the national character of the scheme, and also the necessity of appealing for close collaboration between the electrical companies, the railways and the Government. Such collaboration is to be put into practice by the formation of a sub-commission composed of members of Parliament, business and technical men, who will prepare a report dealing with the practical side of the question for submission to the Committee.—*Reuter.*

THE NEAR EAST.

Progress of Palestine Electrical Schemes.

With reference to the Rutenberg Concession for the SUPPLY OF ELECTRIC POWER AND LIGHT IN PALESTINE, it will be remembered, says "Lloyd's List," that there were two concessions—one, the large main scheme for developing power from the Jordan River, the other, known as the Auja Valley Concession, a much smaller scheme for the supply of power and light to the districts of Jaffa and Tel Aviv. The former has not yet commenced. The Auja Valley scheme is rapidly proceeding, and it is estimated that current will be available for electric light and industrial purposes by July of this year. Contracts for the supply of current for electric light purposes are expected to be signed shortly by both the Jaffa municipality and the Tel Aviv township.

THE FAR EAST.

Electrical Goods in Java.

In a review of the commercial activities of Djokga (Java), the British Commercial Agent states that ELECTRICAL GOODS are among the principal requirements. Sugar refining is the main industry.

Catalogues for Siam.

The Department of Overseas Trade states that one of the maintenance engineers on the Siamese State Railways is DESIROUS OF RECEIVING CATALOGUES of various classes of goods, including wrought iron tubes, electric light fittings, etc. It appears that when submitting particulars of his requirements to the headquarters of the Siamese State Railways, the engineer finds himself handicapped by reason of his inability to refer the authorities to catalogues illustrating the goods requisitioned. He would welcome, therefore, catalogues in duplicate, so that while retaining one copy himself, he may be in a position to forward a copy to his headquarters for reference purposes. British firms desirous of forwarding catalogues can obtain the name and address of the engineer on application to the Department of Overseas Trade.

LATIN-AMERICA.

Tramway Extensions in the Argentine.

The Compañia Eléctrica del Norte, of Tucuman, Argentina, have received permission from the Provincial Government to EXTEND THEIR TRAMWAY LINES in three directions, and will shortly be purchasing plant and material for the purpose.—*Reuter.*

New Electrical Works in Brazil.

In the State of São Paulo important NEW ELECTRICAL CONSTRUCTION is contemplated by the Compañhia Paulista de Forca é Luz The new work includes the installation of a 2 000 H.P. hydro-electric unit in the power plant of Bauru; a 60 000 V transmission line from Salto do Avanhandava, on the Tiete River, to Bauru, and three sub-stations, one of 1 000 kW and two of 2 000 kW. Additiona distributing lines will also be built.—*Reuter.*

A Brazilian Hydro-Electric Scheme.

The State Government of Rio Grande do Sul has granted the concession asked for to provide HYDRO-ELECTRIC POWER to the city of Puerto Alegre and vicinity. Bids for construction will be received up to October 10th, 1923, foreign contractors being free to participate. The proposed site for the hydro-electric plant is on the Rio Jacuhy, in the Municipality of Saledade, situated about 140 miles north-west of the city of Puerto Alegre. According to present estimates, which, however, are subject to revision, a minimum of 40 000 H.P. can be developed.—*Reuter.*

German Designs on South American Markets.

It is stated that the German electrical industry has great hopes of BUSINESS WITH ARGENTINA AND BRAZIL, as South American reports state that there is wide interest in the extension of the use of electricity, and the Argentine Government is encouraging the movement. Two years ago the total H.P. of the motors in the Argentine was 130 000, and an annual increase of 6 000 H.P. is expected. There remain numbers of industrial works within the radius of the power station which are still using steam or gas engines. Apart from new installations, Argentina and Brazil must order all their accessories and spare parts in Europe.

U.S.A.

Electric Vehicle Progress.

The American Express Co., says Reuter, has placed orders for 200 electric vehicles, 35 of which are for use in New York, 50 in Boston, and the balance for distribution in Philadelphia, Buffalo and other cities. When these vehicles are delivered this company will have more than 1 450 electric vehicles in service. The Electro-taxi Corporation, which about three months ago placed a fleet of ELECTRIC TAXIS on the New York streets, has purchased two more.

A Huge Submarine Power Cable.

What is said to be the largest and LONGEST SUBMARINE POWER CABLE ever installed has been laid across San Francisco Bay by the Great Western Power Co., at a cost of approximately $500 000, to bring additional hydro-electric power into San Francisco and to make possible a reduction in the amount of electricity it has been necessary to generate in the company's steam plants. The cable is approximately seven miles in length, and is laid from the south end of Brooks Island, near Richmond, to Pier 41 in San Francisco. It is an 11 000 V, three-conductor, 500 000-circ.mil cable capable of transmitting 10 000 kW.

Imperial Notes.

AUSTRALIA.

Import Duties on Electrical Goods.

Among recent TARIFF DECISIONS approved by the Australian Customs department are the following: Item 404, electric motors, not exceeding ½ H.P., for the manufacture of sewing machines (on security), free under the British preferential tariff, free under the intermediate tariff, 10 per cent. under the general tariff; item 180 (A), receivers used in wireless telegraphy and telephony, and microphones for radiophone transmitting sets, free, 5 per cent., 10 per cent.—*Reuter.*

New Powers for Victorian Electricity Commission.

A committee appointed by the Victorian Legislative Assembly has approved the Bill giving new powers to the VICTORIAN ELECTRICITY COMMISSION, including power to grant subsidies to certain districts, and the right to make an agreement with the undertaker at any time to purchase supply undertaking.

Adelaide Supply Co.'s Good Year.

At the annual meeting of the ADELAIDE ELECTRIC SUPPLY CO., in Adelaide, a final dividend of 6 per cent. was declared on the ordinary shares; making 12 per cent. on the ordinary shares for the year ended August last. The Chairman (Sir George Brookman) said 5 664 new consumers had been added during the year, making the total 40 804, and since the close of the financial year a further 1 730 consumers had been connected. Of the houses in the metropolitan area 66 per cent. are connected to the company's mains.

BRITISH WEST INDIES.

Jamaican Electric Light Project.

The General Commissioners of Kingston have decided to float a loan of £198 000 in Jamaica, for MUNICIPAL WORKS PURPOSES. The projects include a dam to conserve water for domestic purposes, and a turbine plant to generate electricity for the lighting of public thoroughfares and buildings owned by the Government and the municipality. The Commissioners have decided to send one of their engineers to the United Kingdom early in 1923 to select machinery for the work.

The Market for Electrical Goods.

In a report on Economic and Financial Conditions in the BRITISH WEST INDIES, Mr. A. W. H. Hall, Officer-in-Charge of H.M. Trade Commissioner's Office, Trinidad, says a large part of the business to the British West Indies which was captured by the United States has now returned to the United Kingdom. The sale of British electrical apparatus, however, is hampered by the fact that most of the installations are American, and American standards are used. Amongst the principal imports from Germany are hardware and chemicals. American exporters are possibly more affected by German and Dutch than by British competition. Electrical apparatus imported into Trinidad in 1921 was valued at £33 446 (against £23 024 in 1920), of which the U.S.A.'s share was £28 694 (against £21 079), and that of the United Kingdom £3 589 (against £1 790). Corresponding figures for Barbados were: total £11 737 (£14 527), U.S.A. £4 808 (£9,576); U.K. £5 532 (£3 579).

CANADA.

Extensive Use of Hydro-Electric Power.

The value of hydro-electric energy as conserving coal consumption in Canada may be partly gauged by the fact that ONLY 1½ PER CENT. OF THE TOTAL COAL CONSUMPTION takes place in central electric power stations. In the United States 2·6 per cent. and in the United Kingdom 9·7 per cent. of the total coal consumption occurs in these stations. In 1920 over 97 per cent. of all the power output from central stations in Canada was produced from water power. The steady growth of water-power development during the past two years indicates that this proportion will be maintained.

SOUTH AFRICA.

Business in Electrical Goods.

Reporting on trade conditions in South Africa, Reuter states that BUSINESS IN ELECTRICAL GOODS IS FAIR; prospects are favourable and prices firm.

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Electric Traction.

Tramway Extensions and Developments.

The City of CARLISLE Electric Tramways Co. has announced its first dividend for 18 years.

EDINBURGH Tramway Committee is considering a number of extensions, and proposals have been remitted to the Tramway Manager for report.

One of WIGAN'S narrow gauge tram routes is to be reconstructed with broad gauge rails. The other narrow gauge route will be similarly dealt with later.

A specially designed covered car with a low roof is being tried on a particular route of the SALFORD Corporation Tramways. It has to pass under several low railway bridges.

NOTTINGHAM Tramways Committee is recommending the City Council to undertake the re-laying of the tram tracks in London Road while the thoroughfare is being repaired. The estimated cost is £16 000.

The ceilings of 125 new LONDON County Council trams are to be painted white and the lamps fitted with anti-glare reflectors. It has been found that under such conditions reading in these cars is easier than in older types, and the improvement will be extended to all the cars in time.

MIDDLESEX County Council has granted a new lease of its light railways to the Metropolitan Electric Tramways, Ltd., to supersede the existing agreements for lease, and to operate from January 1st, 1923, until December 31st, 1951, at an annual rental of £110 000. This will result in an immediate increased rental of £15 000.

The Council of the ASSOCIATION OF MUNICIPAL CORPORATIONS has agreed to take part in a conference convened by the Municipal Tramways Association with the object of promoting legislation to compel drivers of vehicles, before passing stationary tramcars on the near side, to pull up in order to allow passengers to clear themselves from the roadway.

Fares, Receipts and Passengers.

The new tram service over the High Level Bridge between NEWCASTLE and GATESHEAD produced £1 000 in fares last week.

During 1922, 726 000 000 passengers were carried by the LONDON County Council trams, an increase of 36 000 000 over the 1921 figure.

LONDON tramways under "Underground" control earned £35 958 in the week ending January 20th, as against £37 473 in the corresponding week last year.

The reduction in tram fares at BOURNEMOUTH, which the corporation put into operation at the beginning of the year, shows that whilst there is an increase in the number of passengers carried, there is a decrease in the total receipts as compared with the corresponding weeks of the previous years.

Following the introduction of penny stages on the trams at EXETER, the number of passengers carried during the first week was 3 754, receipts being £9 less. For the second and third weeks the corresponding figures were 4 380 and £6 10s., and 5 854 and £1 5s. It is anticipated that the position will further improve.

Electric Railway Items.

In connection with the extension of HAMPSTEAD TUBE to Edgware, an additional track is to be laid down at Golders Green Station, and an extra platform provided.

The laying of the high tension cable for the LIVERPOOL, WATERLOO and SOUTHPORT Electric Railway is being carried on in sections. The lengthened trains should be available for the summer traffic.

Westminster City Council is objecting to the Bill under which the LONDON Electric Railway seeks power to construct subways from Piccadilly Circus, Piccadilly, Regent Street, and Shaftesbury Avenue and to make and maintain permanent openings in the roadways and footways. The Committee state that "there does not appear to be any definition of the positions of these openings or any restriction on the number or size of them, and the powers sought therefore appear to be very objectionable."

Projected Railway Electrification.

Electrification schemes are the chief feature of the plans which are being put in operation on the SOUTHERN RAILWAY GROUP as an immediate measure of relief for unemployment. The electrification of the routes from London to Guildford is the main scheme in progress on the South-Western line. By one route this line is electrified as far as Surbiton. Electrification will be continued through Effingham to Guildford. By the other route the line is already electrified to Claygate. The extension of this electrification to Guildford will be begun immediately.

Details of possible electrifications on the LONDON, MIDLAND AND SCOTTISH RAILWAY were given at the recent East Midlands Electricity Supply Area inquiry at Nottingham, by Mr. A. Tylor, who represented the railway company. With regard to passenger electrification, the line from Nottingham to Derby certainly presented possibilities. Regarding freight electrification, gradients were a question of considerable importance. Except in the colliery district of Mansfield (in the neighbourhood of certain pits) and in the north-west corner of the area (in the neighbourhood of Ambergate) there were no gradients that would make the district pre-eminently suited to electrification.

Wireless News.

"Listening-in" in the Public House.

As stated in this column last week, the Manchester Licensing Justices have decided that a music licence is necessary where LISTENING-IN SETS ARE IN OPERATION ON LICENSED PREMISES, but that where houses hold music licences listening-in during the hours in which music is permitted is quite legal. This decision is evidently being taken as a precedent, for this week the proprietor of an Oswestry hotel, who had a wireless installation fitted, applied to the local magistrates for a music licence. He stated that he was taking the course advised by the police. The licence was granted.

The Manchester decision has been severely criticised, however, by the annual meeting of the Manchester and Salford Christian Congregations, and opposition is being organised. Archdeacon Aspinall queried the magistrates' ruling that a concert heard by wireless was music.

Imperial Developments.

The High Commissioner for Australia has received cabled advice to the effect that Australian manufacturers of wireless instruments, traders and others interested, have formed themselves into an ASSOCIATION FOR THE PROGRESS OF WIRELESS in Australia. Mr. G. A. Taylor has been elected first president.

The Association of British Chambers of Commerce, at their quarterly meeting, adopted a resolution urging upon the Government "the importance of taking the necessary measures without further delay to expedite the COMPLETION OF THE IMPERIAL WIRELESS CHAIN, in co-operation with Overseas Governments, as recommended by the Empire Chambers of Commerce at Toronto in 1920 and the Imperial Conference in 1921." The Executive Council was requested to make representations with this object by deputation to the Postmaster-General and the Secretary of State for the Colonies.

The Canadian Government is planning a CHAIN OF WIRELESS STATIONS extending right into the Arctic circle, which are being completed. Six stations are planned, five of which will be in the north-west territories and another at Dawson. The stations on or near the Mackenzie River will be located at Fort Smith, Fort Resolution, Fort Simpson, Fort Norman and Fort M'Pherson.

A Non-Oscillatory Valve Set for Amateurs.

We understand from ROGERS, FOSTER AND HOWELL that they have now perfected 2, 3 and 4 valve receivers containing reactance but conforming in every respect with the regulations of the ordinary broadcasting licence as regards oscillation production. As an example of the advantages possessed by the new reactance set, it is stated that in the makers' testing laboratory, which is situated within three miles of the Birmingham broadcasting station, it is possible to "tune out" the latter when it is in full operation, and to receive either London, Manchester, Paris, or The Hague concerts at maximum strength, without loss of volume or distortion. The importance of this will be appreciated by anyone who has hitherto been using an ordinary receiver within a few miles of a high-power broadcasting station, and who knows the difficulty there has been in the past in cutting out the local station to concentrate upon another more distant concert. In the past the average user has been apt to content himself with the reflection that one concert is as good as another, but now that opera is being broadcasted with success, increasing numbers of wireless amateurs desire to listen in to the opera rather than to any of the other broadcasting.

Wireless at Scottish Exhibitions.

The exhibits at the Scottish Motor Show this week included a MOTOR CAR FITTED WITH A WIRELESS RECEIVER having a radius of a hundred miles, and capable of picking up messages while the vehicle is travelling at full speed. The aerial can be concealed within the car.

The second Scottish Ideal Homes' Exhibition was opened in Edinburgh on Wednesday. One of the stands under the control of the Edinburgh branch of the ELECTRICAL CONTRACTORS' ASSOCIATION is set apart for wireless demonstrations given by Spensers (Scotland), Ltd. A special licence has been obtained from the Postmaster for the purpose of local transmission, to take place between 12 and 5 p.m.

Week-end Wireless Service to United States.

MARCONI'S WIRELESS TELEGRAPH Co. announce that they have introduced a WEEK-END WIRELESS LETTER SERVICE to the United States at the rate of threepence per word without minimum. Telegrams sent by this service must reach Radio House, 2–12, Wilson Street, E.C.2, either by hand or post, before midnight on Saturdays, and will be delivered in New York City on Monday by messenger. Week-end telegrams to destinations in the United States beyond New York City will be mailed without extra charge, but they must bear the full postal address.

The annual report of CALLENDER'S HOSPITAL AND DISTRESS FUND shows that it has been of the greatest benefit to the subscribers. A donation of £100 was received from Callender's Cable and Construction Co.

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Companies' Meetings, Reports, etc.

A dividend of 2 dollars per share, less tax, is announced for the quarter by the COMMONWEALTH EDISON CO.

THE ENGLISH ELECTRIC CO. of Canada has deferred its quarterly dividend on the 8 per cent. cumulative preference stock.

GREENWOOD AND BATLEY announce interim dividends of 3½ per cent. on the preference shares, and 2½ per cent. on the ordinary shares.

A final dividend at the rate of 12 per cent. per annum, making 10 per cent. for the year, has been declared by the CHELSEA ELECTRICITY SUPPLY CO.

HERBERT MORRIS, LTD., announce the payment of the dividend for the half-year to January 31st on the 6 per cent. and 5 per cent. cumulative preference shares.

A dividend of 2½ per cent., actual, for the year has been declared by the City of CARLISLE ELECTRIC TRAMWAYS, and £438 are carried forward. No dividend was paid last year.

At an extraordinary general meeting of the AUCKLAND ELECTRIC TRAMWAYS CO., on January 25th, a resolution for the voluntary liquidation of the company was unanimously approved.

The TOTTENHAM LIGHT HEAT AND POWER CO., is recommending dividends in respect of the half year ended December 31st at the rate of 5 per cent. per annum on the preference stock, 8 per cent. per annum on the A stock, and 6½ per cent. per annum on the B stock, all less tax.

New Companies.

SWANSEA WELDERS, LTD. Private. Reg. Jan. 24th. Cap. £2 500 in £1 shares. Welders, electric welders, boiler makers and repairers, general engineers and contractors, etc. Reg. office: The Albion Yard, Morriston, Swansea.

CARY, HALLOWELL AND CO., LTD.—Private. Reg. Jan. 22nd. Cap. £2 500 in £1 shares. Electrical, mechanical and general engineers, manufacturers of and dealers in radio and wireless instruments, etc. Reg. office: New Era Engineering Works, Brentfield Road, London, N.W.10.

N. E. S. (BRADFORD), LTD.—Private. Reg. Jan. 23rd. Cap., £1 500 in £1 shares. To adopt an agreement with A. Wilman and to carry on the business of electrical engineers, dealers in electrical accessories, etc. A. Wilman is permanent managing director. Reg. office: 23, Bank Street, Bradford.

WALTER BENNETT, LTD.—Private. Reg. in Edinburgh on Jan. 20th. Cap. £2 000 in £1 shares. To carry on the business of electricians, mechanical engineers, manufacturers of motor cars, aeroplanes, motor boats, etc. The first directors include W. Bennett, Kilmallie, Bishopton, electrical engineer.

CENTRIFUGAL CLUTCHES, LTD.—Private. Reg. Jan. 20th. Cap. £1 000 in £1 shares. To acquire and deal in interests in any patents for inventions relating to centrifugal clutches and pulleys and other mechanical and electrical plant, etc. Secretary: W. E. Brown, 9–11, Belsize Park Gardens, Hampstead, N.W.

R. W. E. BRAHAM AND CO., LTD.—Private. Reg. Jan. 22nd. Cap. £600 in £1 shares. To acquire the business of a manufacturer of and dealer in electrical and gas fittings and general metal spinners, carried on by A. E. Hodgson, trading as "R.W.E. Braham and Co." at 21, Bowling Green Lane, Clerkenwell, London, E.C.

BROADCASTING INSTALLATIONS, LTD.—Private. Reg. Jan. 22nd. Cap. £1 000 in £1 shares. Manufacturers of and dealers in apparatus, instruments, component parts, accessories and things used in connection with wireless telephony, deep sea soundings, etc. Solicitors: A. J. Greenop and Co., Bush Lane House, E.C.

METROPOLITAN ELECTRIC WIRE CO., LTD.—Private. Reg. Jan. 24th. Cap. £500 in £1 shares. Manufacturers of drawn wire electric cabling and lamps, and all articles made from tungsten, molybdenum and other metals, etc. Solicitors: Kenneth, Brown, Baker, Baker, Lennox House, Norfolk Street, Strand, W.C.

VICTOR RADIO, LTD.—Private. Reg. Jan. 22nd. Cap. £500 in £1 shares. Manufacturers of and dealers in and agents for the sale of all electrical or other contrivances for receiving and/or transmitting messages, photographs, pictures, or other communications by radio or wireless, etc. Reg. office: 3, Chapel Street, Salford, Manchester.

RADIO EBONITE SUPPLIES, LTD.—Private. Reg. Jan. 17th. Cap. £1 500 in 1 000 10 per cent. participating preference shares of £1 each and 2 000 ordinary shares of 5s. each. Manufacturers of and dealers in wireless telegraph and electrical instruments, and suppliers of raw and finished ebonite or like material. Reg. office: 4, Little College Street, London, E.C.

RADOLION MANUFACTURING CO., LTD. Private. Reg. Jan. 25th. Cap., £250 in £1 shares. Electricians, manufacturers of generators, accumulators, suppliers and distributors of electricity and electric energy for lighting, heating, telegraphic and telephonic communications, etc. A. C. S. Couldwell, 7, Queens Road, South Norwood, S.E., wireless engineer, is a subscriber.

DE LAVAL CHADBURN CO., LTD.—Private. Reg. Jan. 22nd. Cap. £35 000 in £1 shares. Designers and manufacturers of and dealers in main and auxiliary machinery for power development, transmission and application, steam and other turbines, reduction gears, fans, blowers, pumps and similar machines and apparatus, milking machines and dairy machinery, etc. W. R. Chadburn is managing director and chairman. Reg. office: Wellington House, Buckingham Gate, London, S.W.1.

Tenders Invited.

UNITED KINGDOM.

DUNDEE CORPORATION.—Electric welding machine for tramway track work. Tenders, with specification, etc., to the City Engineer.

GREENOCK CORPORATION, February 7th.—Wiring and fitting 84 houses in connection with the Upper Cornhaddock housing scheme. Specifications from the Officer of Public Works, Municipal Buildings, Greenock.

HULL CORPORATION, February 7th.—Electric light wiring and fitting Scarborough Street and Chapman Street depots. Specification from the City Architect.

MANCHESTER EDUCATION COMMITTEE, February 7th.—Wiring and fitting Grange Street and Stanley Grove schools. Specifications from the Education Offices, Deansgate, Manchester.

EDINBURGH CORPORATION.—February 13th.—Twenty-four air brakes, suitable for tramway cars. Specifications from the Tramways Manager, 2, St. James' Square, Edinburgh.

MYNYDDISLWYN URBAN DISTRICT COUNCIL, February 15th.—Medium pressure overhead line for distribution system (section 1); cables, services, etc. (1a); two 75 kVA 11 000 400 V transformers (2); and 11 000 V and 400 V three-phase switchgear (3). Specifications from A. Ellis and Partners, 9, Park Place, Cardiff.

MANCHESTER ELECTRICITY COMMITTEE, February 16th.—Electricity meters (Specification No. 31), potential and current transformers (No. 32) and time switches (No. 34). Forms of tender, etc., from Mr. F. E. Hughes, Town Hall, Manchester.

WARRINGTON CORPORATION, February 19th.—(1) L.T. paper and lead covered cables; (2) transformers. Specifications from the Borough Electrical and Tramways Engineer, Howley, Warrington.

LONDON COUNTY COUNCIL, February 19th.—(1) L.T. cables, etc.; (2) overhead electrical equipment. Specifications from the Clerk of the Council, County Hall, Westminster Bridge, S.E.1.

TOTTENHAM DISTRICT COUNCIL, February 20th.—Electric capstan, etc. Particulars from the Council's Engineer, Town Hall, Tottenham, N.15.

ELLAND URBAN DISTRICT COUNCIL, February 20th.—Mechanical and electrical engineers' work required in erection of motors, pumps, control panels, etc. (contracts) in connection with additions to sewage works, construction of effluent carrier, etc. Specifications from Mr. W. R. Nunns, 2, Albert Road, Saltaire, near Bradford.

AUSTRALIA.

DEPARTMENT OF PUBLIC WORKS (NEW SOUTH WALES), February 26th.*—Two electrically-driven stiff leg derrick cranes for the Cordeau Dam of the Sydney Water Supply.

VICTORIAN RAILWAY COMMISSION (MELBOURNE), February 28th.*—*Extension of Time.*—The time for receiving tenders for three-phase motors, starting apparatus and accessories (see notice in our issue of January 12th) is extended from January 31st to February 28th.

POSTMASTER GENERAL'S DEPARTMENT, SYDNEY, March 16th.*—Telephone switchboard parts, including cables, condensers, cords, fuses, keys, holders, jacks, ceiling lamps, plugs, relays, sockets, switches and insulated wires (stores schedules 955, 956 and 957).

MELBOURNE AND METROPOLITAN TRAMWAYS BOARD, March 28th.—Manual control gear and switchboards for rotary converters.

BULGARIA.

BULGARIAN DIRECTION OF POSTS, TELEGRAPHS AND TELEPHONES, February 19th.*—5 000 Leclanché cells, 5 000 positive poles for Leclanché cells, 5 000 glass containers for Meidinger cells, 400 kilos of lead, 200 kilos of tin, 500 kilos of hemp, 100 litres of hydrochloric acid, and other parts and accessories.

EGYPT.

ZAGAZIG MUNICIPALITY, February 15th.—Two mono-phase transformers, 50 periods, 20 kVA, 3 000/2 by 115 V, similar to the transformers already installed.—*Reuter's Trade Service.*

IRELAND.

NORTHERN COUNTIES COMMITTEE (IRELAND) OF LONDON, MIDLAND AND SCOTTISH RAILWAY CO., February 8th.—Twelve months' supply of telegraph ironwork, wire, batteries, electric lamps, carbons, castings, ironmongery, oils, varnishes, paints, etc. Forms of tender from the Stores Superintendent, York Road Station, Belfast.

BELFAST CORPORATION, February 19th.—H.T. three-phase 6-core split conductor cables. Specification (No. W. 4), with form of contract, from the City Electrical Engineer and Manager, East Bridge Street, Belfast.

NEW ZEALAND.

PUBLIC WORKS DEPARTMENT, WELLINGTON, March 20th.*—400 miles (1 047 600 lbs.) h.d. copper wire for section 73 of Mangahao electric power scheme.

TASMANIA.

POSTMASTER GENERAL'S DEPARTMENT, HOBART, April 9th.*—Telegraph and telephone material, including magneto bells, timing clocks, detectors, handsets, galvanometers, keys, lamps, mouthpieces, plugs, sockets and rotary snap switches (schedule Tas. 380).

* Particulars from the Department of Overseas Trade.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

CLIFFORD HOLLINGS AND CO., Market Place, Pontefract, electrical engineers. £17 10s. 8d. December 13th.

DADSWELL, Harold E., 7, Seaforth Grove, Harehills, and 132, Vicar Lane, Leeds, wholesale dealer in electric goods. £12 11s. December 12th.

GEORGE AIREY AND CO. (ELECTRICIANS), LTD., registered office, 25, King Street, Sheffield, electrical engineers. £11 0s. 6d. December 13th.

HODGINS, —, 40, Baker Street, Brighton, electrical contractor. £12 8s. 2d. December 1st.

THOMAS, F. H., and EVANS, Walter E. (trading as THOMAS AND EVANS), Salubrious Passage, Swansea, electrical engineers, £40 2s. 9d. December 27th.

WRIGHT, Allen, 11, Fernbank Road, Undercliffe, Bradford, electric good dealer. £18 15s. 6d. December 6th.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

Satisfactions.

CHIPPENHAM ELECTRIC SUPPLY CO., LTD.—Satisfaction registered January 23rd, £800, balance of amount registered February 22nd, 1913.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD. (late BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD.), London, S.W.—Satisfaction registered January 19th, £205,000 part of amounts registered February 28th, 1902, September 8th, 1903, and August 4th, 1904.

NEWCASTLE AND DISTRICT ELECTRIC LIGHTING CO., LTD.—Satisfactions registered January 20th, £30,000, registered August 11th, 1914, and £20,000 (not executed), registered April 15th, 1922.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-Up Voluntarily.

TOFIELD AND ROBINSON, LTD. A. C. Ridgway, Exchange Buildings, New Street, Birmingham, chartered accountant, appointed liquidator.

Bankruptcy Information.

GREATHEAD, Oswald and GREATHEAD, Walter, in partnership under the style of GREATHEAD BROTHERS, 50, Burnley Road, Brierfield, electrical engineers and contractors. First meeting, February 8th, 11 a.m. Official Receiver's Office, 13, Winckley Street, Preston. Public examination, February 13th, 11 a.m. County Court House, Bankhouse Street, Burnley.

LEE, Hubert, lately in partnership with Albert William Verity, at 143A, Leeds Road, Bradford, under the style of VERITY AND LEE, electrical contractors. Receiving Order, January 22nd Debtor's Petition. First Meeting, February 5th, 11 a.m. Official Receiver's Office, 12, Duke Street, Bradford. Public examination, February 28th, 10 a.m. County Court, Manor Row, Bradford.

Notice of Intended Dividend.

ROLLINSON, Joseph Ernest, 5, Tavistock Chambers, Bestmarket Hill, Nottingham, electrical engineer. Last day of receiving proofs, February 14th. Trustee, H. F. Holloway, Bentinck Buildings, Wheeler Gate, Nottingham.

Application for Debtor's Discharge.

SOUTH, Harry, 43, Rathbone Place, Oxford Street, and late 10–12 Garrick Street, Covent Garden, both in the County of London, electrical engineer. Hearing, February 13th, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

Partnerships Dissolved.

W. DAWSON AND CO. (DAWSON, Walter, and RATCLIFFE, Oliver), electrical engineers, Bridge End Works, Bollington, near Macclesfield, January 27th, 1923, by mutual consent. Debts received and paid by O. Ratcliffe, who will continue the business.

Forty Years Ago.

"The Electrician," February 3rd, 1883.

TRANSMISSION OF POWER BY ELECTRICITY.—The first of a series of articles on this subject by Professor O. J. Lodge appeared in last week's "Engineer."

RESIGNATIONS.—Sir Charles Bright and Mr. Edward Bright have resigned the positions they have held with the British Electric Light Company, the former as consulting engineer, the latter as a member of the board of directors.

ELECTRIC LIGHTING IN ST. MARTIN'S-IN-THE-FIELDS.—The Vestry of St. Martin's-in-the-Fields will oppose all the provisional orders referring to their district on the following grounds:—"That they seek to set aside the provisions of the Electric Lighting Act of 1882, and the rules of the Board of Trade in relation thereto, and to extinguish the right to control the public streets now vested in the local authority; that there is no provision for a regular and efficient service of electricity, nor for the security of the public against personal injury, inspection by the local authority, or for a reduction in price after the payment of a dividend of, say, 10 per cent; that the companies seek, without obtaining consent of the Vestry, power to break up the public streets, to place wires above ground, and to acquire sites for lighting stations." The Vestry also consider that no concession to a company should be for more than fourteen years, that the Vestry should have power to inspect the company's accounts, and that penalties should be exacted for failure to execute the proposed works within a reasonable time.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"Nursery Furnishings"; "Toys of To-day"; "The Decoration of Furniture.—IV.: Inlaid Work—Early Italian Marqueterie"; "The Wholesale Furniture Exhibition at Olympia."

THE CHEMICAL AGE.—"The Growing Chemical Industry of Palestine," by Dr. Percy E. Spielman; "Fine Chemicals at the British Industries Fair"; "The Chemical Warfare Problem."

THE EUROPEAN COMMERCIAL.—"Banking Notes"; "The Financial and Economic Situation of Austria"; "Foreign Exchanges."

THE FRUIT GROWER.—"The Value of the Lapwing"; "Australian Fruit Freights"; "Sugar Duty and Fruit Growing."

GARDENING ILLUSTRATED.—"Ghent Quinquennial Exhibition"; "Among the Hardy Flowers"; "Lapagerias and their Culture."

THE GAS WORLD.—"Final Sitting of the Therm Inquiry"; "Magnitude of the Gas Industry"; "Special By-Product Coking Section Supplement."

THE HARDWARE TRADE JOURNAL.—"Perambulators for 1923: A Review of New Models"; "Notes on Galvanising and Galvanised Goods"; "A Chat on Silver and Plate."

Prices of Metals, Chemicals, etc.

TUESDAY, January 30.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£69 10 0	£1 10s.	—
Electro Wirebars ..	,,	£73 0 0	£1 10s.	—
H.C. Wire, basis ..	per lb.	10 5/16d.	⅛d.	—
Sheet	,,	10 5/16d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2 5/16d.	⅛d.	—
Brass 60/40—				
Rod, basis	,,	7d.	—	—
Sheet, basis ..	,,	9½d.	—	—
Wire, basis	,,	10½d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£5 5 0	8s. 6d.	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£18 0 0	—	—
Lead Pig—				
English	,,	£29 5 0	£1 10s.	—
Foreign or Colonial	,,	£28 5 0	£1 15s.	—
Tin—				
Ingot	,,	£186 2 6	£3 17 6	—
Wire, basis	per lb.	2s. 6d.	¼d.	—
Aluminium Ingots ..	per ton	£100 0 0	—	—
Spelter	,,	£36 12 6	£1 2 6	—
Mercury	per bottle	£10 10 0	—	10s.

Sulphur (Flowers)—Ton £9 *Sodium Chlorate*—Per lb. 2⅞d.
,, (Roll-Brimstone)—,, £8 10s. *Sulphuric Acid* (Pyrites, 168°) per ton, £7 10s.
Copper Sulphate.— ,, £26
Boric Acid (Crystals) ,, £55 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine 1s. 5d.; plantation 1st latex, 1s. 6½d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially ; compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

162 628 DURANDO, G. Thermo-electric steam generator. (27/2/22.)
189 156 BROWNLOW, H., and HADLEY, C. A. Current-controlling arrangement. (23/5/21.)
189 165 BRFISIG, DR. F. Method for determining cross-talk in multiple conductor lines. (22/6/21.)
165 416 FELTEN and GUILLEAUME CARLSWERK A.G. Self-induction coil. (24/6/20.)
189 174 LACY, H. Electro-magnets. (22/7/21.)
166 899 MARKS, E. C. R. (NEW ANTWERP TELEPHONE & ELECTRICAL WORKS). Voltage coils for meters, etc. (23/7/21.)
189 185 LUSE, W. J. Fire and burglar alarms. (17/8/21.)
189 203 FAIRWEATHER, W. C. (DIEHL MANUFACTURING CO.). Electric cord holder. (23/8/21.)
189 227 WEBBER, A. B., and STANDARD TIME CO., LTD. Switches for charging batteries. (25/8/21.)
189 233 DAVIS, W. J. Calling-devices operated by wireless signals. (26/8/21.)
168 882 AMERICAN RADIO AND RESEARCH CORPORATION. Condensers, etc., with electrodes immersed in a gas. (30/8/20.)
189 244 WACKER, G. W. Circuit-closers for electrically operated alarms. (30/8/21.)
170 559 METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Liquid rheostats. (18/10/20.)
189 253 THOMPSON, W. P. (SPLITDORF ELECTRICAL CO.). Combined collector and terminal block for electric ignition distributors. (3/9/21.)
168 897 DUFAUX, C. F. Permanent magnets for magnetos. (7/9/20.)
189 257 VICKERS, LTD., ASTINGTON, E. C., and FLANN, E. T. Frictional driving-gear for electric machines on railway vehicles. (5/9/21.)
189 258 VICKERS, LTD., ASTINGTON, F. C., and FLANN, E. T. Frictional driving-gear for electric machines on railway vehicles. (5/9/21.)
189 259 SUTER, E. F. Electric heating-apparatus for waving or curling hair. (5/9/21.)
189 266 GRENFELL, G. P., ROBINSON, J., CROWTHER, H. L., GILL, T. H., and MURRAY J. ERSKINE-. Directional wireless systems. (7/9/21.)
189 267 MINIOTTI, G. Apparatus for transmitting electric signals. (7/9/21.)
189 270 GENERAL ELECTRIC CO., LTD., and BARTLETT, A. C. Electrically heating wires such as the filaments of electric discharge devices. (9/9/21.)
189 279 RIGGS, F. S. Electric switches. (21/9/21.)
189 284 ILLINGWORTH, W. H. Electrical cut-out. (26/9/21.)
189 285 HYDE, A. C. Flux-coated electrodes for arc welding. (27/9/21.)
189 307 HALL, J., and NEW SWITCHGEAR CONSTRUCTION CO., LTD. Protected switches. (17/10/21.)
189 320 LUCAS, H., IRELAND, H. W. F., and TURNER, W. C. Resistances. (26/10/21)
185 379 POULSEN & CO., L. Electric-spark indicators. (1/9/21.)
189 336 MACKLEY, A. H. Switches. (14/11/21.)
189 339 WELCH, A. P. Holders for thermionic valves. (16/11/21.)
189 344 PILKINGTON, B. A. Telephone transmitters. (21/11/21.)
176 317 CARLES, F. Apparatus for overcoming effects on telegraph and telephone lines of s.p. currents. (4/3/21.)
189 349 DORNIG, W. High-frequency transformers. (30/11/21.)
189 350 DORNIG, W. Electric condensers. (30/11/21.)
189 361 MARSHALL, D. Electrical device for destroying rats. (14/12/21.)
189 305 WESTERN ELECTRIC CO., LTD. (WESTERN ELECTRIC CO., INC.). Telephone systems. (20/12/21.)
174 593 METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Insulating sheet materials. (26/1/21.)
181 358 SKYWING AIRCRAFT CORPORATION. Electric iguition devices. (1/12/20). (Divided Application on 172 308.)

APPLICATIONS FOR PATENTS.

January 15, 1923.

1 235 MIDLAND ELECTRIC MANUFACTURING CO. and W. L. BARBER. Switches.
1 251 H. D'O. MANTLE. Continuously variable rheostat for thermionic valves, etc.
1 252 H. D'O. MANTLE. Crystal detectors, etc.
1 253 W. D. BURNET. Transformers, induction coils, etc.
1 259 H. J. SAUNDERS. Movable mouthpiece receivers for use on telephone instruments.
1 330 AKT.-GES. BROWN, BOVERI ET CIE. Safety apparatus for mercury vapour pumps. (6/6/22 Germany.)
1 332 G. M. WRIGHT, C. S. FRANKLIN, and B. J. WITT. Radio receiving systems.
1 335 WESTERN ELECTRIC CO. (POLINKOWSKY). Telephone systems.
1 343 CONCORDIA ELEKTRIZITATS AKT.-GES. Miners' lamps.
1 346 I. F. TAYLOR. Crystal detectors for wireless receivers.
1 357 AUTOMATIC TELEPHONE MANUFACTURING CO. Semi-automatic telephone systems.

January 16, 1923.

1 378 A. M. CHALMERS and C. V. MORRIS. Receivers for wireless telegraphy.
1 397 R. BOSCH AKT.-GES. Buzzer magnets. (20/1/22 Germany.)
1 398 R. BOSCH AKT.-GES. Battery ignition devices. (23/1/22 Germany.)
1 399 R. BOSCH AKT.-GES. Magneto-electric ignition apparatus. (18/1/22 Germany.)
1 404 F. YEO. Electric light for buoys.
1 424 A. WALDBERG. Electro-deposition of metals. (19/1/22 France.)
1 441 INTERNATIONALT RADIOTELEGRAF AND TELEFON COMPAGNI WAHNOE and PETERS. Switch. (20/1/22 Denmark.)
1 443 and 1 444 A. S. CACHEMAILLE (WESTINGHOUSE ELECTRIC AND MANUFACTURING CO.). Motor control systems.
1 455 J. W. WALKER & SONS, F. P. AND R. H. WALKER. Relay and coupler mechanism for electric organs.
1 458 BRITISH THOMSON-HOUSTON CO., LTD. (GENERAL ELECTRIC CO.). Control of electric circuits.
1 472 R. PEALE. Circuit controlling means.
1 475 WESTLRN ELECIRIC CO. Signalling systems.
1 482 W. MAURICE. Containers for accumulators, etc.

January 17, 1923.

1 484 W. D. G. AND T. L. REES. Self-holding insulator.
1 488 BENTON SCALE CO. and W. A. BENTON. Dash-pots.
1 530 E. E. MATHERS. Trolly heads.
1 535 A. M. TAYLOR. Electrical power transmission systems.
1 557 PRYCO, LTD., and E. A. PYE. Thermostatic switch adaptors for electric circuits.
1 558 PRYCO, LTD., and E. A. PYE. Timing switch device for electric circuits.
1 565 W. A. BRADY. Thermionic valves.
1 572 PHILIPS' GLOEILAMPENFABR. and G. L. HERTZ. Cooling electrodes of X-ray tubes.
1 573 L. SEMAT. Automatic telephone systems. (30/6/22 France.)
1 576 L. APPOULOTT. Switches. (18/1/22 France.)
1 578 W. H. DERRIMAN and J. ROBINSON. Electric valves and relays.
1 582 PHILIPS' GLOEILAMPENFABR. Ductile tungsten bodies. (21/11/22 Holland.)
1 585 BRITISH THOMSON-HOUSTON CO. (CIE FRANC. POUR L'EXPLOITATION DES PROCEDES THOMSON-HOUSTON). Renewable fuses.
1 587 H. BARON (SIGNAL GES.). Electric submarine sound signalling.

January 18, 1923.

1 602 J. D. DUNTHORNE and W. J. RICKETS. Inductance coils for wireless apparatus, etc.
1 606 B. JAMES. Motors for driving paper machines, etc.
1 607 B. JAMES. Alternating current motors.
1 614 G. S. CATTELL and G. H. IDE. Electric heating and cooking apparatus.
1 621 F. AND S. C. WESTWOOD. Dynamos.
1 627 H. G. HUMPHREYS. Telephone call recording apparatus.
1 629 SIEMENS BROS. & CO. and A. E. FOSTER. Cables.
1 642 E. W. DOREY. Electric machines.
1 658 H. ST. G. ANSON. Flash lamps, etc.
1 667 CAMBRIDGE AND PAUL INSTRUMENT CO. and B. A. ROBINSON. Instrument relays.
1 671 H. E. TVERMOES. Electric lamp.
1 684 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Switches.
1 688 AUTOMATIC TELEPHONE MANUFACTURING CO. and C. GILLINGS. Telephone systems.
1 689 J. E. CALVERLEY and W. E. HIGHFIELD. Commutators.

January 19, 1923.

1 700 H. H. SEDDON. Accumulator or battery boxes.
1 715 R. A. REDMOND. Electro-medical appliance.
1 726 H. RICHMOND. Variable resistance.
1 731 J. B. TAUNTON. Testing electric ignition.
1 755 N. STRAUSSLER. Electric signalling devices.
1 762 R. S. ALLEN. Time lag switch.
1 764 CHAMBERLAIN AND HOOKHAM and S. JAMES. Power factor indicators for a.c. systems.
1 765 AKT.-GES. KUMMLER AND MATTER. Resistances. (30/1/22 Switzerland.)
1 768 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Circuit breaker systems.
1 769 METROPOLITAN ELECTRICAL CO. and D. R. DAVIES. High tension switchgear.
1 782 P. W. WOOD. System of charging accumulators.

January 20, 1923.

1 805 F. STOKES. Chain for suspending electroliers, etc.
1 817 R. L. RYAN. Indicating scales of variable condensers for wireless telephony, etc.
1 826 J. J. JENNISON. Trolly wheel, etc., for tramways.
1 856 BRITISH THOMSON-HOUSTON CO. and A. P. YOUNG. Electrical apparatus.
1 857 H. KENNEDY & CO. and H. E. DONNITHORNE. Determination of cyclic variation of current or pressure.
1 858 W. S. HILL and C. SEYMOUR. Wireless communication.
1 872 M. S. STUTCHBURY (KRAUSE). Protection of asymmetrical alternating voltages.
1 874 ENGLISH ELECTRIC CO. and R. A. R. BOLTON. Switches.
1 877 E. T. FISK. Wireless transmission and reception.

Arrangements for the Week.

FRIDAY, FEBRUARY 2nd (To-day).

ELECTRICAL POWER ENGINEERS' ASSOCIATION.

7 p.m. At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Lecture entitled "Characteristics, Operation and Maintenance of Underground Cables," by Mr. A.I. Tracey.

BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION.

7.30 p.m. Salesmanship Conferences. At Caxton Hall, Caxton Street, London, S.W.1. Lecture on "Portable Accessories: Irons, Fans, Small Cookers etc.," by Mr. C. S. Davidson.

JUNIOR INSTITUTION OF ENGINEERS.

7.30 p.m. At 39, Victoria Street, London, S.W.1. Lecturette entitled "Ventilation and Lighting of Factories," by Mr. P. J. Waldram.

ROYAL INSTITUTION OF GREAT BRITAIN.

9 p.m. At the Institution, Albemarle Street, Piccadilly, London. Lecture on "Fact and Phantasy in Industrial Science," by Mr. C. F. Cross.

MONDAY, FEBRUARY 5th.

THE SOCIETY OF ENGINEERS.

5.30 p.m. In the Apartments of the Geological Society, Burlington House, Piccadilly, London. Paper entitled "Practical Notes on Inspection," by Mr. A. Collis-Brown.

INSTITUTION OF ELECTRICAL ENGINEERS (WESTERN CENTRE).

6 p.m. At the South Wales Institute of Engineers, Park Place, Cardiff. Paper on "Some Problems in High Speed Alternators and their Solution," by Mr. J. Rosen.

INSTITUTION OF ELECTRICAL ENGINEERS.

7 p.m. At the Institution, Savoy Place, Victoria Embankment, London. Informal Meeting. Discussion on "The Supply of Steady D.C. for Telephonic and other Purposes." (Opened by Mr. J. Coxon.)

TUESDAY, FEBRUARY 6th.

INSTITUTION OF ELECTRICAL ENGINEERS (NORTH MIDLAND CENTRE).

7 p.m. At the Metropole, King Street, Leeds. Paper on "The Maintenance of Voltage on a D.C. Distribution System by Means of an Automatic Substation," by Mr. C. J. Robinson.

INSTITUTION OF ELECTRICAL ENGINEERS (NORTH-WESTERN CENTRE).

7 p.m. At the Engineers' Club, Albert Square, Manchester. Discussion on "Power Circuit Interference with Telegraphs and Telephones." Introduced by Mr. S. C. Bartholomew.

ELECTRICAL SOCIETY OF GLASGOW.

7.30 p.m. Papers on (*a*) "Electric Vehicles," by Mr. C. W. Marshall; (*b*) "The Present Inefficiency of Electrical Trading: Its Causes and Remedies," by Mr. J. B. Epsteen.

WEDNESDAY, FEBRUARY 7th.

INSTITUTION OF ELECTRICAL ENGINEERS (WIRELESS SECTION).

6 p.m. At the Institution, Savoy Place, Victoria Embankment, London. Lecture on "The Measurement of the Electric Intensity of Received Radio Signals," by Mr. J. Hollingworth.

INSTITUTION OF ELECTRICAL ENGINEERS (LIVERPOOL SUB-CENTRE).

At the Royal Institution, Colquitt Street, Liverpool. Lecture on "The Electrical Propulsion of Ships," by Mr. R. S. Johnson.

INDUSTRIAL LEAGUE AND COUNCIL.

7.30 p.m. At Caxton Hall, Caxton Street, London, S.W.1. Lecture on "Some Obligations of Industry to Labour," by Mr. F. O. Roberts, M.P.

ROYAL SOCIETY OF ARTS.

8 p.m. At John Street, Adelphi, London. Lecture on "Electrical Resistance Furnaces and Their Uses," by Mr. C. R. Darling.

THURSDAY, FEBRUARY 8th.

WOMEN'S ENGINEERING SOCIETY.

6.15 p.m. At 26, George Street, Hanover Square, London. Lecture on "The Kearney High-Speed Railway," by Mr. E. W. Chalmers Kearney.

INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH CENTRE).

7.30 p.m. In Engineering Class Room, University College, Dundee. Lecture on "High Voltage Transmission by Underground Cables" (with Lantern Slides), by Mr. A. M. Taylor.

FRIDAY, FEBRUARY 9th

JUNIOR INSTITUTION OF ENGINEERS.

7.30 p.m. At 39, Victoria Street, Westminster, S.W.1. Lecture on "The Effect of Temperature on the Properties of Engineering Materials," by Professor F. O. Lea.

EDINBURGH ELECTRICAL SOCIETY.

8 p.m. At the Philosophical Institute, 4, Queen Street, Edinburgh. Lecture on "Some of the Less Obvious Uses of Electricity," by Mr. W. F. Martin.

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CONTENTS.

Notes of the Week	131	A Long Distance Joint Meeting	147
Direct Current Disabilities	133	Mr. W. T. Kerr Charged	147
The Problem of Effective Heights of Aerials. By P. P. Eckersley	134	Scottish Ideal Homes Exhibition	147
Institution Dinner	135	Wireless News	148
Notes on Wireless Matters. By Prof. G. W. O. Howe	136	Obituary	148
Voltage Maintenance on D.C. Systems. By F. J. Robinson. Illustrated	137	Personal Items	148
Spring and The Electrician Competition	138	Electricity Supply	149
Manufacturer—Factor—Retailer. By "A Spectator."	139	Imperial Notes	150
I.E.E. Summer Visit	140	Passport Visas in Europe	150
Advisability of Limiting to Super Power Stations the Public Supply of Electricity	140	Foreign Notes	150
Institution of Electrical Engineers	141	Electric Traction	151
Silvanus Thompson Memorial Lecture	142	Reference Index to Wireless Publications	152
Correspondence	142	Tenders Invited and Accepted	153
Selling Small Electrical Apparatus	143	Companies, Meetings, Reports, etc.	154
Merchandise to Sell and Profit By. Illustrated	144	New Companies	154
British Empire Exhibition	146	Institution Notes	154
Technical Institutes	146	Business Items	154
New Underground Rolling Stock	146	Commercial Intelligence	155
Legal Intelligence	146	Forty Years Ago	155
Electricity Supply in S.E. Lancs	147	Books Received	155
		Prices of Metals, Chemicals, etc.	155
		Patent Record	156
		Arrangements for the Week	156

Notes of the Week.

A Bit of a Bombshell.

While the electrical industry is awaiting with interest the Commissioners' draft order on the London and Home Counties Electricity Scheme, the London Electricity Joint Committee (1920), Ltd., has thrown a pebble (or is it a bomb?) into the placid pool. This company, which, it will be remembered, represents the electricity supply companies of London, has resolved that electrical development in London would best be secured by a sort of positive and negative arrangement; in other words, by the formation of two bodies, one representative of the companies and the other representative of the municipalities, to provide London with electricity. With this end in view it is promoting a Bill which will repeal the obnoxious purchase clause, or at least postpone it until 1971, will permit it to purchase any municipal undertakings that desire to be purchased, and will allow for a sliding scale of prices and dividends similar to that in force with the gas companies, as was suggested in the Commissioners' scheme.

One Authority Essential.

Naturally Cerberus in form of the London County Council and the other municipalities concerned are much upset about it. The L.C.C. Special Committee on London Electricity Supply recommends strong opposition to the Bill mainly on the obvious grounds that it would split the metropolis into two camps and provide the companies with a valuable concession without any commensurate benefit to the public. It also points out that the scheme is contrary to the spirit of the Electricity (Supply) Act, 1919, and is open to grave objections from the engineering standpoint. With all these views we unhesitatingly agree. We should still agree were enterprise the entire prerogative of the companies and reaction the entire prerogative of the municipalities. But many of the municipalities are progressive, and not a few of the companies are lacking in enterprise. The right way to tackle the question is to bring London's electricity supply under one authority, as could have been done years ago had those concerned possessed sufficient foresight and goodwill. It is the end for which the Commissioners are now working. The companies, have suffered under many wrongs, but a multiplication of wrongs will not result in right. We fear that the only effect of this Bill, which has not the slightest chance of passing, will be to delay reform still further and to postpone the day when London's electricity supply will be worthy of the greatest city in the world.

Railways and Super Power Stations.

The amount of nonsense that is talked and written about super-stations is almost inconceivable. It may therefore be ultimately beneficial that the civil, mechanical and electrical engineers of Birmingham should have got together to discuss "The Advisability of Limiting to Super Power Stations the Public Supply of Electricity." On the other hand, the electrical industry knows that the super power station idea in all its fragrance and abundance is dead—if it ever was alive—and that the subject is not really of more than dialectical importance. As Mr. S. T. Allen pithily and correctly expressed it, the answer to the question implied in the subject discussed is sometimes "No" and sometimes "Yes." The idea that each district should have only one large station to supply all its wants is, as Mr. Chattock remarked, quite erroneous. In each district there are stations that can economically be extended, and other stations which could with advantage be shut down. In each district electrical requirements will necessitate the building of one or more large stations in positions which experience has shown to be the best. Working on these

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lines electricity will become cheaper, especially if the railway companies realise that their interest will best be served by buying in bulk rather than by building their own stations. Foresight, as Sir VINCENT RAVEN said, is a first essential, while not less important are the claims of the district as a whole rather than the maintenance of parochial monopoly.

Thompson and Wireless Origins.

HISTORICAL research is a branch of engineering study which is still unaccountably neglected. Such a study is not only interesting in itself, but is of great value in determining the paths of future progress. At a time when the developments in radio science are so vital and so widespread, the lecture delivered by Sir OLIVER LODGE on "The Origins of Wireless Communication" at Finsbury Technical College, on Friday last, will therefore repay study. It is well also that such a subject should be coupled with the name of SILVANUS THOMPSON, who, though not primarily connected with wireless progress, had, as Sir OLIVER well said, "a breadth of outlook and a width of interests" which led him to study and unravel the very beginning of things electrical and engineering, and who had as a fact published a pamphlet, from which the lecturer largely quoted, with the same title as that of the lecture. Sir OLIVER showed, as will be seen from the abstract of his lecture which we give elsewhere, how the early work of HENRY, of MAXWELL and of HERTZ, among many others, had contributed to the discovery on a theoretical basis and the perfection on a technical basis of a system of communication which is now an important factor in civilisation. He pleaded especially for a recognition of the ether of space in studying, wireless, and it is certain that if we go back to origins, as he advised us to do, the necessity for a theory of this kind is absolutely evident. No better man could have been found than Sir OLIVER LODGE to deal with such a subject, nor could any better means have been found to commemorate the name of THOMPSON.

The Economics of High Steam Pressures.

A WEEK or two ago we referred to a paper read by Mr. GEORGE ORROK before the American Society of Mechanical Engineers, in which the author discussed the economic limitations of higher steam pressures. In commenting on this paper, Mr. P. JUNKERSFELD pointed out that the extra fixed charges are always greater than the saving in coal, at $6 per ton, for the Rankine cycle of 700° F. maximum temperature, and that the additional gain for 1 000° F. maximum temperature would barely exceed the additional fixed charges. This is probably enough a correct representation of the case, and bears out the views which have been put forward from time to time in this country. But it is not quite certain, as it is difficult to determine accurately the item of "fixed charges per kilowatt-hour," an item which depends on the extra construction cost, the percentage of interest, etc., required and the output. These may vary considerably with different stations.

Still Room for Improvement.

TO MAKE the matter more definite, therefore, Mr. JUNKERSFELD suggests the use of a "generator capacity factor," that is, the ratio of the actual to the possible output of the generator. This factor, when taken over a number of years, is, he considers, much less than is usually supposed, especially where the output of the station has substantially increased. In fact, in two particular cases of stations with the same plant installed the factor was 44 per cent. and 25 per cent. respectively, meaning a large difference in the fixed charges per kilowatt-hour. The figures, moreover, indicate that there is still room for improvement in the construction and operation of equipment with what might be called moderate pressure and superheat—that is, up to 250 lb. and 600° F. This seems to us to be the right line to take. There are many disadvantages in taking big steps up the temperature and pressure scales; and these steps would be unwise until we have determined that all improvements possible with the present figures have been obtained.

Chaos—and a Solution.

ON another page of this issue we publish the last of a series of articles from our contributor "Spectator" on the important question of the relations between the manufacturer, factor and retailer in the electrical industry. These relations are at once friendly, hostile and chaotic. And as their basis must in the limit be also financial, the reason why they are all these three things is evident from the first article, in which the discounts available to all sorts of people were analysed in detail. We believe that such an analysis has not been published before, and as a knowledge of the position is the first step to improvement, it should therefore be extremely valuable. Our contributor further propounded two questions: Can the activities of the various sellers be limited; and can the number of the discounts, which are many, be reduced? Before answering these questions he proceeded in a second article to give the opinions of the manufacturer, factor and retailer upon them. This is what he discovers.

An Electrical Traders' Association Necessary.

THE manufacturer complains that the retailer is not alive to the possibilities of the products offered him for sale, and that his selling methods are musty. He also complains that the retailer and factor are in league against him on the subject of discounts. The retailer complains that the manufacturer sells direct to the public, and that he gives discounts where discounts are not permissible. Both manufacturer and retailer agree that, in historic phrase, the factor "is dangerous, useless, and ought to be abolished," unless he performs his true function of holding stocks. In the article that we publish to-day a plan for overcoming the obstacles to progress evident in these conditions and complaints is propounded. That plan consists in the formation of a League of Electrical Traders on which all parties shall be represented, and whose objects shall be the "freezing out" of the recalcitrant and the greater good of the industry. He also puts forward a list of discounts that should be allowed, the principal novelty in which is that trade users should be allowed a much lower discount than that given to those who buy for re-sale, while their number and complication are beneficially reduced.

What the Association Should Do.

OUR contributor fears that his suggestions will be ridiculed as idealistic and unpractical. We do not propose so to describe them. But though we agree with him as to the end to be achieved, we may be forgiven for wondering whether the means that he has suggested for improving the present chaos are the best that can be discovered. Compared with the position ten years ago, the electrical industry is now well organised. With good will its organisation will become better, and with that better organisation will come understanding and the solution of many of the present problems. For that reason we welcome a conference on the lines suggested by "Spectator." The question of discounts might first be raised and, if possible, decided. It has already long been under discussion by more than one interest. The question of the formation of a League of Electrical Traders might then be dealt with to see whether such a body is practically possible. But for the present the penal clauses had better be deferred. Insistence upon them would do more harm than good.

Broadcasting Disabilities.

THE little cloud which we noticed on the Broadcasting Company's horizon some months ago has become large enough to make us expect that a storm is imminent. It has, of course, arisen over the use of non-licensed sets, and especially of sets constructed by amateurs in their own workshops. As the Company justly point out, the use of such sets is "not cricket," and must adversely affect their

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revenue, which is so far about £12 500, while the annual cost of running a broadcasting station is about £20 000. No wonder, then, that the company are "seriously perturbed." We put it fairly to those who are concerned in these illegal operations, whether it is worth while. Ten shillings is no great sum to pay for a licence, nor will the small additional charges on the selling cost of the apparatus, which the Broadcasting Company's fee entails, mean bankruptcy. But if these moneys are not paid there will soon be no broadcasting. For our part, therefore, we hope the offending amateurs will see reason and that the Post Office will take drastic steps to bring culprits to book.

To Valve or Not to Valve?

WIRELESS nomenclature holds about the same position in our scheme of things as do the sea-serpent and the giant gooseberry in lay journals. Once again, for the *n*th time, the subject has come up for discussion. Last week we had Mr. H. M. SAYERS, as an outsider, complain- that he could not understand radio-telephonic language, and Dr. NICHOLLS trying to make things clear. This week an "insider," Prof. G. W. O. HOWE, propounds the difficult question whether a valve should be called a valve or an electronic tube. The former is sanctified by British practice, the latter with variations by American. The former is more euphonious, the latter more correct, with the reservations that Prof. HOWE sets out in full. But this way madness lies. For if once we begin to discuss with high seriousness which term is the more scientifically correct, we shall be landed in a morass of contradictions from which escape will be difficult. The acid test in this, as in other matters, is usage. The man (or woman) who first named a cat a cat did so, not with high scientific purpose, but because the animal looked like a cat and behaved like a cat, and, indeed, was a cat. In the case of the valve the same argument might apply.

Direct Current Disabilities.

The lot of the supply engineer who possesses a direct current network is at present unenviable. To meet not only a growing domestic load, but the ordinary expansion of his undertaking, he is faced with a heavy capital expenditure on mains and sub-station plant and with considerable money charges attendant upon the operation of the latter. In certain cases, as at Newcastle, this problem has been tackled by boldly changing blocks of consumers over to "alternating," but, apart from the obvious limitations of this course, it is almost impossible where the power load is large and traction has to be considered. The remaining alternatives are to strengthen the feeders from the existing sub-stations, to build new manually-operated sub-stations, to employ mercury rectifiers, or to go in for what are conveniently called automatic sub-stations. The third of these alternatives has found some acceptance in this country, while the fourth, though widely used in America, has, at present, in the British Isles the Walton sub-station of the Liverpool Corporation as its only example.

Are Automatic Sub-Stations Complicated?

Seeing the technical and economic importance of the problem we have just stated, the Institution of Electrical Engineers is to be congratulated on obtaining a Paper from Mr. P. J. ROBINSON, in which not only is the Liverpool automatic sub-station described, but certain financial details are given. We give an abstract of this Paper elsewhere in this issue. About the technical features of the equipment we propose to say little. Both Mr. ROBINSON'S own testimony and that of more than one speaker in the discussion show that the equipment is designed to meet all contingencies, and in practice does meet all contingencies with every satisfaction. Mr. WELBOURN protested against the multiplication of "gadgets." This rather amused the telephone engineers present, who pointed out that compared with an automatic exchange the most complicated automatic sub-station is a thing of pristine simplicity. But Mr. WELBOURN is right. There is no virtue in complication for complication's sake, and if certain of the imposing array of relays can be eliminated, not only will cost be saved, but working efficiency may be increased.

Finance the Controlling Factor.

As in nearly every other engineering problem, it is upon finance that the automatic sub-station will stand or fall. The figures which Mr. ROBINSON gives for capital costs are the most interesting part of the Paper, and it is a pity, therefore, that the matter is not more lucidly put forward. Mr. ROBINSON discusses the cost of three possible schemes, but instead of giving the total amounts necessary to erect these schemes, he works on a method of differences, which is rather difficult to follow. From this he determines that to lay new feeders from the existing sub-stations would cost an "extra" of £12 500, compared with an "extra" of nothing for a new manually-operated sub-station and an "extra" of £1 795 for the automatic gear. The last figure seems extraordinarily low, considering the complicated gear required, and it would be interesting to know whether it can be taken as typical. As regards running charges, there is a sum of £870 in favour of the automatic sub-station over the new feeder scheme and £1 050 over the new manually-operated sub-station scheme. Mr. ROBINSON, however, apparently allows the same depreciation for cables as for running plant, which favours the method that has been adopted at Liverpool. We hope that in his reply he will restate the costs in a simpler manner. They are all important.

Costs of Automatic and Manual Sub-Stations Compared.

Fortunately for him, figures from America confirm his arguments in favour of the automatic sub-station, especially in outlying areas and for traction purposes. Though the first cost of these stations—not "the differences"—is naturally higher than those of the more usual type, this is more than set off by the less cost of operation. Some figures recently published in the "Electrical World" show that in two automatic sub-stations, one with a plant capacity of 9 000 kVA, the other with a plant capacity of 5 000 kVA, and with annual outputs of 24 647 700 kWh and 4 300 090 kWh, the costs for operating and maintenance were 0·0105 cents and 0·0219 cents per kWh respectively. In the case of three manually-operated sub-stations with plant capacities of 14 000 kVA, 6 000 kVA and 4 500 kVA and outputs of 16 661 000, 5 964 000 and 5 728 000, the costs per kWh were 0·106, 0·26 and 0·31 cents per kWh respectively. If these results can be duplicated over here, the chance for the automatic sub-station seems bright indeed, and we shall look for a large following of the example of Liverpool.

Is Direct Current Doomed?

In this connection Mr. W. M. SELVEY'S remarks in the course of the discussion on Mr. ROBINSON'S Paper are of considerable importance. If, he asked, to perpetuate direct-current distribution it is necessary to spend £20 000 when the average load in a district increases from 0·5 to 1 kW, what will it be necessary to spend when the load increases to 5 or 6 kW? Experience is hardly sufficient for a correct answer to be given at present, but the increase is more likely to be in geometrical than an arithmetical proportion. The alternative to this expenditure is, of course, to employ alternating current. But would that be any cheaper? One thing is certain, if the change is to be made, it must be made without delay, otherwise other factors than finance would render it impossible. The best and, indeed, the only way to decide this question is for supply engineers to work out the probable development of their load and plan and budget accordingly.

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The Problem of Effective Heights of Aerials.

By P. P. ECKERSLEY.

The subject of "effective heights," which is of prime importance from the point of view of large transmitting aerials, has hardly received the treatment it deserves. A great deal of attention has been paid to the determination and reduction of the resistance of such aerials, but the effective heights of the structures have usually, except in certain cases*, been only guessed at.

It is obviously false economy to spend a great deal of money on reducing the resistance so as to get an equivalent increase of current for a given amount of power, if at the same time the effective height is proportionally reduced; for the signal strength (in volts per m.) is proportional to the product of the current and effective height of the transmitting aerial, and the increase of one factor with a corresponding decrease of the other will leave things as they were as regards the transmission efficiency of a station, and the trouble spent in the reduction of the resistance will be entirely wasted. A case in point is that of an aerial with a self-supporting lattice tower. It is known that a considerable reduction of aerial resistance may be effected by bonding up the joints of the tower with copper wire. At the same time this reduces the resistance of the tower to the currents flowing in it, and will probably increase these and produce a proportional reduction in the effective height. We may well ask ourselves whether the expense involved in this bonding process is worth while.

Difficulties of Determination.

This neglect of the effective height in the past has been no doubt due to the difficulties involved in its determination, not only as a matter of experiment, but as a matter of theoretical definition. Some interesting pioneer work in this subject has been done by Prof. Vallauri and Dr. Pession.† The latter has described his method and results in an article in the "Radio Review."

Pession's Method.

This method, in which three aerials are used, is at first sight comprehensive, and appears to determine uniquely the effective height of each of the aerials, but to my mind it involves an assumption which, without further investigation, cannot be considered proved.

This is the assumption that the transmission formula

$$E=\frac{377\,HI}{\lambda d} \qquad \text{(1)}$$

E in volts per m., λ, d, H in metres, derived by Hertz for the transmission in free space or over a perfectly conducting plane, is correct for transmission over the earth, which in certain cases is very far from being perfectly conducting.

Dellinger has gone so far as to assume that the earth is nearly perfectly insulating and proposes to use the formula

$$E=\frac{188\,HI}{\lambda d}$$

as suitable in this case.‡

The matter does not merely depend on a definition of H so that the product of A_0H_0 when substituted in a transmission formula $\frac{A_0H_0I}{\lambda d}$ will give the observed value E, but is something more than that, as the following example will show.

It has been proposed to measure the effective height of a given aerial by erecting two exactly similar aerials at a distance d apart and observing the voltage induced in one by a given current in the other. Although this condition may not be possible to attain in practice, theoretically it is quite conceivable.

The observed values of V will then be given by

$$\frac{377\,h_1^2I}{\lambda d}=V\text{; or}$$

$$\frac{188\,h_2^2I}{\lambda d}=V$$

according as we use the first or second formula.

If we compare the values of h_1 and h_2 given by these formulæ we get

$$h_2=\sqrt{2}h_1$$

Now observe that it is possible to measure the value of the field strength E by means of a frame, for we have very approximately the voltage V induced in a frame by a wave in which the electric force is E.

$$V=\frac{2\pi AE}{\lambda} \qquad A=\text{Area of frame.}$$

so long as the dimensions of the frame are small compared with the wave-length.

Two-Aerial Method.

Suppose we use this method now for determining the effective height. A frame is placed at a distance d from a transmitter T whose effective height it is desired to find. We can measure E as above and from the transmission formulæ (1) and (2)

$$E=\frac{377\,h_1I}{\lambda d} \qquad \text{or} \qquad E=\frac{188\,h_2I}{\lambda d}$$

determine h_1 and h_2.

The relation which must now exist between h_1 and h_2 is

$$h_2=2h_1$$

which is inconsistent with (1).

Discrepant Definitions.

The two methods of defining the effective height cannot be consistent. The fact is that there are two methods of definition current and these two methods do not necessarily agree. They are connected with reception and transmission respectively.

The former, which is easier to describe, will be dealt with first. If an aerial is acted on by a plane wave, the electric force in the wave front being E, then the effective height is defined as being h, where $Eh=V$—i.e., the voltage induced in the aerial which produces the same current as the signal.

The effective height defined in this manner is a perfectly definite quantity, which we will denote by h_R.

The e.m.f. induced in a receiving aerial is then h_RE. As regards transmission we know that a radially symmetrical aerial on a perfectly conducting earth will produce an electric force in the wave front at a distance d equal to

$$\frac{377\,hI}{\lambda d}$$

and if this value of E is measured by a frame we can define the effective height for transmission as

$$h_T=\frac{E\lambda d}{377\,I}$$

all the quantities on the right hand being observed or measured.

Transmission Over Perfectly Conducting Plane.

It is easy to show that in this case—i.e., transmission over a perfectly conducting plane, $h_T=h_R$ when the 377 factor is used. The difficulty arises when the earth is not perfectly conducting and when there are currents induced in the masts and stays, etc., which detract from the radiating power of the aerial. h_R as defined above needs no modification, but a further examination of the case is necessary before we can attach a definite meaning to h_T, which has been defined in terms of a transmission formula which may not hold under these circumstances. Indeed, since there must be some loss of energy in the resisting

* See Vallauri, "Radio Review," February, March and April, 1921.
† "Radio Review," May, 1921.
‡ See also Moullin on The Measurement of Horsea Signal Strength. "Proc. Inst. E.E.," Vol. 61, p. 67, December, 1922.

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earth the formula cannot hold, except as an approximation or possibly as a limit to which E tends as d becomes sufficiently small (though still large compared with λ).

Sommerfeld's Theoretical Treatment.

Fortunately we have in the work of Sommerfeld a very complete theoretical treatment of the case of a radially symmetrical transmitting aerial sending waves over the surface of a semi-conducting medium.

He shows* that the field of any such transmitting system, the dimensions of which are small compared with the wave-length, is expressible in the form (1) so long as the quantity $|\alpha^2|$ is small compared with unity, where

$$\alpha=\frac{\chi_1^2}{\chi_2^2}\sqrt{\frac{k_1^2-k_2^2}{k_1^2}}\sqrt{\frac{rk_1}{2i}}$$

$$k^2=\frac{\epsilon\mu n^2+i\mu n\sigma}{C^2}$$

ϵ=dielectric constant, μ=permeability, σ=conductivity, n=frequency. $\chi_1^2=\frac{k_1^2}{\mu}$

$$\chi_2^2=\frac{k_2^2}{\mu}$$

r=distance and C=velocity of light.

The suffix 1 refers to the air and the suffix 2 to the earth. The quantity α^2 is approximately equal to

$$\frac{\pi r/\lambda}{\epsilon_2+2\pi i\alpha C}$$

and is small in all practical cases up to a distance of many wave-lengths.

Effective Height Defined.

It is therefore permissible to define the effective height h_T as before—i.e., as the value of h which when substituted in the transmission formula gives the observed value E at a given distance d. But in this case we have no guarantee that $h_T=h_R$. The value of h_T obviously depends on the constant used in the transmission formula. For a fixed value of observed value of E the apparent value of h varies inversely as the constant used. There is, however, the following relation between h_R and h_T. Consider two aerials, 1 and 2, tuned to a definite wave-length. Power is supplied to each and they are in a steady state with currents I_1 and I_2 respectively.

The dissipation of energy from the system can be derived from a definite dissipation function

$$W=\tfrac{1}{2}R_{11}\times I_1^2+R_{12}\times I_1\times I_2+\tfrac{1}{2}R_{22}\times I_2^2$$

Any change of power dissipated is

$$\delta W=(R_{11}\,.\,I_1+R_{12}\,.\,I_2)\,\delta I_1+(R_{12}\,.\,I_1+R_{22}\,.\,I_2)\,\delta I_2$$
$$=V_1\delta I_1+V_2\delta I_2$$

where V_1 and V_2 are the voltages in the two aerials respectively, since W is a perfect differential

$$\frac{\delta V_1}{\delta I_2}=\frac{\delta V_2}{\delta I_1}$$

i.e., the change in voltage in aerial 1 produced by a unit current in 2 is equal to change in voltage aerial 2 produced by unit current in 1, or if we have two aerials, A and B, if V_A is the voltage in A produced by a current I_B in B and V_B is the voltage in B produced by a current I_A in A, then

$$\frac{V_A}{I_B}=\frac{V_B}{I_A}$$

From the transmission formula

$$\frac{V_A}{I_B}=\frac{377\,h_{BT}h_{AR}}{\lambda d}$$

$$\frac{V_B}{I_A}=\frac{377\,h_{BR}h_{AT}}{\lambda d}$$

i.e., $$h_{BT}h_{AR}=h_{BR}h_{AT}$$

$$\frac{h_{BT}}{h_{BR}}=\frac{h_{AT}}{h_{AR}}$$

i.e., the ratio of h_T to h_R must be a constant for any given wave-length. It is easy to see that by choosing the right constant A_o in the place of 377, h_R and h_T may be made equal.

The value of A_o to produce this quality cannot be theoretically predicted; for in Sommerfeld's work he does not explicitly express the value of h in terms of the dimensions of the aerial; in fact, he avoids any assumption except that the field in the neighbourhood of a certain point is similar to that of a Hertzian radiator.

Hence it is a matter of experiment to determine the value A_o. So far as experiments have been made up to the present the assumption $h_R=h_T$ seem to be consistent with $A_o=377$ and not 188, as given in a formula by Dellinger.

* "Annalen der Physik," February, 1909, p. 665.

The Institution Dinner.

Mr. Gill on International Telephone Progress.

The Annual Dinner of the Institution of Electrical Engineers was held on Tuesday. Mr. Frank Gill presided and about 400 members and guests were present.

Attempts were made to improve the notoriously bad acoustics of the Grand Hall at the Hotel Cecil by the installation of the Public Address System which we described a week or two ago. Two groups of projectors were erected, one directly over the President's chair and the other immediately opposite, over Mr. Highfield's seat. The first group was used for the reproduction of the President's speech and the other speeches made from the top table, while the second group was used to amplify Mr. Highfield's speech. We understand that the actual installation was compassed about with certain difficulties, and this, no doubt, explains the fact that while the "loud speaker" improved the hearing it gave rise to some rather unpleasant ringing effects.

Letter from the Prince of Wales.

Mr. Gill read congratulatory telegrams from the American Institute of Electrical Engineers, from the French Society of Electricians and from the Italian Electro-Technical Association. He also read part of a letter from the Prince of Wales regretting His Royal Highness's inability to accept the Institution's invitation, but intimating that he might be able to attend the dinner on a future occasion.

Advancing Knowledge and Improving Practice.

Sir William Joynson-Hicks, in submitting the toast of the "Institution," said their policy of advancing knowledge and improving practice was one which most Government departments might take for their own. It was by the development of science, yoked in double harness with commercial improvements, that the trade of our country was developed in the past and would be developed in the future. Much advantage could be obtained through the overseas students who came to our workshops and colleges, for every one of those students was worth ten commercial travellers when he got back to his own country.

Big Business Essential.

The President, in replying to the toast, pleaded with those who had to deal with electricity supply to do their best to build up big business because only big businesses could be strong businesses. Turning to international telephony he said that no Government in Europe dared take an order for international telephone calls on a contractual basis because none of them had the control which was necessary. A first class extensive telephone service in Europe was not possible under the present system, but that was no one's fault. He was glad to say that some progress had been made towards improvement by the French Government issuing invitations to a meeting to consider the question. It was not a matter for co-ordination or for books of rules and only by arranging for unity of control for the whole of the through business could success be achieved. He mentioned that Liverpool had just been made a centre of its own and in calling attention to the local Centres' services conveyed the thanks of the Council to their Committees and officials as well as to the Headquarters' staff.

In replying to the toast of the "Guests" proposed by Mr. J. S. Highfield, the Postmaster-General said that no department of the Government was so closely connected with, and dependent upon, the progress and science of electricity and its application to daily life as the Post Office. In regard to wireless telegraphy and telephony there was incalculable possibilities.

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Notes on Wireless Matters.

Thermionic Valve or Electron Tube: A Question of Nomenclature.

By Prof. G. W. O. HOWE.

I was somewhat surprised and amused to see that the reviewer of a book on wireless telegraphy stated recently that the book would not appeal to English readers because of the Americanisms it contained—such, for example, as "electron tube" for a thermionic valve. I was amused because at a recent meeting of a committee dealing with nomenclature "electron tube" had been seriously put forward as a suitable term for use in this country in the place of thermionic valve.

This piece of apparatus has always suffered from a superfluity of designations. The original two-electrode valve, first introduced as a detector by Prof. Fleming, was called either a Fleming valve or a thermionic valve, then de Forest introduced the name "Audion," applying it first to the Fleming valve used with an anode battery, and afterwards transferring it to his three-electrode valve. The General Electric Co. of America having made a three-electrode valve with a much better vacuum than had been previously attained, called it a "pliotron." Then, to avoid the use of such long names as two- or three-electrode thermionic valves Dr. Eccles suggested the words "diode" and "triode," but, although they are employed to some small extent, the word "valve" maintains an impregnable position in the wireless vernacular of this country.

Two Invalid Objections.

Some people object to "valve" whilst others object to "thermionic"; in my opinion neither objection can be seriously upheld. A valve, whatever its etymological implications may be, has long been recognised in engineering as a device which is not necessarily non-return or unidirectional, but which merely regulates the flow. The slide-valve of a steam engine controls by its position the flow of steam from the steam pipe to the cylinder, and similarly in the thermionic valve the grid by its potential controls the flow of electricity from the filament to the anode. Whether it is employed as a detector, as an amplifier, or as a generator of high-frequency oscillations, the thermionic valve acts as a valve.

The objection to "thermionic" is based presumably on the fact that the ideal hard valve would contain no ions but only electrons. In any actual valve, however, there are some ions present and in soft detecting valves a great many. If it be objected that the name suggests that ions are liberated from the heated filament this could be met by the term "thermelectronic valve," but in my opinion "thermionic" is preferable as signifying a medium ionised or rendered conducting by a heated cathode. Although "three-electrode thermionic valve" is a cumbersome name, it would rarely be used, the abbreviation, "valve," being quite sufficient in the vast majority of cases where no ambiguity is to be feared.

Is a Valve a Tube?

The term "electron tube" is largely employed in the United States but has little to commend it. It is a literal translation of the German "Elektronenröhre" and was probably introduced by those already familiar with the German literature on the subject. Although the French also use the word "tube" it is difficult to see why a thing which is more often a round bulb should be called a tube, which the dictionary defines as a long hollow cylinder. The action of the apparatus has nothing to do with the shape of the vessel, and it is surely undesirable to give an apparatus a name descriptive of such an unimportant detail as the shape of the containing vessel, even if it were a correct description.

A Succint and Accurate Description.

In my opinion thermionic valve is a wonderfully succinct and accurate description of the construction and principle of the apparatus.

In considering the desirability of international uniformity in nomenclature, it must not be overlooked that in Germany at present it is considered far more important that a name should be German than that it should be an accurate description of the apparatus. For example, a transmitting station, even if it contains an arc or a valve transmitter, is called a "Funkstelle" or "spark-place." Whether this is due to some lack in the language or to lack of imagination, it should not be used as an argument for any modification of our nomenclature.

Electric Antennæ and Magnetic Coils.

In the opening number of a new monthly magazine entitled "Modern Wireless," there is an article on the transmission of wireless waves, by Sir Oliver Lodge, in which he seeks in his usual simple, lucid manner to remove the current misconceptions of the nature of electromagnetic waves. In the course of the article the following sentences occur:—

> For electric waves are not only electric, they are electromagnetic; that is to say, they have an electric component which is detected at a receiving station by an elongated or linear conductor; and they have a magnetic component which is detected by a closed loop or coil of wire. These are the two kinds of aerials in common use, the elevated wire and the closed loop. One responds to the electric, the other to the magnetic oscillation.

This statement, implying that there is some fundamental difference in the manner in which an electromagnetic wave affects an antenna and a coil is worthy of closer examination.

Cause and Effect Undeterminable.

Although the wave consists of both electric and magnetic fields, it is impossible to say that one is cause and the other effect; the vertical electric field moving with the velocity of light is associated with a horizontal magnetic field, and similarly, the horizontal magnetic field moving with the velocity of light is associated with a vertical electric field. The existence of the electron suggests that the electric field is the more fundamental, and that the magnetic field is merely a phenomenon of the electric field in motion. This is irrelevant, however, to the present discussion.

A vertical conductor, whether it be an antenna or the side of a coil contains free electrons which are acted upon and set in motion by the vertical electric field. Although one hesitates to dogmatise on such a subject, one may safely say that an electron is not acted upon by a magnetic field, but only by the electric field which may be produced by the variation of a magnetic field.

Magneto-Electric Antennæ.

Although, when using a coil for reception, one is tempted to say that the E.M.F. is induced in the coil by the variation of the horizontal magnetic flux passing through the coil, one must remember that the same E.M.F. is induced in space if the coil is not there. The variation of the magnetic flux produces an electric field, and if a conductor is situated in this field a current is set up in it, whether it be the side of a coil or a vertical antenna. The two vertical sides of the coil may be regarded as vertical aerials situated in electric fields a little out of phase. When the coil is rotated into the zero position, that is, broadside on to the wave, no magnetic flux links the coil, but its sides are still acted on by the vertical electric field, the induced electric forces being now in phase and giving no resultant E.M.F. around the coil, which merely acts as a vertical antenna.

The belief that the elevated antenna was only acted on by the electric field, and the coil only by the magnetic field, each abstracting from the wave the corresponding moiety of the available energy, has led in the past to the devising and patenting of special aerial arrangements intended to collect both forms of energy.

The above considerations force one to the conclusion that there is no such fundamental difference as Sir Oliver suggests, but that both coil and antenna are acted upon by the same electric forces associated in both cases with same magnetic fields.

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Voltage Maintenance on D.C. Systems.*

The Automatic Sub-Station as a Solution of the Problem.

By P. J. ROBINSON.

With the growth and expansion of cities the length of feeders has become troublesome owing to the voltage-drop, and on direct current systems the engineer is faced with a difficult problem, more particularly in the residential areas.

The more extensive use of domestic apparatus has raised the average load taken by consumers from ½ kW to 1 kW, up to 5 or 6 kW. This has necessitated more feeding points along the system to make full use of the copper laid down. The problem of maintaining a constant voltage over the network and keeping down costs has given general concern. In Liverpool it was decided to try and deal with the matter by installing automatically operated stations at different points on the system, thus reducing operating costs to a minimum, and enabling existing mains to be utilised to the best advantage. A scheme was evolved for the control of a three-wire system with the conditions that would have to be met in Liverpool as follows :—

(1) Station capacity 500 kW, with room for extension. (2) Station to cut in after the pressure on the l.t. feeder bars had fallen and remained low for a pre-determined time. (3) Station to cut out after the current on the busbars had fallen and remained low at some fixed figure for a pre-determined time. (4) Station to operate plant running across a 3-wire system, 230 V between each outer and the neutral, and to maintain a balance of pressure. (5) Station to operate in parallel with other plant. (6) If load demanded due to existing manually operated stations shutting down was greater than its capacity it should not cut in; if already running, the output should be limited to the capacity of the plant. (7) In the event of a fault on either the negative or positive side of the system, the automatic switch controlling that particular circuit should operate to cut it out, without interference with any other circuit. (8) In the event of a short-circuit on the outers of a feeder that feeder should be cut out without interference with any other circuit or the running of the plant generally. (9) The middle wire of the system being earthed through a limiting resistance at the manually operated stations, an earth fault would be dealt with from those stations.

Details of Equipment.

The equipment included one tap-started 500 kW rotary converter, coupled through a transformer to a 6 000 V three-phase 50 supply on one side, and to a three-wire 460 V across outers on the other, the middle wire being connected to a tapping on one leg of the transformer supplying the rotary converter. An electrically operated oil switch with an a.c. closing coil, in a high tension stone cubicle, was used to control the rotary converter. The transformer supplying the operating coils on the relays was controlled by two liquid fuses. Other apparatus included a three-phase transformer for the various instruments, isolating switches, a low tension d.c. panel for the rotary converter, low tension feeder panels for control of the four three-wire feeders, etc.

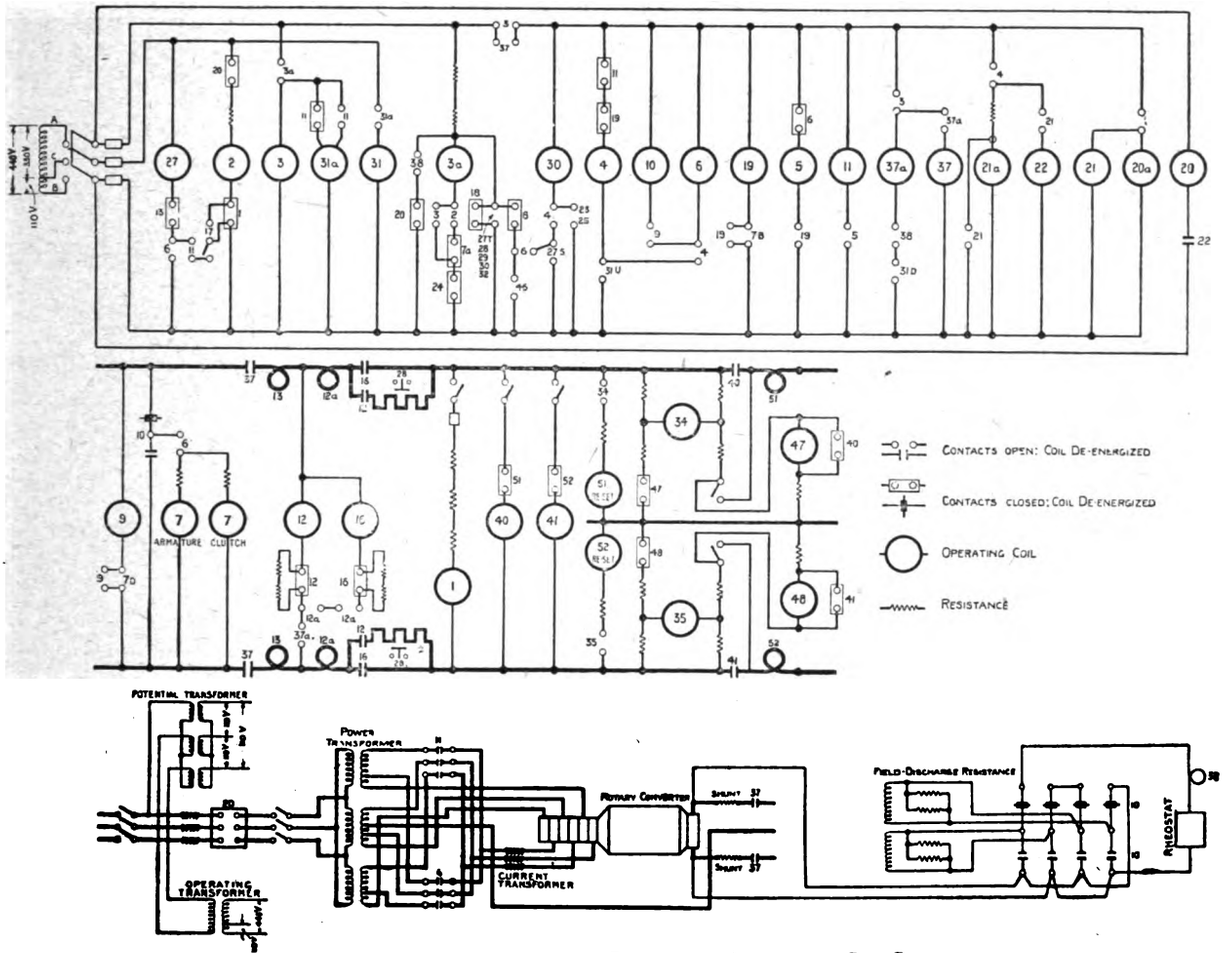

DIAGRAM OF CONNECTIONS AT THE LIVERPOOL AUTOMATIC SUB-STATION.

The Connections Analysed.

All the connections are shown in the accompanying diagram. Automatic operation is started by relay (1), which closes its contacts when the d.c. busbar voltage falls by a specified amount. By operating an interlock on the main oil circuit breaker (20) the operating coil of a.c. voltage relay (2) is inserted. This relay prevents the station starting due to a sudden drop in the d.c. network voltage, or when the a.c. voltage is abnormally low. The closing of the contacts of relay (2) establishes a circuit through the master relay (3a), which in turn completes a circuit through the operating coil of relay (3) and holds (3a) in. This step, by means of relay (31a), starts the small motor and brush lifting device (31). When the brushes are raised to full extent a throw-over switch disconnects relay (31a) and de-energises the motor. The brushes remain up until the circuit of (31a) is again completed and there is a cycle of operations which preserves the required conditions. Relay (18), by short-circuiting the operating coil of

* Abstract of a paper on "The Maintenance of Voltage on a D.C. Distribution System by Means of a Fully Automatic Sub-Station" read before the Institution of Electrical Engineers.

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relay (3a) will prevent the starting of the converter if the phase rotation of the supply is reversed, or if one phase is open.

All Contingencies Provided for.

In the original paper the operation of the other relays is described in detail, every contingency being provided for. Thus if the converter becomes unduly overloaded accelerating relays insert limiting resistance to limit the load. If the load still persists grid thermostats (28), on reaching red-heat, shut down the automatic equipment. On cooling down they start the station again. Similarly the d.c. reverse current relay (32) will disconnect the line if the a.c. supply becomes inadequate while the machine is connected to the d.c. system. There is also protection against short circuits in the converter or leads. Thermostats are placed in each machine bearing and will cut out the machine if necessary. Relays also shut down if trouble arises on the high tension line while the converter is running. Other automatic arrangements provide for the disconnecting of any feeder in the event of serious overload. When the demand for power falls to a pre-determined value d.c. relays (13) bring into operation adjustments which close down the station, but leave it free to start up again as occasion requires.

The sequence of operations is very quickly performed, the total time from the demand arising to the connection of the rotary converter to the line being seldom greater than 55 seconds, plus the time-lag on the relay. This is a great advance over manual operation.

The operation of the station has been almost perfect since it was first put on load. Naturally, adjustments to the relays, etc., have been necessary, but this has been to enable them to meet our conditions of working. As regards the control of the outgoing d.c. feeders, there are two possible requirements—i.e., to control a dead-ended feeder and an inter-connector fed from another source of supply. The re-closing mechanism was designed to be applicable to both.

Operation Satisfactory.

Various artificial faults have been put on the plant for experimental purposes, but have all been dealt with almost uncannily. The relays are of substantial construction and are unlikely to give any trouble.

The fact that a second station on similar lines to the one described has been put in hand illustrates the satisfactory nature of the arrangement. In the station described, arrangements were made to run the plant for traction purposes when desired. As this station is on a tramway route which several times a year has to handle heavy traffic, this arrangement is useful, especially as the station is situated on the top of an incline.

Financial Details.

The network between the two stations was laid at a pre-war cost of approximately £20 858, but as only 40 per cent. was available for useful work, due to voltage-drop, a feed into the centre will enhance its value nearly three times. The following five methods were available :—

(1) To change over the whole distribution to a.c. by connecting the d.c. mains across a split single-phase transformer.

(2) To replace the whole of the d.c. mains by a.c. mains, creating a new a.c. system and finally scrapping the d.c. mains ; or else to superimpose on the area an a.c. supply.

The cost of the above methods, coupled with their obvious disadvantages, led to their elimination. Other possibilities were :—

(3) To lay new d.c. feeders of sufficient capacity from the existing stations to a central point of the system.

(4) To erect a new building and equip it with manually operated plant with three double shifts of operators.

(5) To erect a new building and equip it with fully automatic plant requiring the occasional services of an inspector.

Alternatives (4) and (5) would allow for considerable extension to the existing distribution system, as new distributors could be installed as and when required. In each case new buildings and plant would be required, and the cost of buildings, rotary converter, manually operated converter and feeder gear has been taken as being common to all.

Considering first the capital cost of alternatives (3), (4) and (5), and ignoring the items common to each, we have :—

(3) The cost of new cables, together with the cost of laying the same to feed into the network at the position chosen, namely, £12 500.

(4) Over and above the cost of laying a short length of feeder out of the station to connect up, the cost would be nil.

(5) The cost of the automatic gear, over and above the cost of the manually operated gear, £1 795, and connecting up feeders as in (4).

As regards the operation of the three schemes :—(3) requires little more attention than at present ; (4) requires three shifts of two men per shift, at £1 285 per annum, and £20 per annum for lighting—i.e., total running charges £1 305 per annum ; (5) requires more skilled inspection and higher rate of pay than manual operation, but less as clerical work at head-quarters, there being no weekly wages to be made out and paid to shift men. No lighting.

The maintenance has been considered as common to each.

The following would be the actual total charges :—

(3) £12 500 at, say, 9 per cent.	..	£1 125 per annum
(4) Running charges	..	£1 305 „ „
(5) £1 795 at, say, 9 per cent. = £162 Running charge = £93		£255 „ „

The energy required to operate the station is only 1 719 W when idle. When operating there is a total of 3 397 W, and it was on the above figures that the operating cost of £93 was calculated.

In practice it is found that, although the voltage regulator keeps the pressure steady, it does not allow for a rise in pressure with increase in load—i.e., there is no compounding effect. Accordingly a contactor type of field regulator is being introduced, which is operated from the main ammeter shunts and which will automatically raise or lower the pressure 1 V for every 100 A increase or decrease in load.

Complete data regarding the relays used in the station are given in an appendix to the original paper.

Spring and "The Electrician" Competition.

The weather of the last few days, if our own observations are to be relied upon, has drawn the inhabitants of this country out of their houses into their gardens. Much spade work, in the literal sense, is being performed and contemplative groups of all sexes are watching the growth, abnormal and normal, of many useful and ornamental members of the vegetable family. We do not pretend to any expert knowledge of gardening, but we shall all the same try to draw a parallel between these phenomena and conditions in the electrical industry. After a long winter of discontent we are for the moment sunning ourselves in the balmy atmosphere of reviving trade. In clubs and places where they—talk, men are more cheerful and there is a general feeling that the worst is past.

Atmospheric and Industrial Conditions Compared.

Though we do not wish to be labelled as pessimistic, it is only right to state that atmospheric conditions and industrial conditions may continue to stand close comparison. The beautiful weather of the beginning of the week could not be expected to last and though spring will assuredly come we have got to endure more winter before it does. The same is true of trade. It is reviving, but revival generally has an oscillating motion and it is probable we are not yet on the straight road to success. This need not, and should not, make us despair. It should rather inspiret sill to discover yet further improvements in our methods so that when trade does really revive we can take the fullest advantage of it. In other words we must go back to our houses, like the gardeners, as cheerfully as we can.

The Moral of It.

Of course, there is a moral in all this and we will hold it back no longer. The future of the electrical industry to a large extent is going to depend on the development of the domestic load. The development of the domestic load is going to depend on the way problems of wiring, design, distribution and price are tackled. The time to tackle them is when we get back to our houses. Our "All-Electric" House Competition which closes on March 29th, 1923, will help to crystallise ideas on a most important branch of this subject and thus greatly assist towards their solution. But it is a question which must be tackled by the whole industry in order, as a correspondent says, that those concerned may derive a great amount of benefit themselves as well as the trade in general. Time is now getting short. Those who have ideas on the subject should not delay to put them on paper and send them to us.

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Manufacturer—Factor—Retailer.

A Study of the Present Trading Conditions and Some Suggestions.

By "A SPECTATOR."

In the two previous articles* in this study of the trading conditions in the electrical field I have shown the chaos that exists on the question of discounts, and I have briefly stated the points of view of the manufacturer, the factor, and the retailer upon it.

I anticipate the natural question as to whether I can make any suggestions that will be the means of creating a better plan of work. I use the word "plan" deliberately. Too long have we suffered from the vague cry for more co-operation and understanding between all concerned. We want these two factors—co-operation and understanding—but they must come into force after the plan has been thrashed out and settled. Nothing will be gained, nothing achieved, unless we are prepared to sit down, discuss, and finally formulate a plan of work. I reiterate with emphasis that this must be done before anything else. On this basis, therefore, do I make my suggestions in the hope that they will play a small part when executives come together to make the "Great Plan." It cannot be too much emphasised that if plans are to be ready for next season the discussion must commence now.

A League of Electrical Trades.

A conference should be called at once. This could be done by the E.D.A. An absolutely impartial chairman should be appointed (an outside man). Delegates should be invited from the E.D.A., the Electrical Wholesalers' Federation, the various retailers' organisations, the various contractors' organisations and from the organisations representing the various electricity supply companies. On the manufacturing side representatives of the B.E.A.M.A., and from the various sections dealing with the class of apparatus that is dealt with in this discussion would be required. A broadcast invitation should be made to those manufacturers (of which unfortunately there are many), who are not represented by any association or organisation. The conference should be a real conference in every sense of the word, lasting, if need be, for a week or more. Nothing would be achieved if it were simply decided to have a series of scrappy, spasmodic, informal meetings, which delegates would only attend if they had time. We must form a "League of Electrical Traders;" that is, if it is outside the sphere of of the E.D.A. No useful purpose would be served by my elaborating any plans on which this conference could make an agenda. I will, however, briefly and broadly lay down the following :—

The Skeleton Agenda.

A. The fundamental basis to which all details are subsidiary is the adoption of the principle of establishing an association which will embrace all "sellers" of electrical merchandise (using this expression in the sense of these articles).

B. All electrical manufacturers to be members of the association, and to undertake to refuse to trade with any buyers who are not members.

C. All factors to be members of the association. The basis of membership should be that they are members of the E.W.F., to which, in turn, no further members should be admitted without two very definite qualifications: (1) A minimum stock value of £10 000 held at their head depot or distributed over a number of depots; (2) an undertaking not to engage in manufacturing. Members admitted on this basis would undertake not to buy from any "sellers," or sell to any "buyers," outside the association.

D. All contractors (or retailers) to be members of the association. The basis of membership should be that they are members of the E.C.A. or kindred associations. They should undertake not to engage in manufacturing work, or engage in "back door" factoring. Members admitted on this basis would undertake not to buy from any "sellers" outside the association, and would refuse to carry out any installation work on jobs in the area of a supply company outside the association.

E. All electricity supply companies (whether privately owned or municipal and without distinction as to whether they are engaged in retail merchandising or not) to be members. They would undertake to refuse to connect up on jobs where installation work is carried out by contractors or wiremen outside the association. Companies carrying on retail merchandising would undertake to buy only from "sellers" in the association.

F. All fittings manufacturers to be members. They would undertake not to sell to buyers not in the association.

G. Large departmental stores having an electrical department (either for merchandising or for contracting work) to be members. They would undertake not to buy from sellers outside the association.

H. Various other agents and sellers supplying auxiliary material to the electrical trade to be members. They would undertake not to sell to buyers outside the association.

I. Architects and consulting engineers to be members. They would undertake not to specify any material made by a non-member and to refuse to sub-let contracts for wiring and installation work to any contractor who is a non-member.

The Idea in Practice.

I have stated briefly what I consider the fundamental basis of this new "Electrical Traders' Association," and I will at once accept the challenge to prove how these ideas will work out in practice. I make no pretence that my suggestions will prove 100 per cent. efficacious, or that the scheme is holeproof. Thrashed out and trimmed up by the suggestions of more experienced and mature minds than mine, it will, however, produce a plan of work far more efficient than at present. The practical workings of my suggestions are as follows :—

(1.) Manufacturers, being members, would refuse to sell to factors, contractors, retailers, etc., not in the association. Those manufacturers who refused to come in would be boycotted by the various buyers in the association. It would be impossible for them to do business with buyers outside the association, because if they sold to non-member factors the latter could only sell to non-member contractors or retailers. who, in their turn, would suffer under the penalties that the larger and more widely advertising manufacturers in the association would refuse to sell to them, and supply companies would refuse to connect them up.

(2.) Factors, being members, would refuse to sell to contractors, retailers, etc., not in the association, and those factors who refused to come in would be boycotted by the various buyers in the association. As I have already demonstrated under (1), there would not be many channels through which the non-members could dispose of their goods.

(3.) Contractors, being members, would refuse to buy of the manufacturer or the factor outside the association. Those who stood aloof would be penalised to the extent that association members (manufacturers or factors) would refuse to sell to them, and even if they traded with non-association "sellers" they would be unable to have the profitable handling of the well advertised lines. Further, the electricity supply authorit es would refuse to connect up.

(4.) All electricity supply authorities (whether privately or municipally owned), if carrying on a merchandise business, would refuse to buy from sellers outside the association. If they stood aloof they would be subject to the same penalties as I have laid down under (3). If they were not retailing, then contractors would refuse to carry out work on jobs in their area. If they were carrying out contracting work then factors and manufacturers would refuse to sell to them, and if they purposed buying from those sellers outside the association they would suffer the great penalty of not being able to handle the best products on the market.

There is no need for me to cite the circumstances which would come about so far as the other "buyers" and "sellers" are concerned. The conditions which I have outlined would affect them in the same way.

Discount Conditions.

My suggestions with regard to discounts on apparatus can be briefly summarised as follows :—

A. Material should be classified under schedules or grades according to their nature. Following this we have (say) six grades: (*a*) net prices, (*b*) 10 per cent., (*c*) 15 per cent., (*d*) 20 per cent., (*e*) 25 per cent., (*f*) 33⅓ per cent. Particularly would I emphasise the importance of not going beyond a 33⅓ per cent. discount except on such lines as pocket lamps and novelties where the stock laid up is considerable and depreciation heavy. High list prices with large discounts are a fallacy.

B. Following this plan, therefore, I append the following list classifying various material and the suggested discounts to trade buyers and to trade users :—

Apparatus.	Schedule.	Trade or retail discount. Per cent.	Trade users' discount. Per cent.
*Lamps	—	—	—
Fittings (for commercial lighting) ..	E.	25	12½
Fittings (for domestic lighting) ..	E.	25	12½
Fittings (more ornate type) for architectural schemes and the like ..	C.	15	nil.
Accessories (lampholders, switches, etc.)	A.	net	nil (1)
Cables, flex and wires	A.	net	nil (1)

* See THE ELECTRICIAN, January 26th and February 2nd, 1923.

* The problem of lamp discounts is so involved that it is one which requires treating on a separate basis.

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Apparatus.	Schedule.	Trade or retail discount. Per cent. net	Trade users' discount. Per cent. nil (1)
Conduit and conduit fittings ..	A.		
Fans (domestic and office patterns of a portable type)	E.	25	12½
Fans (heavy type, as exhaust fans, for factory and commercial use) ..	C.	15	5
Heating and cooking apparatus—			
(a) Small portable appliances ..	E.	25	12½
(b) Fires	E.	25	12½
(c) Domestic cookers	C.	15	5
(d) Large cookers	B.	10	nil
(e) Hot water apparatus	C.	15	5
(f) Vacuum cleaners	E.	25	12½
(g) Medical apparatus	E.	25	12½
(h) Industrial heating apparatus	C.	15	5
(i) Ironing machines	C.	15	5
(j) Electric washers	C.	15	5
Lighting glass	E.	25	12½
Silk shades	E.	25	12½
Ironclad switchgear	D.	20	10
Bells and bell miscellanea	E.	25	12½
Telephones	E.	25	12½
Batteries	A.	net	nil (1)
Small motors	C.	15	5
Pocket lamps	F.	33⅓	15
Small novelties	F.	33⅓	15

Agreement on Discounts Essential.

The prices for items marked (1) must be left to the contractor and retailer. This class of material is very largely handled and used as the raw material of wiring and installation work.

All members of the association would have to agree to this schedule of discounts. Manufacturers and factors would most emphatically agree to the schedule of discounts for trade users. The scale I have laid down would mean that the retailer could (if he thought fit and had a well-defined policy) quote the trade user and secure the turnover. It will need no second glance over the list of apparatus to see how impossible it is to have one, or even three, discounts over the whole diverse range. Obviously it is a false practice to make a high list price for a cooker in order to allow the retailer 25 per cent. discount; also it would not be equitable trading conditions if the retailer had to be content with 10 per cent. on the list price of portable heating and cooking apparatus where the depreciation on finish and seasonal tendencies plays such a large part. Further, it is not expected that a retailer such as the electricity supply undertakings will stock cookers to any great extent, but on fittings, fans, portable heating and cooking apparatus and the like, a progressive business means holding stocks to some considerable amount, hence it is economically necessary to have a larger gross profit on the turnover.

Future Policy.

So long has this condition of chaos gone on that the elders of the industry have become hardfaced to any suggestions to reform. They want reform, but they argue that it cannot be achieved. My suggestions will be ridiculed as idealistic and unpractical. Many will cry out that they will be the sufferers. If we really understand the goal for which we are aiming we must have co-operation all round. If we have made mistakes in the past some must be weeded out to rectify those mistakes and must suffer in the process. We have got to establish proper economic trading conditions in the industry, and if we don't do it in a very short time many will be faced with ruin. In the strictest and most narrow interest of the industry as a whole we must bring this economic war to an end.

"An honest tale speeds best plainly told," and it is this dictum that gives me hope that my notes will be of help in the building of a solid trading fraternity.

I.E.E. Summer Visit

Opens at Manchester on June 5th.

Details are to hand of the arrangements made for the summer visit of the Institution of Electrical Engineers. Members will arrive in Manchester on the evening of Monday, June 4th, and the proceedings will commence at 10 a.m. on the following day. In the evening, the members attending will be the guests of the Lord Mayor at a reception and dance. The proceedings will be continued on Wednesday, June 6th, and on the following morning a special train will leave for Liverpool at 9 a.m.

Members of the North-Western Centre are invited to extend their hospitality to those attending from other parts of the country, as sufficient hotel accommodation is not likely to be available. Offers should be sent to Mr. A. B Mallinson, Worsley Street, Salford.

The Advisability of Limiting to Super Power Stations the Public Supply of Electricity.

A joint meeting of the local branches of the Institutions of Mechanical, Civil, and Electrical Engineers, to discuss "The Advisability of Limiting to Super Power Stations the Public Supply of Electricity," was held in the Council Chamber, Birmingham, on January 25th. Mr. L. St. L. Pendred presided.

Cheaper Production of Fundamental Importance.

Sir Vincent Raven, speaking as a railway engineer, said that cheaper production of electricity was of fundamental importance. Otherwise many prospective users would hold back. Large power stations with at least 15 000 to 20 000 kW turbo-generators should be erected in specially selected positions, and electricity should be produced at not more than 2 lb. of coal per kWh. He did not favour generation of power for individual undertakings, not even for railways, as the load factor was not so good as when all classes of consumers were catered for. The simplest and best system was that adopted on the north-east coast. Linking up existing stations might be helpful as the first stage, but it should be associated with modern plant extension. The control and use of all generating systems and main transmission lines should be centralised through the medium of a joint electricity authority or advisory board. Bulk supplies should be made available to smaller stations, which it was a waste of money to extend.

Super Power Stations Not Alone Required.

Mr. R. A. Chattock could not unreservedly endorse the limitation of electricity supply to super power stations. The idea that each district should have only one large station to supply all its wants was quite erroneous. Such stations would cost huge sums and the financial burden imposed by the scrapping of existing stations would outweigh any benefit derived from cheaper operation of the new plant. Developments should proceed on lines that had governed existing large undertakings, the older generating stations being used to meet the intermittent or peak load for a few hours a day, the bulk of the load being carried by the more modern stations.

Cheaper Power Essential.

Mr. J. H. T. Legge said that there was general agreement that they must generate on more suitable sites and with larger plants. Linking up should mean better average costs. With a much bigger area for supply stations there should be a better diversity factor, and this would be helped by linking up of railways with the industrial and domestic load.

Sir Henry Fowler remarked that it was agreed that they could generate most economically in large stations, but from the financial standpoint he did not believe that power from a super-station could replace arrangements in a small works where the steam drove the set, lighted the works and provided the necessary power for the drill. It was wholly a question of economics and individual circumstances.

Sometimes "No," Sometimes "Yes."

Mr. S. T. Allen said that if the question before them referred to the whole country the answer was "No." But if the country were divided into districts the answer might sometimes be "No" and sometimes "Yes." The size of a district, the nature of the load factor, and the conditions in regard to fuel, water and transport might be widely different.

Prof. W. Cramp agreed that it would be well to get rid of many small and uneconomical stations, and districts should be supplied from super-stations in suitable places. But there should be complete freedom and no tyrannous monopoly.

Premature to Limit Progress.

Prof. F. C. Lea said that it was premature to set limits to future progress. Power might ultimately be produced on a much more economical basis than 2 lb. of coal per unit. Undue concentration on large stations might prevent the realisation of such possibilities of development which usually took place first on a small scale and then on a large one.

Problem Mainly Financial.

The Chairman, in closing the discussion, remarked that the problem they had to consider was primarily an engineering one. But the highest economy was not always the best policy. It was agreed that electricity could be generated more economically in a large station, but it did not follow that this was the best course. It was remarkable that the smallest station of all, Launceston, had a coal consumption of only 1·7 lb. per kWh, while Carville, probably the biggest, had 1·78 kWh. The Electricity Commissioners believed that the efficiency of medium-sized stations would be considerably improved.

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Institution of Electrical Engineers.

Presentation to Mr. J. W. Meares.

The proceedings at the meeting of the Institution of Electrical Engineers on February 1st began by the President making a presentation to Mr. J. W. Meares, who has recently retired from the position of electrical adviser to the Government of India, after twenty-five years' service.

The presentation, which took the form of a silver tray and a silver cigar and cigarette box, both suitably inscribed, was a mark of appreciation from Mr. Meares's colleagues. It was found impossible for the presentation to be made before Mr. Meares left India, and it was therefore arranged for this to be done at an Institution meeting.

Details of Mr. Meares's Work.

The PRESIDENT said that Mr. Meares went to India in 1896 to take charge of the hydro-electric installations. Two years later he became electrical engineer to the Government of Bengal, and in 1905 he was appointed electrical adviser to the Government of India, a most important position. In 1918 he became chief engineer to the hydro-electric survey of India. From 1911 to 1914 he had also held the position of Controller of Patents in India. The Institution had only one wish and that was to do all it could to honour any man who had done service such as Mr. Meares, he therefore had the greatest pleasure in presenting these gifts as a mark of esteem, regard and affection on the part of those with whom Mr. Meares had been associated in India.

Consistent and Conscientious Endeavour.

Mr. J. P. GRIFFIN (Delhi Electric Lighting and Tramways Co.) said that as one who had worked in one of the Provinces which had come under the jurisdiction of Mr. Meares, he would like to say that he was regarded as one who had consistently and conscientiously endeavoured to further the interests of the electrical industry in India. Mr. Meares had been at all times anxious to help the supply engineers in India. They would feel that in his retirement they had lost an excellent friend.

Mr. MEARES, in reply, said that when he first heard of this presentation, he thought it was a kind idea on the part of some of his electrical colleagues in the official world, but he had discovered during the past few days that the whole of the electrical profession in India was concerned. The fact that the presentation was made by the Institution of Electrical Engineers—of which he had been a member for 30 years and for which he had been able to do a little work as local honorary secretary in India—added to the pride which he felt on this occasion. He had often regretted that he forsook real engineering for the administrative and advisory work of a Government office, and now that he was actually retiring he felt that his feelings were admirably expressed by another ex-official, Mr. A. P. Trotter, whose entry in "Who's Who" stated that his recreation on retiring would be remembering that he was no longer an official. At the end of his career in India he went back into real engineering, and was placed in charge of the hydro-electric survey. He was very pleased indeed to have had a hand in that piece of work, at which a small band of enthusiastic engineers had worked with him for three years under great financial difficulties. That work, however, would have far-reaching effects in India when the country had settled down again.

Mr. P. J. ROBINSON's Paper on "Automatic Sub-stations," of which we give an abstract on p. 137 of this issue, was then read.

Too Many Gadgets.

Mr. B. WELBOURN said he had seen the Liverpool sub-station on three occasions, and it operated in quite an uncanny manner. Last year he had seen a fully-automatic traction sub-station near Chicago, and that operated in the same perfect manner as the author had described. The one point in regard to the plant which struck him was that there were too many gadgets in it. Manufacturers ought to bear that in mind. Some of these gadgets ought to be eliminated. There seemed no need to have thermostats on every bearing, and there were certain risks which could well be accepted as commercial risks in relation to some of these things. A good case had been made out in the paper, financially, for the decision taken at Liverpool, which was merely following out the tendency more and more to adopt labour-saving devices. Labour need not, however, be afraid of this tendency because experience had shewn that labour-saving devices brought more business and made more work. It would be interesting to hear what steps were being taken by British manufacturers to be ready for the considerable market which was undoubtedly coming for automatic sub-stations. During the last few days an important order had been placed in this country by one of our large cities for such a sub-station, and it was an open secret that the plant was to be British-made in this country.

Costs Criticised.

Mr. G. H. MORRIS agreed that it would be an advantage if the number of gadgets, mentioned by the last speaker, could be reduced. He had seen the Liverpool sub-station and could find no fault with its operation. The average time taken to start up was 44 seconds. When the rotaries started up the wrong way, it took about five seconds longer. The author's figure of the cost of a manually operated sub-station, viz., £1 285 per annum for labour, seemed excessive. For a 500 kW station it would not be necessary to have two men per shift nor would three shifts be absolutely essential.

The Pressure Drop Problem.

Prof. E. W. MARCHANT thought the system was not unduly complicated and it was soundly constructed. The result of the adoption of automatic working would be that the heating of the cables would become important. Instead of laying mains of large section, therefore, there should be a larger number of smaller section mains. In this way a much better result would be obtained, as twice as much current could be carried for the same temperature rise.

What of the Future?

Mr. W. M. SELVEY said the broad point of the paper was that the more extensive use of domestic apparatus had had the effect of raising the average load to 5 or 6 kW, when domestic apparatus was used. The author proposed to deal with this by perpetuating the low tension distribution system. If in order to deal with an increase in the average load from ½ kW to 1 kW he had spent £20 000, how much would he have to spend in order to deal with the increase to 5 or 6 kW? He often had to face the problem of dealing with an increased load, and, whilst he was fully cognisant of the expense of the change over, he was still more seized with the difficulties which would arise if we went on taking the cooking and heating load on the old system. It was for this reason that he suggested that any system of automatic sub-stations should be confined to traction, which was direct current and would remain so.

Advantages of Traction Loads.

Mr. CHEETHAM said reference had been made to the complexity of the arrangement described in the paper, but when the apparatus was examined it was simple compared with a multiple unit train control system. In America every satisfaction was now felt with the working of automatic sub-stations. In many cases d.c. distribution would be retained and the use of these sub-stations meant a considerable reduction in cost compared with manually operated sub-stations. In traction work, the advantage was a reduction of the light load running costs in the case of an infrequent service, while the load efficiency of the station was improved because it was not called upon to operate until there was definitely some load for it.

Simple Compared with Automatic Telephony.

Mr. A. H. BALDWIN was interested in this scheme as a telephone engineer, and he could assure those who had any doubt as to the reliability of these switches, that their fears were quite unfounded. The functioning of automatic telephone apparatus could now be relied upon with unfailing precision and regularity. Altogether there were 64 relays in the system described in the paper, whereas the number of relays brought into operation at every call on an automatic telephone system was much in excess of this.

Mr. Ross said he had been associated with automatic sub-stations for three years and assured those who had spoken of the number of gadgets in them, that they had been so developed that the number could not reasonably be reduced, except in one or two instances. There was little possibility of trouble arising from the bearing thermostats and, generally speaking, the devices were a good insurance against inefficient working and were well worth the extra money.

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Silvanus Thompson Memorial Lecture

Sir Oliver Lodge on Wireless Origins.

At the request of the Finsbury Technical College Old Students' Association, Sir Oliver Lodge gave the first Silvanus Thompson Memorial Lecture at the College on February 1st. The audience numbered over a thousand, and included many eminent past students.

After a reference to the splendid work of the College in the past, and its hopes for the future, the lecturer recalled the brilliant succession of teachers—Ayrton, Perry, Meldola—colleagues of Thompson. Of the latter he said: "The breadth of his outlook and width of his interests are almost proverbial; his facility in foreign languages enabled him to hold his own in assemblies abroad; and he had a real artistic faculty. He had a love of discoveries in their nascent stages, and became a recognised historian of science. To a man of his cosmopolitan feelings and pacific disposition, the war and its atrocities were a great distress; grief and worry and overwork overtook him, and he succumbed on June 12th, 1916—a victim of the war—having been Principal of Finsbury since 1885."

Wireless Prior to 1896.

Proceeding to the subject of the lecture—"The Origins or Foundations of Wireless Communications"—and confining himself to matters prior to 1896, Sir Oliver recalled that the term "inductance" did not at first exist; Lord Kelvin introduced it as a mathematical coefficient, Maxwell spoke of self-induction, and Heaviside originated the term now used. In the early work on the production and detection of electric waves in the ether, Kelvin, Maxwell, Fitzgerald and Hertz laid the foundations which made the present structure possible.

In 1875 Edison observed the possiblity of drawing sparks from insulated objects in the neighbourhood of an electrical discharge. Already in 1842 Henry, in Washington, had surmised—through a similar observation—that there was some similarity between the etherial disturbance caused by the discharge of a conductor and the light emitted from an ordinary high-temperature source. Early in the 'eighties, David Hughes, working with the microphone and galvanometer, got something like a coherer, but was discouraged from pursuing the matter. In 1865 Maxwell gave the theory of electric waves before their generation or detection was understood; he showed that they would travel with the velocity of light, that light was an electro-magnetic phenomenon, that conductors of electricity must be opaque to light, and that the refractive index of a substance was intimately related to its dielectric coefficient.

Maxwell's Great Discovery.

This discovery aroused great enthusiasm, and one result was to influence the lecturer to devote his life to the study of electric waves; he discussed them with Fleming and Fitzgerald, and spoke about them at the British Association in 1879 and later. In 1883 Fitzgerald proposed the generation of the waves by using the oscillatory discharge of a Leyden jar, and the lecturer, in 1887, produced and detected them. The waves were received on wires adjusted to the right length for resonance. The experiments of Hertz, who received the waves on a nearly closed ring of wire having a short spark gap, were reported by Fitzgerald at the B.A. meeting of 1888, and Sir Oliver calculated the horse-power of the oscillator—about 100 for a millionth of a second; he exhibited many of the effects of the waves at the Royal Institution in 1889, but nothing akin to signalling; that was foreshadowed, in 1892, together with the possibility of tuning, by Sir William Crookes, who spoke of wave lengths with which to signal to specific people, and alluded to Hughes' signals from room to room without intervening wire. In 1890 Sir Oliver employed a form of coherer to complete a bell circuit, and in 1893 heard of Branly's filings-coherer. In memory of Hertz, for whom Sir Oliver expressed the greatest admiration, both on account of his experimental skill and mathematical thoroughness, he gave a lecture at the Royal Institution on his work; at this lecture actual signalling with a coherer was demonstrated. This work led to the grant of Lodge's patent in the United States, which was the fundamental patent of the American Marconi Company. The lecture stimulated Dr. Muirhead, Captain (now Admiral Sir Henry) Jackson, Admiral Popoff, Prof. Righi, and others to their experimental successes; in 1896 Mr. Marconi came to this country—and the rest is common knowledge.

Two Words to the Wise.

"Incidentally, however," said the lecturer, "I want to say two things to those who are occupied with the subject to-day. First, do not hesitate to speak and think of the ether of space as the continuous reality which connects us all up, and which welds not only us but all the planets into a continuous system. Do not be misled by any misapprehensions of the theory of relativity into supposing that that theory dispenses with the ether. For anything like a physical explanation of light or electricity or magnetism or cohesion or gravitation, the ether is indispensable. Secondly, we must congratulate all those whose wonderful advances have rendered possible the astonishing feat of, in any sense, and by whatever means, carrying the human voice across the Atlantic; made possible by the valve of Prof. Fleming and Dr. Lee de Forest, and others. . . ."

An Early Unpublished Pamphlet.

Referring to an unpublished pamphlet by Silvanus Thompson on the "Early History of Radio Signalling," from which he had largely quoted, Sir Oliver Lodge expressed his gratitude to one so well qualified to deal with the subject, and said: "He was a good friend; and posterity may be glad to have this record of what he had to say concerning 'The Origin and Basis of Wireless Communication.'"

Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument

HIGH VOLTAGE POWER TRANSFORMER AT 100 000 V.

To the Editor of THE ELECTRICIAN.

SIR,—With reference to Mr. W. T. Taylor's letter in your current issue, it may be of assistance if I amplify the statement in my letter of the 20th inst. that "in considering the voltage class of such (e.h.t.) transformers, the line voltage is the criterion, as this is the voltage for which the transformer has to be insulated."

Whether the h.t. windings are connected in delta or star (with unearthed neutral) does not affect the main insulation problem, which consists in insulating the h.t. windings from the core and the l.t. windings sufficiently to withstand the specified test pressure. The standard test pressure (according to the B.E.S.A. and A.I.E.E. Rules) is 1 000 V plus twice the normal *line* pressure for one minute; thus, a 110 kV transformer has to be tested between the whole of the h.t. windings and core and l.t. windings with 221 kV, whether it is delta or star connected.

The design of the actual h.t. winding and its "interior" insulation is an easier problem with star connection, particularly for ratings below, say, 1 500 kVA; this is due to the number of turns per phase in star connection being less in the ratio of $1/\sqrt{3}$, and the section of conductor being $\sqrt{3}$ greater than in the delta connection. For this reason alone the star connection is preferable, especially for relatively small e.h.t. ratings.

The above remarks refer to star connection with unearthed neutral. If the neutral is solidly and permanently grounded, with star connection, it is not unusual practice to allow a reduced pressure test of 1 000 V plus 2·73 times the voltage of the circuit to earth.

For a 110 kV line transformer the test would thus be 174 kV for one minute. In this case, the test pressure is applied by over-exciting the transformer at increased frequency (induced voltage), the neutral being earthed and the insulation at the neutral end of the h.t. windings being practically nil. In the former case, the test voltage is applied from a separate source to the whole of the winding.

The 1 500 kVA, 110 kV, Mangahao transformers I referred to are for delta connection, with test pressure 221 kV, and the insulation problem is the most severe of the above cases.—

I am, etc.,
A. G. ELLIS,
Chief Engineer, Transformer Dept.,
Metropolitan-Vickers Electric Co. Ltd.

Trafford Park,
February 3rd.

A BRIDGE METHOD OF DETERMINING THE EFFECTIVE RESISTANCE OF AN INDUCTION COIL.

To the Editor of THE ELECTRICIAN.

SIR,—In an article on "A Bridge Method of Determining the Effective Resistance of an Inductance Coil or Condenser" in your current issue, the author gives a diagram of the well-known Maxwell Bridge, but calls it the Wien Bridge. As Wien's name is already rightly associated with other types of bridges (see "Dictionary of Applied Physics," Vol. II., pp. 131, 435), there is no obvious reason for attaching it to the Maxwell Bridge.—I am, etc.,
G. W. O. HOWE.

Glasgow, February 5th, 1923.

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Selling Small Electrical Apparatus.

At the Salesmanship Conference organised by the Electrical Development Association on Friday last, Mr. C. S. DAVIDSON, Borough Electrical Engineer of Barnes, dealt with "Portable Accessories." Mr. H. Marryat, President of the Electrical Contractors' Association, was in the chair.

Mr. DAVIDSON said his interest in this subject arose from the fact that in his area he retailed 4 million kWh per annum, after the undertaking had been in existence for more than 21 years. The consumption of electricity per consumer per annum was 400 kWh, and although this was good for a small area, yet it by no means represented saturation. In a typical street there were 140 maisonettes; all had electric light, all had gas cookers, and some had gas fires, and whilst the total revenue to the electricity undertaking was £250 per annum, the gas company collected £1 000. Owing to increased activity by manufacturers' salesmen, there had recently been installed a few more cookers, but it would require much more collective and courageous effort before results were obtained which would irritate the complaisance of the gas company.

The Field to Till.

As typifying the field to be tackled for the use of small electrical apparatus, the following figures were given of a typical suburban district: Population, 40 000; number of houses, 10 000; electricity consumers, 5 000; gas consumers, 9 500; electric cookers installed, 100; gas cookers installed, 9 000; electric irons installed, 1 600; electric fires installed, 1 200; gas fires installed, 8 000. Accessories: Grills, fans, percolators, toasters, rings, etc.; 250 kW. Price of electricity for cooking and heating, 1½d. to 1d. per kWh. Price of gas, per 1 000 cub. ft., 5s.

The Supply Engineer and Portable Accessories.

Little effort had been made in many districts to encourage the use of small apparatus by offering a reasonable charge per kWh. Coupled with this encouragement there should be circulated suitable propaganda literature to householders, and demonstrations and exhibitions should be arranged at frequent intervals. Bright advertising in non-technical media was too infrequently adopted. To make electric cooking attractive, a tariff not in excess of 1d. per kWh must be made the standard. At Barnes the "Norwich" or rateable value system had been adopted 13 years ago as the best for the particular conditions, and the introduction of this system was instrumental in almost every instance in increasing the demand threefold. It must not, however, be assumed that the revenue increased proportionately with the demand, and it was the disquieting fact that whole streets of small consumers were being supplied at something considerably less than cost. This had compelled the Department to institute a campaign urging these people to increase their demand. The alternative was the imposition of a minimum quarterly charge, and, like sensible people, possessing a rooted objection to paying for something which they were never likely to have, these consumers installed useful accessories.

It would, said Mr. Davidson, be of advantage to the consumer and the supply authority if, instead of discounts being allowed, small current consuming devices were handed out to consumers on payment of their accounts. By this means the whole of the money was kept within the industry, and it was equivalent to reinvesting the profits in the undertaking. Whilst this policy might not meet with the views of the contractors, it was an idea worth considering.

Abolishing the Bedroom Fireplace.

Speaking of methods of propaganda, Mr. Davidson caused considerable amusement by relating that one of his earliest attempts was to engage a young couple to look over houses and then see the speculative builder and casually mention that they would have bought a certain house, or rented it, if it had been wired for electricity. Incidentally, he advocated, as he had done on many previous occasions, the abolition of the bedroom fireplace in the construction of new houses. The bedroom fire was probably not lighted half a dozen times during the year, and to abolish the bedroom fireplace altogether would cheapen the cost of building and afford opportunities for the use of electric fires.

Encouraging the Accessory Load.

The accessory load was one which no supply authority could afford to neglect, having regard to the present high capital charge per kW of plant installed, and the consequent need for load having good load factor characteristics. The efforts of the manufacturers and contractors should be supplemented by whole-hearted co-operation on the part of the supply authorities. As an example, it was pointed out that if, in the district mentioned above, 3 000 further flat irons were used, with an average consumption of 80 kWh per annum, the revenue at 1½d. per kWh would be £1 500; this feat would by no means be impossible, and might well be accomplished by taking the flat irons round in a van and leaving them with every consumer who had not got one. He believed that payment would soon be forthcoming, and that few would be returned. Even at present many flat irons were used at lighting rates. This increase in revenue would be effected without any increase in plant or mains, for although the load factor of a flat iron was only about 2 per cent., the diversity might be 20, thus enabling more units to be sold per kW of plant installed than obtained with other consuming devices having higher individual load factor characteristics.

Precursors of Electrification.

Small accessories of the kind he had mentioned should be sent out on "sale or return," and, further, the principle of complete satisfaction or money back should be adopted. The introduction of these small devices nearly always paved the way for something more substantial. It had been his experience that the portable grill and rapid boiling kettle were generally the precursors to the complete electrification of the kitchen. At the same time, Mr. Davidson deprecated launching out into the hire of washing machines and similar apparatus, in which the cost of current consumed bore little relation to the cost of the apparatus. On the general question of hire, it was not thought likely that this would be possible on a large scale until a greater degree of standardisation in apparatus was reached.

DISCUSSION.

The CHAIRMAN emphasised the importance of collective advertising. Better results could be obtained by spending on collective advertising, through the E.D.A., one-quarter of what was at present spent in this direction individually.

Cold Reception of the Standard Cooker.

Mr. W. A. GILLOTT criticised the figures given in the paper as showing poor results. Although many good suggestions were contained in the paper, he asked whether Mr. Davidson had put those suggestions into operation himself. A specification for a standard cooker had been drawn up by a committee representing all interests, and, although one manufacturer had decided to make 200, the very people who sat on the committee would not buy a standard cooker.

Mr. W. R. RAWLINGS complained that the rules governing wiring already installed did not permit of that free use of apparatus which one would desire. He believed the day would come when we should revert more or less to the old system of wiring. A house to-day should be wired so that every circuit was capable of carrying something like 20 A. If there were then a fuse at each point capable of protecting the particular piece of apparatus connected to it, the system would be perfectly safe and economical. Supply authorities should do more than they were doing to help the industry. They would profit most by the efforts of the E.D.A., and should subscribe to its funds to the tune of anything up to £50 000 per annum.

Mr. L. L. ROBINSON joined issue with Mr. Rawlings by pointing out that municipal supply undertakings were not out to make money, but to supply cheap electricity. He asked who benefited more than the contractor, who made his 25 or 33 per cent. out of the job, while municipal undertakings sold at cost. The contractor was a broken reed.

Electric Water Heating.

Mr. C. G. NOBBS emphasised the importance of developing water heating electrically. It gave an off-peak load, and a load factor of 60 per cent., so that it was valuable to a station engineer. Statistics showed that the average amount of hot water used per day by a family of four or five persons was 50 gals., and this could be provided with 500 W, working at a 24-hour load factor.

Mr. J. W. BEAUCHAMP also directed attention to water heating, which, he said, was generally admitted to be the hardest proposition before us to-day. He, however, was of the opinion that we should find our salvation in water heating. The apparatus was simple, and the load was an off-peak load.

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Merchandise to Sell and Profit By.

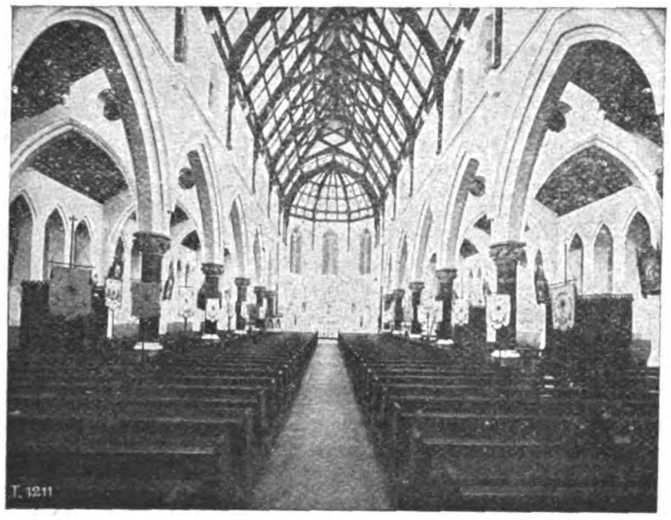
In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

Modern Church Lighting.

It is "strictly business" to get business for the better lighting of churches. Church congregations need better illumination and contractors need the profits. One medium to bring the parties together is the compelling folder entitled "Church Lighting," issued by the BRITISH THOMSON-HOUSTON CO. It is not our purpose to illustrate the B.T.-H. apparatus which achieves these remarkable



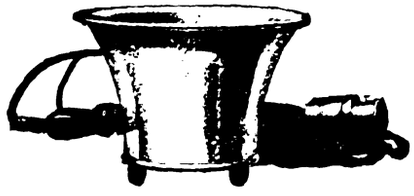
HOW A CHURCH SHOULD BE LIGHTED.

installations, rather shall we make contractors realise the possibilities of this market by giving an example of one of the many installations carried out with B.T.-H. apparatus. We cannot do better than quote briefly from the leaflet. " . . . poor illumination leads to inattention, drowsiness, and eyestrain. The old methods of illumination by means of rows of bare or insufficiently shaded lamps, suspended within full view of the congregation, are unsatisfactory from every point of view. They are architecturally bad, because they tend to obscure the details of the roof and upper walls. They hinder devotion, because the patchiness and inadequacy of the illumination make the reading of hymn books and prayer books difficult, and produce a feeling of somnolence in the congregation. They are hygienically bad, because they cause eyestrain and headaches."

These are the cardinal points which can be put before a Municipal Committee, and with the overprinting provided by the B.T.-H. a lot of business should be secured from the church authorities.

The "Creda" Shaving Pot.

It would be interesting to analyse figures showing how many male electricity users use an electric shaving water pot. Undoubtedly it would be revealed that there are but very few. Many reasons have been assigned for this, but at least one reason is the fact that there

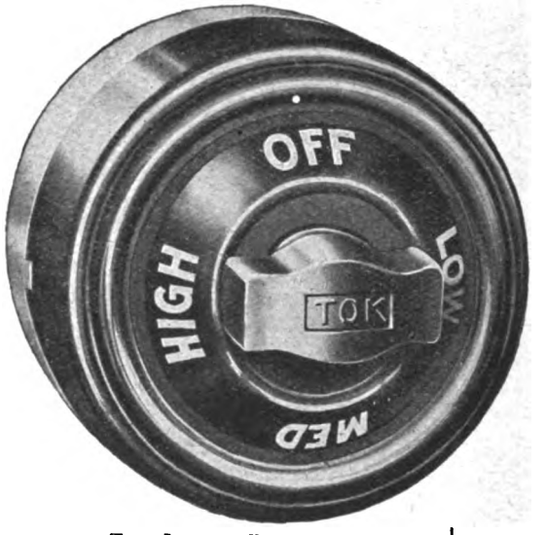


A COMFORT ON COLD MORNINGS.

are but few devices of this kind offered at an attractive price. Only a simple equipment is needed by a mere man, and the "Creda" shaving pot listed at the popular price of 21s. fills the bill. Therefore all retailers should see that this device is well displayed and stocks well maintained so that hairy chins and sore cheeks are reduced in number. It is manufactured by the CREDENDA CONDUITS CO.

A British-made Rotary Snap Switch.

It was an event in manufacturing circles when a British-made snap switch was placed on the market, by TOK SWITCHES, LTD. Until then this market had been the monoply of American manufacturers. As a line of "merchandise to sell and profit by" rotary switches will not appeal to the retailer, but they will interest



THE LATEST ROTARY SWITCH.

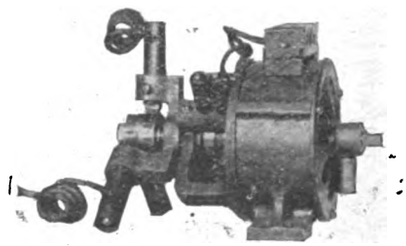
him from a contracting or installation point of view. In fact, the slow, but none the less positive, movement forward to a higher standard of electrical practice means that contractors must see to it that they know all there is to know about TOK rotary snap switches. It is not sufficient to argue that one or two of the well-known makes of tumbler switches are now rated for 15 A, and that these suit all requirements. This is not so. Leaving aside the question of circuits working at 400 V and upwards where rotary switches are absolutely necessary (unless a lever switch is used), more use could be made of TOK rotary switches on circuits controlling gas-filled lamps where the rush of current is very sudden.

Our illustration is of the type No. 311 switch, which is a single pole series parallel combination with a 5 A capacity at 250 V. This particular illustration shows a switch fitted with fire-proof insulating cover. It can be supplied with several variations of switches in several capacities.

The "M.W." Battery Charger.

It is beyond doubt that the "wireless" boom will create a market for battery charging apparatus, and those retailers who are on a.c. circuits will have to give study to the several types of rectifiers on the market before coming to a final selection as to which they shall push. Among the several battery chargers offered to retailers, and worthy of attention, is the "M.W." battery charger, manufactured by M. W. WOODS.

The illustration shows the set, which has a neat and compact



A BATTERY CHARGER FOR A.C. CIRCUITS.

appearance. The specification of No. 1 set shows that it consists of a synchronous a.c. motor fitted with a two-part interrupting commutator at such a point in the a.c. wave curve that sparking is practically eliminated. The rotor is excited by current rectified by the commutator, and synchronism is readily effected by closing the switch and giving the spindle a sharp twist in a clockwise direction. No other starting device is necessary. An auxiliary to the set can be supplied by a special switchboard. The capacity of the set

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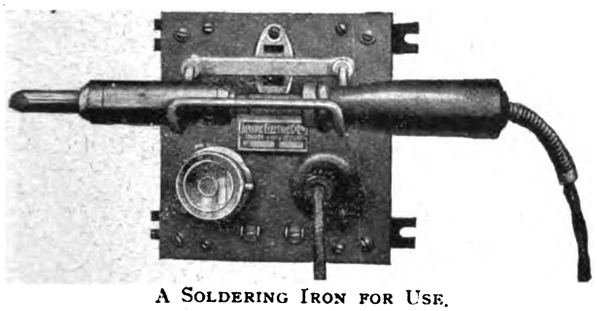
is suitable for a primary circuit of 100 to 250 V at 50 to 60 cycles, giving a secondary output of 3 A at 15 V.

As in the case of all "popular" apparatus of this kind, the price must also be popular, and the "M.W." battery charger is being marketed at £7 10s.

An Electric Soldering Iron.

The range of electric soldering irons marketed by the IGRANIC ELECTRIC Co. should be carefully weighed up as a line in which to increase turnover and make profits. The illustration shows the iron on the Igranic economy rack, which we describe below.

The constructional details of the iron are as follows:—It is simply constructed on the unit system, and every part is easily removable, replaceable and interchangeable. The heating element is of nickel-chromium ribbon insulated with pure mica, and is kept in intimate contact with the core by means of a patented compressed winding. The exterior of the iron is perfectly smooth;



A SOLDERING IRON FOR USE.

there are no projecting screwheads. The finish is of polished nickel with a walnut finish wood handle. The copper tips are of standard size drawn copper rod $\frac{3}{8}$, $\frac{4}{8}$, and $\frac{7}{8}$ in. respectively in diameter. As the tip wears away it is possible to withdraw it from the core, and most of the tip may thus be utilized.

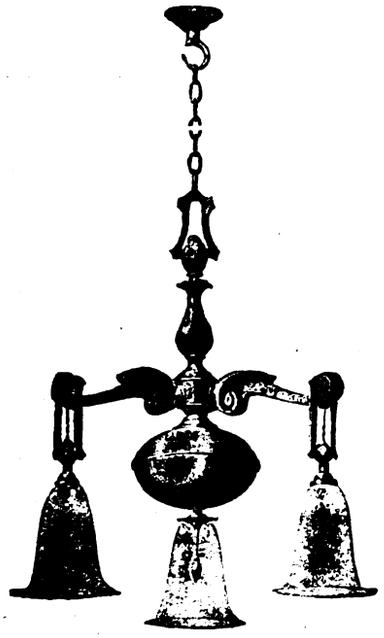
The tips are of straight rod and do not have an enlarged head. Experience has proved that the extra copper and the increased diameter of an enlarged tip head do not increase the capacity of an electric soldering iron. The capacity depends entirely upon the watt consumption and thus upon the heat units supplied, combined with a construction that makes these heat units effective at the point of the tip.

The electric rack referred to above is shown in our illustration, and should be offered with every soldering iron, because it has a real use, which makes it a profitable investment.

The rack comprises (a) a slate panel carrying on the back a resistance unit; (b) a switch for the supply; (c) a cradle on which the iron is rested; (d) a socket to which the plug and flexible wire is connected. Placing the iron on the cradle (which acts on the principle of the telephone receiver hook) reduces the current to just sufficient to keep the iron at the right temperature for soldering. Lifting it off the cradle restores the full current necessary to keep it hot while soldering.

A "Simplex" Fitting for Domestic Lighting

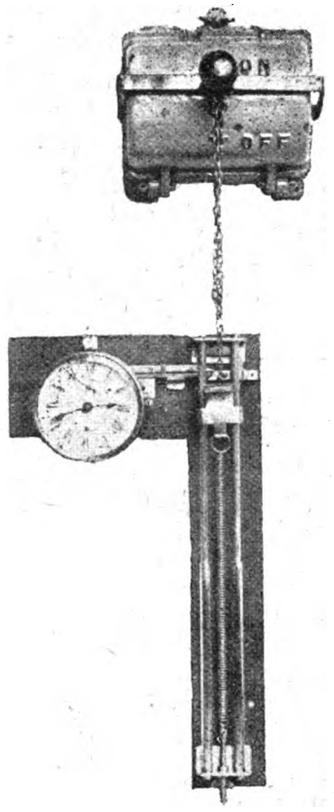
If it is accepted that semi-indirect, or "bowl" fittings are a dying fashion, the retailer will find much to appeal to him in the designs of fittings which the SIMPLEX CONDUIT Co. show, amongst many other fittings, in a new catalogue, entitled "Simplex Lighting Fixtures." In fact, he will have cause for much gratification, because it cannot be denied that these designs of semi-indirect or "bowl" fittings (as they are popularly called) have become very stereotyped, and the style of lighting does not lend itself to much diversity in the design of the metal work or the style of the glass. In handling fittings of this kind the retailer has to lay out his programme under two headings. Under the first heading must be placed "fittings to a price," and under the other heading "fittings to a design." Fittings to a design, however, can be obtained at very moderate prices, as is proved by the Simplex list. The electrolier, No. E 4412, which we illustrate, falls under this heading.



AN ARTISTIC FITTING.

Up-to-Date Time Switching.

An interesting time-switching system which is operated by mechanical means has been devised by the BOROUGH ENGINEERING AND SUPPLIES Co. It consists of a chain which is fastened at one



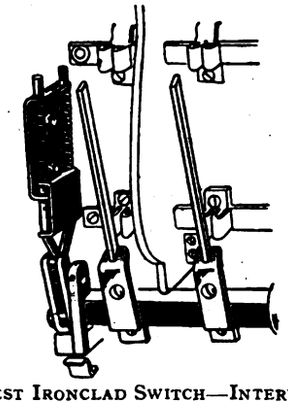
A MECHANICALLY OPERATED TIME SWITCH.

end to the switch-lever and at the other to a strong spring. At a predetermined time the clock releases the spring, which in turn pulls off the switch lever. The device, which is suitable for switches up to 150 A, certainly has simplicity to recommend it.

A "Superior" Ironclad Switch.

W. SANDERS AND Co., have just put on the market a new type of quick make and quick break ironclad switch, which is known as the "Superior." It embodies some original features not hitherto incorporated in switchgear.

We have a deliberate purpose in showing the illustration of the internal mechanism, because this detail is far more important than the external view of the iron case. It will be seen that the mechanism is novel, the mechanical action being entirely separate from the electrical part. The action is controlled by a spindle working from the handle through a mica-insulated square steel sleeve carrying the knife blades. At the end of this spindle is fixed a radially-operated arm with a steel roller at its working end. This roller in turn works on the "V" end of a "U" shaped fork carrying compression springs,



THE LATEST IRONCLAD SWITCH—INTERNAL VIEW.

which actuate the quick make and quick break action. The switch has either got to be "on" or "off" for slow operation of the movement is impossible. Further, when switching on the formation of the "V" end is such that it is impossible for the switch blades to strike the bottom of the contact blocks. The entire absence of springs and other devices round the electrical part leaves the latter accessible, with the result that wiring is simplified to an extraordinary degree.

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British Empire Exhibition.

Sir W. Joynson-Hicks's Report.

Recommendations for putting the business organisation of the British Empire Exhibition on a new footing are embodied in the report of Sir William Joynson-Hicks, who has held an inquiry on behalf of the Government on questions connected with the Exhibition.

It is recommended that control over the Exhibition Management should be established by the formation of a standing Executive Committee of five members, to which the present Executive Council of 120 members should delegate its powers. This Executive Committee would consist of the chairman or vice-chairman of the Executive Council, the deputy-chairman (who should give the whole of his time to the work and receive adequate remuneration), one representative of the High Commissioners, the chairman of the Exhibition Finance Committee, and the chairman of the Management Committee.

With regard to the amusements concession, it is found that there has been no corruption of any kind. The widest possible publicity was not, however, given to the fact that the concession was available, with the result that some competitors were handicapped in tendering for it.

The Question of Publicity.

Sir William Joynson-Hicks finds that the present position with regard to the Publicity Committee "cannot be allowed to continue." He points out that the success of the Exhibition will depend to a very important extent upon the publicity which can be secured, and to achieve the dual purpose of the Exhibition—i.e., of securing financial success and (what is more important) improving inter-Imperial relationships of all kinds—vast and well considered schemes of publicity will be necessary.

His recommendations on the subject are thus framed:—"Great care should be taken to secure a committee as strong as possible, whose individual members can both advise the Management, and by their influence assist publicity throughout the whole of the world. I suggest that the Publicity Committee should be reconstituted on these lines, and that the Publicity Director should be instructed to give proper attention to such a committee after it is formed."

He further suggests that an administrative manager should be appointed for this department at an adequate salary, and considers that, given proper tact and capable treatment of the matter, "there should never have been, and should not be in future, the least difficulty in securing the fullest publicity for the Exhibition."

Technical Institutes.

Record Session at the Borough Polytechnic.

The report presented by the principal, Mr. J. W. Bispham, at the annual distribution of prizes on Friday last, shows that the Borough Polytechnic Institute has had a record session so far as both quality and bulk of work were concerned.

Sir Douglas Hogg, who presented the prizes, said that it was not the desire of the Institute to turn out a number of half-fledged amateurs to compete with the men in the workshops, but by technical instruction to enable those in the workshops to make themselves more efficient and to make greater progress in the industry to which they belonged. He was sure that the policy which had actuated the Governors in supplementing the experience of the workshop by trade instruction was a sound one, as was the policy of selecting teachers who themselves had worked in the trades.

The Institute was to be congratulated on the way in which it had enlisted the help of expert trade committees, trades unions, and associations of employers in order to keep its work closely related to the current needs of industry. In addition, however, to purely technical instruction, the social side of the Institute was a very strong one. It was concerned even more with the education of good citizens than with the production of expert craftsmen.

Sir John Cass Institute.

The prize giving at the Sir John Cass Technical Institute also took place on Friday last. The Rev. J. F. Marr, Chairman of the Governors, said the numbers of the past year had reached a total of 1 075—the highest figure in the history of the institute. They were still much in need of accommodation for its science departments, especially chemistry. Thirty-one students were engaged in research work during the session, and papers published by students and members of the staff brought the numbers of original investigations issued from the Institute to 120. Twenty-five students were successful at examinations of the university during the past year, and of these six had gained the B.Sc. degree with honours in chemistry, and of the fifteen students successful in the City and Guilds examinations, ten were in metallurgy. For the second year in succession the first prize of a silver medal was gained in non-ferrous metallurgy.

Sir Thomas Holland, Rector of the Imperial College of Science and Technology, who presented the prizes, gave an address to the students on "Humanism in Technical Education."

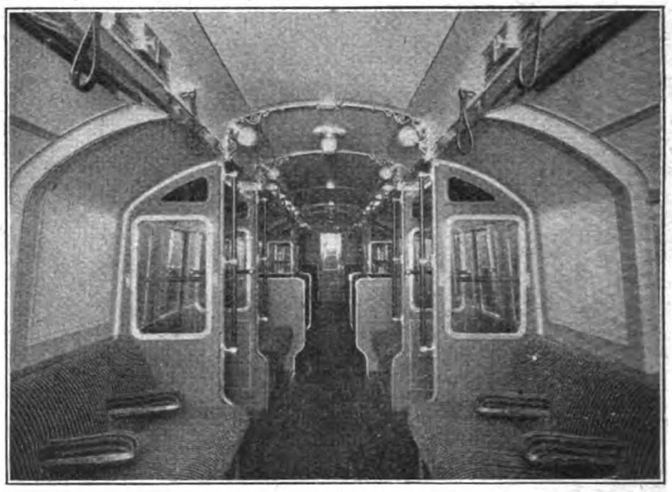
Electric lamps were used for the first time last week-end by night patrols of the City Police Force. The innovation was a success.

New Underground Rolling Stock.

The Problem of Noise Elimination.

The new cars ordered for the London underground railways are now undergoing tests prior to the determination of the final type to be adopted. Five firms—the Birmingham Railway Carriage and Wagon Co., Cammell Laird and Co., the Gloucester Railway Carriage and Wagon Co., the Leeds Forge Co., and the Metropolitan Carriage Wagon and Finance Co.—were each invited to design and build a car. They were given a free hand subject to certain general reservations. The Gloucester Co. has also built a car to a design prepared by the Underground Co.

The accompanying illustration shows the car built by Cammell Laird and Co. A concealed lighting scheme has been introduced with good effect. Bulkhead lighting fittings have been employed



Interior of the Car by Cammell Laird & Co.

by the Leeds Forge Co., and all the cars embody numerous devices which should materially help towards solving London's traffic problems.

Noise elimination has been successfully handled. Tests made by Prof. Low showed that noise could be greatly reduced by boxing in each separate bogie truck. Better ventilation devices make it possible for the car windows to remain closed without discomfort to the passengers, and the final result is that the noise is greatly lessened. Such noise as remains is not of the same pitch as the human voice, as was formerly the case, and conversation can be carried on in comfort.

It is probable that certain features of each car will be embodied in the final choice. The new stock will be used on the line between Hendon and Moorgate, which is scheduled to open for traffic in October next.

Legal Intelligence.

Judgment Reserved in Mullard Valve Case.

In the Court of Appeal, consisting of the Master of the Rolls and Lords Justices Warrington and Younger, on February 5th, the hearing was concluded of the arguments in this case upon the cross appeals of the parties from the judgment of Mr. Justice Lawrance, in the Chancery Division, holding that the defendants had not infringed the plaintiffs' letters patent Nos. 28 412 of 1913 and 126 658 of 1916 by the manufacture and sale of their thermionic valves, and also holding as against the defendants that there was sufficient subject matter to support the validity of both the plaintiffs' patents. He accordingly held that none of the documents relied upon by the defendants disclosed either of the inventions on which the plaintiffs relied—viz., the 1913 patent relating to improvements in wireless receivers and the 1916 patent relating to improvements in vacuum tubes, and that both of those inventions were novel and useful.

At the conclusion of the arguments their lordships reserved judgment.

British Thomson-Houston Litigation.

In the Chancery Division on Friday last Mr. Justice Sargant, on the motion of Mr. Travers Watson, for the British Thomson-Houston Co., the defendants' counsel consenting, gave judgment for the plaintiffs restraining the Irradiant Lamp Works, Ltd., from infringing the plaintiffs' patent relating to leading-in wires for electric lamps. The question of damages was to be the subject of inquiry.

Mr. Terrell, for defendants, in consenting, said he understood a dozen lamps were sold.

In a similar action by the same plaintiffs against the General Electric Engineering Co. his lordship granted an interim injunction to restrain the defendants infringing the same patent, and his lordship advised the person who appeared and said he was the company to make an end of the matter by agreeing to a perpetual injunction.

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Electricity Supply in S.E. Lancs.

Draft Order Issued by the Commissioners.

The Electricity Commissioners have issued an order consituting the South East Lancashire Electricity District and establishing the South East Lancashire Electricity Advisory Board.

In January, 1922, an enquiry was held into the scheme put forward by those concerned and a statement of the conclusions and decisions of the Commissioners was issued in the following April.

The present order recites the constitution of the district as modified after the enquiry and contains the usual provisions for the establishment and constitution of the Board, the appointment, remuneration and expenses of officers, servants and members, for the appointment of an engineering advising committee, and for the co-option of railway engineers. The engineer of the Stalybridge station is to be a member of the Engineers' Committee on such occasions as proposals affecting the area of that Board may be considered and his admission to full membership should the frequency in that area be standardised, is authorised. Power is also given to appoint other committees and provisions are made for dealing with extensions, new works, appeals, statistics and expenses, for the keeping and audit of accounts, and for the annual report.

Constitution of the Board.

The Advisory Board is to consist of 50 members, five of whom will be appointed by the Manchester Corporation, two by each of the Corporations of Bolton, Bury, Oldham, Rochdale, Salford, Stockport and Wigan, one by each of the Corporations of Ashton, Buxton, Eccles, Heywood, Leigh and Middleton, one by each of the Urban District Councils of Atherton, Farnworth, Hindley, Littleborough, Radcliffe, Swinton, Turton and Sale, one by the Stalybridge, Hyde, Moseley and Dukinfield Electricity Board, two by the Lancashire Electric Power Co., one by the South Lancashire Tramways Company, and one by each of the companies supplying in Altrincham, Alderley, Glossop and Macclesfield. The local authorities in whose districts there is a provisional order in force will be entitled to four members and the local authorities in whose districts a provisional order is not in force will be entitled to appoint two members. The London, Midland and Scottish Railway Co., and the London and North Eastern Co. will each be entitled to appoint one member, and provision is made for undertakers who subsequently come into the scheme with the exception of the Yorkshire Electric Power Co. to become members of the Board at a later date.

The Engineers Committee.

Undertakers who generate more than 5 per cent. of the total units generated by all the undertakers in the district will each be entitled to one member on the Engineers' Committee, those who generate more than 3 per cent., but not more than 5 per cent., will appoint two jointly, those who generate more than 1.5 per cent. and not more than 3 per cent. will be entitled to one jointly, as will those who do not generate more than 1.5 per cent., and those who do not generate at all but receive a supply in bulk.

Technical Features.

Three-phase alternating current at a standard frequency of 50 cycles and transmission pressures of 33 000 V, 11 000 V and 6 600 V are laid down as standard, except in the area of the Altrincham Electric Supply Co., where the frequency is 80, at the station of the London and North Western Railway at Clifton, where it is 25, and the stations of the Alderley and Wilmslow Electric Supply Co., the Buxton Corporation and the Electricity Co. of Macclesfield, where direct current is used. These systems will combine to operate for the present, but in the case of Altrincham the company are to consider the practicability of effecting extensions on the alternating current system. The Stalybridge, Hyde, Moseley and Dukinfield Electricity Board will continue to operate at a frequency of 40.

The existing generating stations at Alderley Edge, Altrincham, Ashton-under-Lyne, Atherton, Bolton, Bury, Leigh, Manchester (Stuart and Bloom Streets), Oldham, Radcliffe (Outwood), Rochdale, Salford (Frederick Road), Stalybridge, Stockport, Stretford (Trafford Park), and Wigan stations will continue to be utilised. Generating stations will be erected at Barton and Carrington by the Manchester Corporation, at Agecroft by Salford Corporation, at Chadderton by the Oldham Corporation, at Kearsley by the Lancashire Electric Power Co., at Cheadle by the Stockport Corporation, and at Stalybridge and Wigan.

Main transmission lines will be laid between Barton and Walkden, Barton and Eccles, Walkden and Atherton, Atherton and Leigh, Worsley and Leigh, Barton and Stretford, Radcliffe and Rochdale, Bury and Rochdale, Radcliffe and Bury, Agecroft and Salford, Manchester and Oldham, Manchester and Ashton-under-Lyne and Atherton and Wigan.

A Long-Distance Joint Meeting.

During the eleventh mid-winter Convention of the American Institute of Electrical Engineers which is to be held in New York on February 14th to 17th an interesting feature will be a joint meeting with the Chicago Section by the use of telephone connections and loud speakers. Two Papers will be delivered by means of the loud speakers, one being presented at New York and the other at Chicago. Lantern slides will be shown at both places simultaneously and a joint discussion will follow.

Mr. W. T. Kerr Charged.

Sent for Trial at Assizes

Charges involving a sum of £1 641 7s. 7d., the money of the Hereford City Corporation, were brought against Walter T. Kerr, formerly electrical engineer to the Corporation, at a special police court held at Hereford on Friday last.

The accused was charged with fraudulently applying to his own use sums of £90 and £810, and further with the fraudulent conversion of £250 on May 28th, 1920; of £400 on July 6th, 1920; of £101 7s. 7d. on October 12th, 1920, the sums in each case being described as the monies of the Hereford Corporation.

The magistrates present were Mr. E. Herns, chairman, Mr. F. H. Merrick, Mr. J. C. Mackay, and Mr. R. S. Beavan. At the first hearing Major E. A. Capel appeared for the defendant, but the latter was now represented by Mr. H. W. Orme.

Mr. Micklethwaite, who was instructed by the Town Clerk, said that Kerr was appointed electrical engineer to Hereford Corporation in 1904. He remained in that position for 17 years. The Electricity Committee allowed him considerable freedom, relied upon him, and trusted him implicitly.

The £900 Charge.

The first charge was concerned with the sale of a 60 kW steam balancing set, purchased by the Corporation about 1906. In 1920 the question arose of replacing it by a more up-to-date installation. On July 27th, 1920, the accused reported to the Electricity Committee that he had a prospect of selling the old set. He was, he said, in negotiation for the sale of the set for more than its original cost (which was £540 in 1906), and that there was a prospect of getting £650 for it. The report was approved on July 27th, 1920. Nothing happened as far as the Committee was concerned until November 23rd, 1920, when Kerr reported to the committee again. What he worked out as being the position showed that he had sold the steam balancing set for £640.

The truth was, continued Mr. Micklethwaite, that before ever the first report was made, namely, on June 19th, Kerr had entered into a contract for the sale of the set for the sum of £900. At the time the first report was made that he was hoping to sell if for £650 he had been paid his 10 per cent. deposit and that was paid into his private banking account, and had been used for his own purposes.

By his instructions the cheque in payment of that sum had not been drawn to the Corporation, but to him personally, and on August 5th the machine had been sent off to a firm at Swansea.

On September 20th (before the second report was made) a cheque for £810 had been sent to Kerr personally, and was paid by him into his banking account, and used by him without disclosing one word. After he had had the money he stated falsely that he was in negotiation for the sale of the article.

Evidence for the Prosecution.

David Ernest Joseph, managing partner in the Western Engineering Co., Swansea, then went into the witness box, and said he resided at Swansea. He bought the balancing set from Kerr and gave him a cheque as the invoice was in his name. If it had been in the name of the Hereford Corporation the cheque would have been made out to them.

Clarence E. Turner, bank manager, gave evidence that the accused paid in to his private account various cheques accounting for money mentioned in the charges.

Frank Allen Hayward, station engineer at the Hereford Electricity Works, spoke as to packing and despatching the balancing set.

Evidence was also given by the Town Clerk (Mr. Robert Battersby) and the chief constable (Mr. T. Rawson), the latter giving evidence of arrest.

After evidence had been given in regard to the remaining charges, prisoner pleaded not guilty and reserved his defence. He was committed to the Hereford assizes for to-day (Friday).

The bail was increased to £1 500 in two sureties of £750 each.

Scottish Ideal Homes Exhibition.

Electrical Labour-Saving Devices Prominent.

Electricity is well to the fore at the Second Scottish Ideal Homes Exhibition, now in progress at the Industrial Hall, Annandale Street, Edinburgh.

A block of stands (Nos. 147 to 154) is occupied by the ELECTRICAL CONTRACTORS' ASSOCIATION OF SCOTLAND, and an excellent composite exhibit is presented. Electric light fittings of all kinds are shown, as well as electric fires and heaters. Demonstrations of electric cooking are given and all the latest electric labour saving devices are brought to the notice of the public. One part of the exhibit is devoted to wireless demonstrations by SPENSERS (SCOTLAND), LTD.

Stands 53 to 60 are occupied by the EDINBURGH CORPORATION ELECTRICITY DEPARTMENT. The many uses of electricity in the home are effectively demonstrated.

"Hotpoint" and "Falco" domestic electrical appliances are shown on stands 26, 27 and 28. "Hotpoint" irons and clothes washers are prominent, as well as the "Falco" Cooker, nearly 400 of which have been hired out by Glasgow Corporation Electricity Department.

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Wireless News.

New Broadcasting Stations.

The CARDIFF station of the British Broadcasting Co., which it is hoped will be functioning about February 12th, will have the call letters " 5 W A " and a wave length of 395 m. The GLASGOW station, which is expected to be in service about the middle of March, will have the call letters " 5 S C " and a wave length of 415 m.

A wireless station, somewhat similar to the Eiffel Tower in Paris but not quite so large, will shortly be erected in DUBLIN. It will be entirely a Government enterprise, and is expected to be situated in the Phœnix Park, where there is every facility for such a plant. The Free State authorities, once the station is established, intend broadcasting to towns in the provinces, latest market reports, news, weather bulletins, etc., which would be of use to the community and would assist trade.

The Danger of Gas Pipes for "Earthing."

It has been found that the practice exists among wireless amateurs of using gas pipes and brackets for the connection of earth wires. The danger of such a course is obvious, as if the aerial were struck by lightning, an explosion in the gas system might ensue.

Transmission Underground.

The penetration of the earth's surface by radio waves is the object of a series of experiments being carried on by the Pittsburg station of the United States Bureau of Mines, in an effort to perfect its life-saving system. The idea is the development of a radiophone that will allow rescuers to c mmunicate with entombed miners when all other means of communication have been cut off by explosion or other accidents. The Bureau has found that signals from a broadcasting station 18 miles from the mine were recorded by a receiver situated inside the mine, and that it was possible to SEND AND RECEIVE MESSAGES UNDERGROUND THROUGH THE STRATA. About 50 ft. from the receiving station in the mine was a 6 in. bore-hole from the surface, lined with iron pipe and containing electric light wires which extended throughout the mine. The presence of these wires, the report of the engineers said, evidently assisted greatly in the reception, for when the receiving set was carried to another part of the mine removed from the wires the signals were barely audible through 50 ft. of cover. The fact that the signals were detected, however, even though faintly, was taken as sufficient evidence of transmission through the ground, and gave encouragement for further experimentation.

Imperial and Foreign Developments.

It is understood that the Radio Corporation of America is prepared to cede its rights for the exploitation in BELGIUM of certain patents relating to improvements to radio-telegraphy transmission systems and in receiving systems.

In connection with the recent announcement that an American company intended shortly to inaugurate a wireless broadcasting service in SHANGHAI, the Customs Commissioner has informed the company that any wireless sets imported would be seized as contraband of war.

The Bill giving sanction to an agreement between the SOUTH AFRICAN Government and the Marconi Co. for erecting and operating a wireless station has passed its second reading and been referred to the Public Accounts Committee, a step which is not likely to delay its final passage.

The Australian Board of Control under the wireless agreement for DIRECT WIRELESS COMMUNICATION WITH GREAT BRITAIN has granted Amalgamated Wireless (Australia), Ltd., six months' extension. A " T mes " corr espondent says the difficulty which has led to delay is the selection of a site for the station in Great Britain. On the 8th ult. Mr. Neville Chamberlain stated that the size of the station was a question on which the Government had not made up their mind definitely and that the Government were considering the financial aspect of the question.

Miscellaneous Wireless Items.

It is reported that a large number of wireless sets has been purchased at the SCOTTISH MOTOR SHOW.

The WRITTLE WIRELESS STATION of the Marconi Sc ientific Instrument Co. has been closed down.

On Monday for the first time a wireless telephone message was RECEIVED DIRECT FROM AN AEROPLANE in a London newspaper office.

On Tuesday night, members of the Marconi staff succeeded in picking up both London and Birmingham broadcasting stations on a LONDON–LIVERPOOL EXPRESS TRAIN. A frame aerial was employed with good results.

The Liverpool Marine and General Insurance Co. inform us that they have had inquiries with regard to their WIRELESS INSURANCE SCHEME from U.S.A., South Africa and Egypt, as well as from all parts of the United Kingdom and the Continent.

Capt. O'Connor, who is associated with the recently invented NON-AERIAL WIRELESS SET, suggests that for an increased licence fee of £1, owners of sets should be allowed to carry them to friends' houses within a radius of 20 miles from Charing Cross.

The secretary of the National Trade Defence Association has stated that members of the licensed trade would, as an organised body, take an early opportunity of testing the validity of the decision of local benches in ordering that a music licence must be obtained in conjunction with WIRELESS ON LICENSED PREMISES. They were taking the question to the High Court.

Obituary.

Percival Philip Kipping.

Mr. PERCIVAL P. KIPPING died at his Harrow residence on Sunday, aged 56. He was associated with the General Electric Co. for some years, principally in connection with that firm's subsidiary companies. He was at various times London manager of the Peel-Connor Telephone Works, technical director of the Bogota Telephone Co., and secretary of Coventry Automatic Telephones, Ltd. He was an Associate Member of the Institution of Electrical Engineers. The funeral service was held at Harrow Presbyterian Church on Wednesday, the interment following at Harrow Cemetery.

Mark Heaton Robinson.

The death took place at Kingston-on-Thames, on Friday last, of Mr. MARK H. ROBINSON, in his 79th year. After some years in the civil department of the Admiralty, he founded, with the late Mr. Peter W. Willans, the engineering firm of Willans and Robinson, of Thames Ditton. After 1881 his attention was mainly devoted to the development of the single-acting high-speed engine with which Mr. Willans's name is associated, and in 1882 he invented, and in conjunction with Mr. Willans patented, the application of an air cushion in addition to or in substitution for the usual steam cushion, to enable single-acting engines to work at high speeds without knocking, irrespective of load or steam pressures. Later, he was engaged in developing the steam turbine business of his firm. He resigned the chairmanship of the company through ill-health early in 1909, and practised as a consulting engineer. He has been magistrate for Warwickshire and a member of the Council of the Institution of Mechanical Engineers. He was also a member of the Institution of Civil Engineers, the Institution of Electrical Engineers, the Institution of Naval Architects, the Iron and Steel Institute and the Société des Ingenieurs Civils de France. The funeral took place at Teddington Cemetery on Wednesday.

Alexander Ross.

A past president of the Institution of Civil Engineers died suddenly on Saturday in the person of Mr. ALEXANDER ROSS. He was 78 years of age, and had a distinguished record of service with Scottish and English railway companies. He was for 15 years chief engineer to the Great Northern Railway, and also practiced as a consulting engineer. Among his chief works was the construction of the tube railway from Finsbury Park to the Strand. The numerous bodies on which he served included the British Engineering Standards Association and the Committee on Railway and Tramway Rails (chairman). He held the rank of Lieut.-Col. in the R.E. (T.), and held important positions under the Ministry of Munitions. It will be remembered that he formulated a scheme for an outer circle railway linking up the railways running north of London. The funeral took place at West Hampstead Cemetery on Thursday.

Charles Walker.

The death has taken place after a short illness of Mr. CHARLES WALKER, who had been associated with the electricity undertaking of the Barnes (Surrey) Urban Council since its inception.

Personal Items.

Mr. H. W. BAKER has been appointed lecturer in engineering at Manchester University.

MR. G. C. WESTON has been appointed chief engineer to the Kensington and Knightsbridge Electric Lighting Co.

Mr. S. J. WATSON, late electrical engineer, has been presented by the staff of the Bury Electricity Department with a barometer.

Mr. H. S. DIX, manager of the Melbourne Metropolitan Tramways Board's system, has retired, and will leave Australia shortly to spend a holiday in England.

Mr. GANO DUNN and Mr. M. L. KRISTIANSEN have been appointed local honorary secretaries of the Institution of Electrical Engineers for U.S.A. and Norway respectively.

Mr. J. R. BROOKE has been promoted to be Secretary to the Ministry of Transport, on the retirement of Sir William Marwood, which took effect as from January 31st.

Sir EDWARD MANVILLE is associated with an appeal being made by the NATIONAL ALLIANCE OF EMPLOYERS AND EMPLOYED for £100 000 to enable it to carry on its work.

The London Telephone Advisory Committee has passed a resolution expressing its sense of the valuable services rendered by Mr. G. F. PRESTON, late Controller of the London Telephone Service.

Mr. BENJAMIN G. LAMME, chief engineer of the Westinghouse Electric and Manufacturing Co., East Pittsburgh, U.S.A., has been selected by Ohio State University as the first recipient of the Joseph Sullivant medal.

MR. A. BRAMMER, general secretary of the National Association of Supervising Electricians, has been elected hon. treasurer of the National Federation of Professional, Technical, Administrative and Supervisory Workers.

Mr. W. G. WATSON, managing director of W. G. Watson and Co., Sydney, Australia, is visiting England via America on business. He leaves Sydney by the " Niagara," arriving at Vancouver on March 24th. His address in U.S.A. will be c/o G. J. Mitchell Corporation, 3240, West Lake Street, Chicago, up to about the end of April. Mr. Watson expects to arrive in London about May 15th. Letters addressed to A. Murray Coombs and A. F. W. Richards, 150, Southampton Row, London, W.C.1, will reach him.

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Electricity Supply.

Extensions and Developments.

REIGATE Town Council is purchasing three generators, driven by Diesel engines, for the electricity station.

During the fortnight ending January 24th OLDHAM electricity undertaking sold the record total of 1 403 114 kWh.

BATH City Council has been advised by the electricity department not to proceed with a hydro-electric scheme on the River Avon.

HAMMERSMITH Electricity Committee proposes reduced charges to shopkeepers who wish to keep their premises lighted after closing hours.

NOTTINGHAM Corporation has applied for tenders in connection with the construction of the North Wilford power station, and every effort is being made to push on with the work.

LIVERPOOL Tramways and Electricity Committee has agreed to offer shopkeepers a supply of electric light for the illumination of their shop windows after closing time at the nominal charge of 1½d. per kWh.

The borough electrical engineer has reported to SOUTHPORT Electricity Committee that the erection of the 1 500 kW turbo-alternator was progressing satisfactorily, and that it should be under steam in a month's time.

MARYLEBONE Council is to extend the electric supply plant and buildings at a cost of £292 367. Tenders have been accepted for a new 12 500 kW turbo-alternator with condenser equipment, and four rotary converter sets (three 2 000 kW and one 1 500 kW), with transformers.

The WEST GLOUCESTERSHIRE POWER Co., which owns the station now being erected at Lydney, and hopes to have power available by midsummer, has just opened an office at 21, Eastgate Street, Gloucester, and will be ready to enter into contracts with prospective consumers within the next few days.

RIPON City Council, in view of the proved unsuitability of the Camp generating plant, has decided to engage a consulting engineer to advise on the initial cost of a small power station centrally situated, and the possibilities of the generation of electricity by a combined plant scheme at the Gas Works.

DOVER Electricity Committee, on January 30th, decided to recommend the Town Council to instal two 1 500 kW turbo-alternators, to have the necessary alterations made to the power station, and to provide a cooling pond for the extra water supply. The committee also recommend that a consulting engineer be engaged to supervise the arrangements for the installation of the new plant.

Since April last 820 new electricity consumers have been connected at BLACKPOOL, as compared with 354 during the same period in 1921. During December the total output was 907 110 kWh, an increase of 109 194. For the nine months April-December inclusive the total output was 7 127 460 kWh, an increase of 1 363 813. Lighting, heating and power accounted for 4 121 510 kWh (increase, 938 543); tramways, 2 810 650 (increase, 382 970); and public lighting, 195 300 (increase, 42 300).

A sub-committee of GLASGOW Electricity Committee has been asked to confer with the General Finance and Parks Committees regarding the acquisition of ground for a site for the erection of a large new power station. In this connection a statement by the general manager points out that an extension of the Dalmarnock generating station will require to be put in hand next year, and that, assuming the normal growth of demand is equal to what has been experienced in the past, the plant to be installed therein will be fully loaded in ten years from this time.

Loans Applied for and Sanctioned.

GUILDFORD Town Council has received sanction to a loan of £10 000 for boiler and other plant, and a battery.

ABERTILLERY Urban Council has received from the Electricity Commissioners sanction to a loan of £10 340 for plant, etc., for the electricity scheme.

MAIDSTONE Town Council has received sanction to a loan of £17 266 for the provision of a new boiler and accessories with the necessary buildings at the electricity works.

BATH Electric Lighting Committee recommends the Town Council to instal at the electricity works a turbo-generator with accessories, and to apply to the Commissioners for a loan of £30 108 to cover the cost.

The Electricity Commissioners have sanctioned the borrowing by COLNE Town Council of £10 000, the amount required for the prospective expenditure on extension of trunk feeders, services, and transformers during the next two years.

ILFORD Urban Council has decided to apply to the Electricity Commissioners for a loan of £2 000 for electrical cooking apparatus for hiring out, and £1 000 for the wiring of houses on the rental system. An electrical exhibition is to be held in the Town Hall.

Alterations in Charges, Proposed and Actual.

A further reduction in charges will be made by the KENSINGTON and KNIGHTSBRIDGE Electric Lighting Co. as from the Lady Day meter readings.

At a meeting of the PENARTH Urban District Council, on Monday, a letter from the Electric Lighting Co. was read stating that the question of charges would be considered and that a reduction would probably be announced shortly.

The WESTMINSTER Electric Supply Corporation announces that the price for current will be reduced, beginning with the March quarter's readings, by ½d. per kWh. At present lighting current is 6½d. per kWh up to 4 000 and 5d. above. The new price will be 6d. for the first 4 000 kWh and 4½d. above.

At the public inquiry held at BRECHIN on February 1st with regard to the charges for lighting made by the North of Scotland Electric Co., Mr. Annand, an Edinburgh accountant, stated that, in his opinion, the reserve of the company should be one-half of what it was, this making a difference of £670. That would represent a reduction of 2d. per kWh on a consumption of 80 000 kWh. One of the witnesses stated that he was paying at the rate of 2s. 6d. per kWh.

At a meeting of the Electricity Committee of DOVER Town Council, on January 31st, the chairman announced that the Act allowing the price of current to be above the maximum would come to an end during the year, and then they would have to drop the price to 7d. per kWh. It would make considerable difference to them, and it would not allow for the price for power and heating to be dropped. He suggested that they should apply for their maximum charge to be increased to 9d. They would probably charge 8d. per kWh next year. It was decided to apply to the Ministry of Transport for permission to do so.

Tapping New Areas.

CHESTER Rural Council has asked the Mersey Power Co. for terms for extending their mains into the Council's area.

A canvass is to be held at DESBOROUGH with regard to the proposed supply of electricity for lighting from Kettering.

MAIDSTONE Town Council is taking a canvass at the village of Loose with a view to the mains being extended to that parish.

The Mersey Power Co. has informed the Council that the supply of current in the streets of ELLESMERE PORT, in accordance with the Special Order of 1923, is now being considered.

The Town Council of BALLYBAY (Monaghan) has decided to form an electric light company for the town, the company to be managed and directed by the Town Council in the interests of the ratepayers.

STROUD Electric Supply Co. have applied to the Electricity Commissioners for a Special Order adding Nailsworth Urban and Stroud Rural Districts to the company's area of electricity supply. Objections to the Secretary, Electricity Commission, Whitehall, London, by February 27th.

Miscellaneous Supply Items.

SHERBORNE Urban District Council is to lodge an objection to the application of Crompton and Co. for a special order to supply electricity to the town.

LYME REGIS Town Council have been in negotiation with Lyme Regis Electric Light and Power Co. for the purchase of the undertaking, and there is a likelihood of the transaction being carried out during the next twelve months, provided opposition to the Council's contemplated purchase is not unduly pressed.

At a meeting of BELFAST Corporation reference was made to the fact that during the last six or seven weeks the sea had threatened the new electric station at the harbour and flooded the basement to the extent of almost three feet. The flooding took place when there was an abnormal spring tide, the highest in the lough for about twenty years.

GLASGOW Corporation have approved the recommendation, detailed in these columns last week, to reduce the war bonus of their employées by 2s. per week in the case of men and 1s. in the case of women, boys, and non-ablebodied males. In the case of salaried officials graded reductions in bonus are being made. Employées in the electricity supply department are affected.

SPALDING Urban Council, on January 31st, decided by eight votes to seven not to entertain a proposal to adopt an electric lighting scheme for the town. The Council are the owners of the gas works, and fear the introduction of electricity would be prejudicial to their interests. The capital outlay was put at £15 000, and it was contended that after the first year the undertaking would be self-supporting. Very substantial support had been promised by residents for lamps and motors, and an expert expressed the view that the undertaking would be likely to be almost self-supporting the first year.

Sheffield Chamber of Commerce announces that the railway companies have agreed to a REDUCTION OF RAILWAY RATES FOR STEEL AND IRON. Machinery will, with certain exceptions, be conveyed at owner's risk scale. This represents a considerable saving on many classes of goods.

"Les Annales des Postes, Télégraphes et Téléphones," which for several years past has been issued every two months by the French Post, Telegraph and Telephone Department, became as from January 1st, A MONTHLY PUBLICATION. The price will continue to be 24 fr. for subscribers in France, and 27 fr. for subscribers abroad.

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Imperial Notes.

AUSTRALIA.

Melbourne Electrical Engineer's European Tour.

Mr. W. H. ALABASTER, electrical engineer to Melbourne Council, has returned to Melbourne after a SEVEN MONTHS' TOUR of Great Britain, America, France, Switzerland and Germany. He intends to present to the Electric Supply Committee a report based on his observations abroad, which he says have been particularly devoted to street lighting and domestic electric appliances.

Supply Extensions in Queensland.

WINDSOR (Queensland) Corporation propose to take a supply of electricity in bulk from the City Electric Light Co., of Brisbane, and have secured a promise from the State Treasurer of a loan of £25 000 for the distribution system. It is estimated that almost sufficient economy will be effected in the cost of street lighting to pay the capital charges.

Travelling Facilities in Melbourne.

Major H. B. Walters, chief architect to the Closer Settlement Board, has prepared a scheme, which is being submitted to the Victorian Government, for a MELBOURNE CITY ELECTRIC RAILWAY. The railway would be about 3¼ miles in length, and would extend by way of Carlton and Fitzroy, from North Melbourne to Richmond, at which points it would connect with the existing line. It is claimed that by this means the congestion at Flinders Street would be obviated, business expansion in the districts served would be encouraged, and land acquired compulsorily by the Government would be so enhanced in value as to pay, upon re-sale, the whole cost of the scheme. Three additional city stations would be constructed and one at Jolimont, and these stations would all abut on to existing tramway routes. The total cost is estimated roughly at £5 000 000.

CANADA.

Toronto Street Railway Valuation.

The arbitration board has valued the TORONTO STREET RAILWAY PLANT at 11 200 000 dollars. The system has been taken over by the city from the railway company.

New Power Plant in Winnipeg.

The first unit of 28 000 H.P. of the Great Falls HYDRO-ELECTRIC POWER PLANT of the Manitoba Power Co. has been opened in Winnipeg. The ultimate capacity will be 170 000 H.P., and a second unit of 28 000 H.P. will be ready in six weeks. The new plant, which was financed by the sale of bonds in Canada, is being completed ahead of schedule. The total cost will approximate 14 000 000 dollars.

EAST AFRICA.

Imports of Electrical Apparatus.

A report on the trade and commerce of East Africa compiled by Mr. C. Kemp, Officer-in-Charge, Naorobi, state that IMPORTS OF ELECTRIC APPARATUS for the year ending March 31st, 1921, amounted in value to £41 364. Of this total, £2 419 represented imports from the United Kingdom, and £14 807 from U.S.A. For the nine months April-December, 1921, the position was reversed, the United Kingdom supplying imports to the value of £15 727 and U.S.A. to that of £2 957 out of a total of £18 783. The report points out that the demand for heavy machinery is negligible, and that the call for small industrial machinery will be small for some years to come.

WEST AFRICA.

Electric Light Scheme for Accra.

Accra, the capital of the GOLD COAST COLONY, is still without electric light, but is to have an electric light installation erected this year; Sir William Arrol and Co. are reported to be the contractors. The installation is estimated to cost between £50 000 and £60 000, of which about £10 000 will be recovered from installing electric light and power in private dwelling houses and workshops. The Governor has promised to hand over management of the installation to the municipal authorities when it is completed.

Passport Visas in Europe.

Detailed Information as to Regulations and Charges.

Every business man who has occasion to travel in Europe knows the time and trouble involved in ascertaining the exact formalities which have to be complied with in order to obtain passport visas for various countries. The question is an important one, since even the smallest irregularity in a passport may involve the detention of the holder at a frontier for some time.

The "European Commercial" is now publishing in tabulated form all the regulations and charges enforced by the various States in Europe. The information given includes such items as documents to be submitted, time necessary for obtaining the visa, the period of its validity, the fees charged, etc. Countries already dealt with include France, Germany, Sweden, Denmark, Poland, Rumania, Belgium, Holland and Switzerland. Further countries are dealt with in the current issue.

Albert Van Twyl Day has applied for the RESTORATION OF PATENTS Nos. 148 380 (20 308 of 1920) and 174 064 (500 of 1922) for "Improvements in or relating to electric high frequency signalling," which expired on July 17th, 1922, owing to non-payment of renewal fee.

Foreign Notes.

EUROPE.

Berlin Underground Railway Opened.

The so-called Nord-Sued Electric Underground Railway, linking up NORTH BERLIN from the Seestrasse to the Hallesches Tor in the south, and connecting up with the existing underground and overhead systems, has been opened to the public. The construction was started in 1914.

Forthcoming Austrian Railway Electrification.

Lecturing on "The Commercial and Industrial Developments of Austria" at the City of London College last week, Dr. J. M. Bach, of the Austrian Legation, said that the time was approaching when large sections of the AUSTRIAN RAILWAY SYSTEM—particularly the mountainous lines west of Innsbruck to the frontier of Switzerland and the Salzkammergut (Upper Austria)—would be worked electrically, besides two other lines aggregating about 400 miles. Not only were the necessary power stations nearly finished; the equipment of permanent way and rolling stock was also far advanced, and one of the forty-seven large electric locomotives was already finished. Austrian engineers had succeeded in turning out quite a new type of electrical locomotive that probably would be widely imitated abroad. The saving in coal would be about 400 000 tons for railway purposes alone.

Unusual Accident Reported from France.

An unusual FATAL ACCIDENT FROM ELECTRIC SHOCK is reported in the "Revue Générale de l'Electricité." Wires used for radio-telephonic communication between two stations on a distribution network ran parallel to the high tension lines at a distance of 1·80 m. from the latter. On cutting one of these wires a workman received a fatal shock, notwithstanding the fact that the wire was isolated from any source of current and did not touch the high-tension line either before or after being cut. The author attributes the mishap to a capacity effect, current being induced in the circuit—containing the capacity and including the workman—by the 15 000 V current in the adjacent lines. He maintained that workmen should not be allowed on structures carrying high tension lines until the latter have been disconnected, even though work is not to be done on those lines themselves. This precaution is particularly necessary when work is to be done on lines running parallel to the high tension lines for some distance.

THE FAR EAST.

Electric Power Supply in Japan.

According to investigations carried out by the Japanese Department of Communications the number of ELECTRIC POWER SUPPLY CONCERNS at the end of October last was 839, with a total capitalisation of over 2 316 000 000 yen, and when the work of construction now in progress is completed they will be able to supply a total motive power of 1 981 822 kW, of which 1 630 648 will be generated by water power and 351 174 by fuel. Compared with the same period for last year the number of concerns showed a decrease of one, but the capitalisation shows an increase of 354 847 315 yen and the power supply an increase of 273 258 kW.

LATIN-AMERICA.

Brazilian Import Duties on Electrical Goods.

The BRAZILIAN BUDGET LAW for 1923 provides for the following IMPORT DUTIES. Electric lifts imported with or without motors up to 1 500 kilogs., 500 reis (8d.) per kilog.; over 1 500 kilogs., 400 reis (6·4d.) per kilog. Electricity, 5 reis (0·08d.) per kWh for light, 2 reis (0·032d.) per kWh for power. There is an alternative rate of 5 per cent. if electricity is supplied on "minimum consumption" system.

Electrical Plant for Buenos Aires.

Electrical plant, machinery and fittings, says Reuter, will shortly be required in connection with the considerable building extensions about to be undertaken by GATH AND CHAVES, LTD., a British concern closely connected with Harrods (Buenos Aires). Other large establishments in Buenos Aries to install similar equipment in connection with extensions upon sites recently purchased, are J. Voss y Cia. and Casa del Acqua.

Brazilian Traction, Light and Power Earnings.

The aggregate gross earnings of the BRAZILIAN TRACTION, LIGHT AND POWER CO. for 1922 amounted to 197 749 000 milreis, an increase of 26 882 000 on the 1921 figure. The net earnings were 124 506 000 milreis, an increase of 29 401 000. The increased revenue is largely due to the revenue from some of the services being payable on a gold basis. Large receipts of milreis are therefore shown in consequence of the decline in the Brazilian Exchange.

Mexican Railway Electrification.

A contract for the electrification of a portion of the MEXICAN RAILWAY, a British Corporation, has been alloted to a United States electrical firm. The first portion of the track to be electrified is the mountain section between Orizaba (82·6 miles) and Esperanza (111·8 miles from Vera Cruz). The cost of the electrification of the mountain section is estimated at £1 500 000, while further schemes, including the construction of a line from the rich mining district of Pachuca to Tampico, the latter being the shipping port for the Tamaulipas petroleum fields, may absorb a further £1 000 000.

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Electric Traction.

Tramway Extensions and Developments.

GATESHEAD Tramways Co. proposes to double the existing single line along practically the whole length of the Felling route. The Durham County Council has agreed to the Felling Council giving their consent to the scheme, subject to conditions as to widening the road, etc.

BURNLEY Tramways Committee have recommended the Town Council to take in hand the re-laying of Padiham Park Lane Section of the tramways track during the next year. The length of the track proposed to be relayed is 7 260 yards and the estimated cost at £5 per yard is £36 300, which, it is stated, will be met out of a loan of £38 950 for relaying purposes.

BRADFORD Tramways Committee has been considering the objections which have been lodged by various outside authorities to the proposals of the Corporation to extend the trackless tram services into the areas of those authorities. The committee has decided to appoint a special sub-committee to go more fully into the various objections raised with the view of effecting some arrangements for securing the adoption of the proposals.

Fares, Receipts and Passengers.

HULL City Council has refused by 39 votes to 19 to allocate £10 000 from tramway profits to rate relief.

Transfer tickets are again being issued on Nottingham tramways. The concession is not regarded as likely to produce additional revenue.

Objections have been lodged by Rawmarsh and Mexbro' to an application by the MEXBRO' and SWINTON Tramways Co. for sanction for the continuance of existing fares for another year.

The introduction of cheaper fares on the LONDON County Council tramways has resulted in increased receipts. For the six weeks ending January 17th, the total number of passengers carried was 84 525 624, and increase of 4 306 191 on the corresponding period a year ago. The receipts amounted to £550 168, an increase of £11 660.

BURNLEY Tramways manager has presented to the Town Council a statement showing the effect of a reduction proposed by the Tramways Committee, and another giving particulars of the work of the undertaking from March 31st, 1912, to March, 1922. A recommendation was made to the Council to defer the consideration of the reduction of fares until after April, when the balance sheet will be available.

Returns submitted to BLACKPOOL Tramways and Electricity Committee show that from December 8th to January 18th the Corporation trams carried 2 383 710 passengers, an increase of 331 553 on the corresponding period last year. The receipts were £15 397, an advance of £790, but the extended car mileage resulted in a reduction of ·66d. per car mile on average receipts, this year's figure being 16·21d.

The number of passengers carried on the WALLASEY CORPORATION tramways during December was 1 406 258, compared with 1 480 419 during the corresponding month of the previous year, and the receipts amounted to £10 543, compared with £11 815. The Finance Committee have deferred until the end of the summer season the proposed reinstatement of the fares and stages in operation during 1918–20.

The estimates of SUNDERLAND Corporation Tramways undertaking for the year ending March 31st next, show a surplus of £5 975 on the year's working, which will be put to the renewals fund, leaving nothing for the relief of rates. The revenue is expected to fall to £126 000 against £134 707 last year, but the expenditure will be about £14 000 less than last year, due to saving on wages, current and other economies. The income includes £2 000 from advertising on the cars. About £10 000 a year is being spent out of the renewals fund on repairing the track and on maintenance and re-building of cars, work which had to be neglected during the war.

Ashton Tramway Workers give Notice.

Seven days' notice, terminating to-day (Friday) has been given by the employees on the ASHTON-UNDER-LYNE Corporation Tramways to cease work failing the Tramways Committee granting the Oldham and Manchester rates of pay for men working on the Oldham and Denton routes, or alternately that the men be raised from grade 2 to grade 1. The Ashton undertaking was graded in grade 2 by the district council of the National Joint Industrial Council. The Corporation Tramways Committee have decided not to accede to the men's demands, and have accepted the notice served upon them by the men. They regret that the men should make a point-blank demand without first having recourse to arbitration or to the National Joint Industrial Council.

The Hull Rails Contract.

At a meeting of the HULL City Council last week, attention was drawn to an entry on the minutes that the City Engineer had stated that it would be necessary for the steel tram rails ordered in Belgium to be inspected at the works of the manufacturer before shipment. That, said Councillor Eastman, was one of the first results of the acceptance of a foreign tender. A deputation had to go to see the rails. Did it mean that the Chairman of the Tramways Committee and the City Engineer had a free hand to do what they liked in sending a deputation to inspect the rails? Councillor Willoughby replied that in all cases of this kind the City Engineer sent somebody or authorised a technical expert to inspect the rails before they were put on rail or shipped. In this instance, three nominations had been submitted from which one would be chosen.

L.C.C. Tramways Contracts and Foreign Firms.

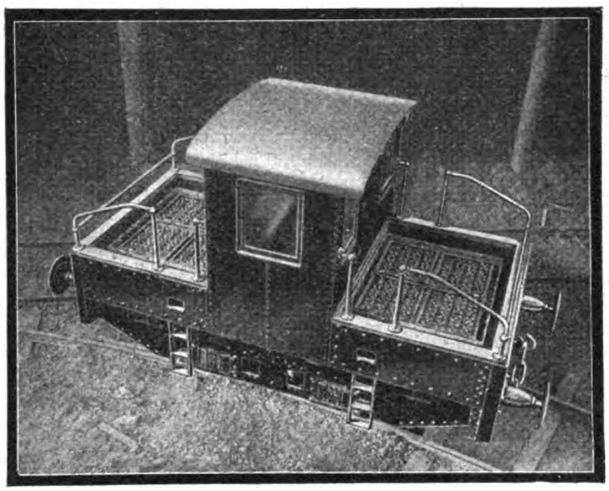
The Highways Committee of the LONDON County Council has, with the concurrence of the General Purposes Committee, made a rule as follows :—

The names of foreign firms and the British agents of foreign firms are not to be included in the selected lists of firms to be invited from time to time to tender for tramway stores and materials, etc., but such firms or agents are to be invited to tender in any case in which it is considered expedient to do so. The general manager, tramways department, so far as tenders for machinery, etc., are concerned, and the chief officer of stores, in the case of tenders for tramway stores and materials dealt with by him, are to report for determination by the Committee any case in which it is considered advisable to invite foreign firms or their British agents to tender as well as British firms.

A Recent Battery Locomotive.

The accompanying illustration shows a typical application of the Ni-fe accumulators made by BATTERIES, LTD., to the everyday need of industry.

The outstanding features claimed for the Ni-fe cell are its lightness, remarkable strength, and the fact that it is practically



A "NI-FE" ELECTRIC LOCOMOTIVE.

fool-proof, since overcharging is not injurious, and it can be left for years without re-charging, still maintaining its original condition. It is unspillable, and proof against all vibration.

Electric Railway Items.

For the week ending January 27th, the traffic receipts of the MERSEY Railway amounted to £4 206.

The experiment of placing automatic ticket machines in the foyer of the LONDON Hippodrome, made recently by the Underground Railway, has proved successful, and similar machines have now been installed at Selfridges, Ltd.

The directors and members of the Supervisory staff of the LONDON Underground Railway met at Prince's Galleries on January 29th to hear the reading of reports by officials of the Company who have been studying traffic transport systems abroad. Germany, France, Switzerland and U.S.A. have all been visited and some instructive comparisons were drawn.

At a meeting of the Saddleworth Council last week, Councillor Mallalieu introduced the question of electric traction, and thought they ought to join with Oldham in trying to persuade the railway company to make such a change. He thought an ELECTRIC RAILWAY to DELPH from OLDHAM would be a great advantage, and would obviate the necessity for tramcars. It was decided to give the matter consideration.

Organised by the Office Appliances Traders' Association, a BUSINESS EFFICIENCY EXHIBITION was opened at the Central Hall, Westminster, on Wednesday. It will remain open until February 17th. Amongst the exhibitors are Dictograph Telephones, Ltd., the Dictaphone Co., Thomas A. Edison, Ltd., the Telephone Manufacturing Co., Beveridge's Calculators Co. (electric calculators), Hendrik Jansen, general agent for the Victoria Typewriter Co. (the Mercedes electric typewriter), the British Tabulating Machine Co. (the Hollerith electrical machines), Blick Time Recorders, Ltd., and Gledhill-Brook Time Recorders, Ltd.

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Reference Index to Recent Wireless Publications.

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J. Hill. Action at a Distance (*Popular Wireless*, 1, p. 360, December 16th, 1922). R.000.

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The piloting of ships and aeroplanes by induction (*Annales des Postes, Télégraphes et Téléphones*, 11, p. 889, July-August, 1922). R.800.

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The Invention of the Pilot Cable (*Discovery*, 3, p. 279, October, 1922). R.800.

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Tenders Invited.

UNITED KINGDOM.

MIDDLESBROUGH CORPORATION.—Twelve months' supply of a.c. metres. Specification, etc., from the Borough Electrical Engineer.

BO'NESS (SCOTLAND).—Contractors desirous of tendering for wiring and fitting of the fourth instalment of 16 houses under the Craigallan Housing Scheme are requested to apply to the Interim Burgh Surveyor, Bo'ness.

DUBLIN ELECTRICITY AND PUBLIC LIGHTING COMMITTEE. February 12th.—Dismantling and removal of water tube boiler, economiser, steel stack, pipework and accessories at Pizian House Fort generating station. Specification from the City Electrical Engineer, Fleet Street, Dublin.

GLAMORGAN EDUCATION AUTHORITY. February 13th.—Electric light wiring and fitting at Trenewydd (Newton, Gelligaer) school and Fochriw mixed school. Plans can be seen at the schools or at the County Hall, Cardiff.

HALIFAX CORPORATION. February 17th.—Electric lighting work in connection with extensions to stables at Stoney Royd Depot. Forms of tender, etc., from the Borough Engineer. The successful contractor will be required to engage unemployed men through the Labour Exchange on conditions laid down by the Unemployment Grants Committee.

DEWSBURY CORPORATION, February 21st.—Pumps and motors for sewage disposal works. Particulars from James Diggle and Son, 14, Brown Street, Manchester, or from the Borough Engineer, Dewsbury.

DEWSBURY CORPORATION. February 28th.—Electrically driven raking and cleaning apparatus for sewage works. Particulars from Jas. Diggle and Son, 14, Brown Street, Manchester, or from the Borough Engineer.

FULHAM (LONDON) BOROUGH COUNCIL. February 28th.—Electrical and engineering stores for 12 months. Particulars from the Town Hall.

LONDONDERRY CORPORATION. February 28th.—Two water-tube boilers, superheaters, economisers, stokers, etc. Specification, etc., from the City Electrical Engineer.

TYNEMOUTH CORPORATION, February 28th.—(a) Switchboards for sub-station; (b) transformers. Specifications, etc., Mr. C. Turnbull, Borough Electrical Engineer, Electricity Works, Tynemouth.

STEPNEY (LONDON), COUNCIL, March 1st.—River water-screening apparatus for Limehouse generating station. Specification from the Borough Electrical Engineer, 27, Osborn Street, Whitechapel, E.1.

PORTSMOUTH CORPORATION. March 6th.—Electrically operated 8-ton portable jib crane. Drawings, etc., from the Borough Engineer.

CLACTON-ON-SEA URBAN DISTRICT COUNCIL, March 7th.—(a) 340 B.H.P. Diesel engine; (b) 225 kW multipolar, shunt wound generator; and (c) cooling plant, steel structure and pipe work. Specification from the Electrical Engineer, 14, Electric Parade, Clacton-on-Sea.

LEICESTER CORPORATION, March 12th.—Steam, electric or other type of pumping machinery in connection with sewage disposal works. Specification, etc., from the City Surveyor.

AUSTRALIA.

AUSTRALIAN POSTMASTER-GENERAL'S DEPARTMENT.*—16 750 Léclanché porous cells and 1 200 earthenware outer jars.

VICTORIAN ELECTRICITY COMMISSION, March 15th.*—Motors, starters and isolating switches for the Yallourn briquetting works (specification 23/7).

VICTORIAN ELECTRICITY COMMISSION. March 31st.*—Transformers. April 28th.* Transformers and spares.

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE.*—April 3rd.—5 100 receiver diaphragms (Stalloy or similar material) (schedule 98); April 10th—686 tons bronze wire (schedule 101); 5 001 000 paper jointing sleeves (schedule 106); April 17th—595 timing clocks (schedule 97); 400 000 copper jointing sleeves (schedule 105).

POSTMASTER-GENERAL'S DEPARTMENT, ADELAIDE, April 10th.*—Telephone apparatus (stores schedule 653).

BRISBANE METROPOLITAN WATER AND SEWERAGE BOARD. June 26th.*—Three pumping units, each with a capacity of 6 million gallons for 24 hours (or two with a capacity of 9 million gallons each), with a 140 kW 440 Vd.c. electric generator.

SOUTH AFRICA.

JOHANNESBURG MUNICIPAL COUNCIL. February 14th.*—Electric cables. Owing to the limited time, this announcement will probably only be of service to firms who can cable to local agents.

SOUTH AFRICAN RAILWAYS AND HARBOURS. Administration. March 5th.*—Cables and wires and bare copper wires for the year 1923.

SWEDEN.

SUNDSVALL TRAMWAY SCHEME.*—A company has been formed at Sundsvall to construct an electric tramway from the town of Sundsvall to the suburb of Gangviken. Requirements of material will be advertised in the local press. The name and address of the person to whom inquiries may be sent can be obtained from the Department of Overseas Trade, London.

* Particulars from the Department of Overseas Trade.

Tenders Accepted.

BARKING COUNCIL have accepted the tender of the Union Cable Co. for cable for public lighting at £135 15s.

REIGATE CORPORATION have accepted the tender of the General Electric Co. for ironclad switch-gear, at £101.

The Davenport Engineering Co.'s tender (£8 698) for cooling towers has been accepted by HULL CORPORATION.

The tender of E. O. Walker and Co., for wiring houses at Acton, at £203, has been accepted by WREXHAM CORPORATION.

The tender of the Metropolitan-Vickers Electrical Co. has been accepted by ATHERTON URBAN COUNCIL for transformers.

LEWISHAM (LONDON) GUARDIANS have accepted the tender of the Medway Lift Co. for electric lifts for the hospital at £1 375.

Twelve Tilling-Stevens petrol-electric motor omnibuses were despatched from Maidstone last week for service in BARCELONA.

GLASGOW CORPORATION have accepted the tender of the Western Electric Company for an automatic telephone installation in connection with the Electricity Department, at £2 100.

The UNDERGROUND ELECTRIC RAILWAYS COMPANY OF LONDON has placed a contract with Waygood-Otis, Ltd., for three escalators for Bank Station of the Central London Railway, at £29 650.

The following tenders have been accepted by CHEADLE AND GATLEY URBAN COUNCIL:—Ferguson, Pailin Ltd., switchgear, £2 053 5s.; Hackbridge Electric Construction Co., transformers, £502.

WAYGOOD-OTIS, LTD., have secured a contract from the UNDERGROUND ELECTRIC RAILWAY COMPANY OF LONDON for four escalators for City and South London Railway stations (two at Clapham Common and two at Stockwell) at £34 865.

C. A. Parsons and Co. have secured the contract for steam turbines and three-phase alternators for the new BARKING POWER STATION of the COUNTY OF LONDON ELECTRIC SUPPLY CO. The total capacity of the new plant will be between 90 000 and 100 009 kW.

KINGSTON-ON-THAMES CORPORATION have accepted the tender of the Brush Electrical Engineering Co. (the lowest of 5 tenders received) for a 2 000 kW turbo-alternator at £13 443 12s. Including foundations and other work, the total cost of the plant extension will be £15 507 12s.

Lowdon Bros. and Co. have secured a contract for a hydro-electric installation for lighting and heating BOWHILL HOUSE, SELKIRK, for the Duke of Buccleuch, at £3 700. The firm have already carried out similar work for the Duke at Eildon Hall, Langholm Lodge and Dubton House.

SWAN HILL (VICTORIA) COUNCIL have placed with the Homewood-O'Neill Ptys., Ltd., an order for a 500 H.P. Fairbanks-Morse crude oil engine, with alternator, and switchboard, electric starter, etc., which are to be used in place of the suction gas driven plant now used in their generating station. It is expected to generate electricity at a fuel cost of 0.4d. per unit compared with 0.92d. on the present system.

ABERTILLERY URBAN COUNCIL have provisionally accepted the following tenders in connection with their electricity supply undertaking:—Ferguson, Pailin Ltd., static transformers and switchgear, £525 15s.; Johnson & Phillips, h.t. feeder, £1 295 10s. 6d., overhead system, £4 190 14s. 2d.; Hewittic Electric Co., 32 kW converter, £425 15s. 6d.; British Thomson-Houston Co., rotary converter and h.t. switchgear, £1 762.

STEPNEY (LONDON) COUNCIL have accepted the following tenders:—General Electric Co. (lowest tender) for 1 000 25A fuse boxes, £166 11s. 3d. (three tenders received; highest £208 6s. 8d); Reason Manufacturing Co. (lowest tender) £104 3s. 4d. (three tenders received, highest £121 17s. 6d); Drew-Bear, Perks and Co. (lowest tender), for chequer plating for flooring of Limehouse generating station, £261 10s. (three tenders received, highest £476).

MANCHESTER CORPORATION have accepted the following tenders:—Municipal Appliances Co., c.i. tramcar-wheels and axles; English Electric Co., oak planking; Titan Trackwork Co., special trackwork; J. V. Pyatt, electric light wiring at Cleansing Depot, Oldham Road; Sudlow and Co., electric light wiring, Mansfield Street and Seymour Road schools; W. T. Glover and Co., cable; L. E. Wilson and Co., telephone extensions; E. M. Evans and Son, dry cells.

The tender of the Consolidated Construction Company, amounting to £200 243, has been accepted for the construction of the DEARNE VALLEY (YORKSHIRE) LIGHT RAILWAY, connecting Bolton-on-Dearne, Wombwell, Wath-upon-Dearne and Thurnscoe. The English Electric Company have the contract for the rolling stock and electrical plant, and orders have been placed with the Cargo Fleet Iron Co. for rails and fishplates, Edgar Allen & Co. for special points and crossings, and Stewarts & Lloyds for the poles to carry the overhead conductors.

Electric coaling staithes capable of dealing with 400 tons an hour are to be constructed at Hebburn by the WALLSEND AND HEBBURN COAL CO.

A fire broke out at the electric sub-station of the SHEFFIELD Corporation in Ellin Street on Friday last. Damage estimated at £4 000 was done.

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Companies' Meetings, Reports, etc.

An interim dividend of 5 per cent. less tax on the ordinary shares is announced by FREDERICK BRABY AND CO.

The HONG KONG TRAMWAY CO. has declared a final dividend for 1922 of 2s. per share, less tax, equal to 40 per cent. actual.

A balance dividend of 1s. 3d. per share (making a total of 5 per cent.) is recommended by the CITY OF BUENOS AIRES TRAMWAYS CO.

A final dividend of 7s. 6d. per share, making 12 per cent. for the year, has been declared by the WESTMINSTER ELECTRIC SUPPLY CORPORATION.

The following companies were STRUCK OFF THE REGISTER OF JOINT STOCK COMPANIES on January 30th: Boardman Electrical Patents Co., Immisch Electric Launch Co.

The directors of the KENSINGTON AND KNIGHTSBRIDGE ELECTRIC LIGHTING CO. have recommended a balance dividend of 7s. per share on the ordinary shares for the half-year ended December 31st, making, with the interim dividend paid in August, 12 per cent. for the year.

The directors of the ST. JAMES' AND PALL MALL ELECTRIC LIGHT CO. recommend a final dividend on the ordinary shares of 7s. 6d. per share, making 12½ per cent. for the year, and, in addition, a bonus of 2s. per share, making the total distribution 14½ per cent., compared with 12 per cent. paid for the previous three years. This will be the first occasion on which a bonus has been paid.

The net profit of the YORKSHIRE ELECTRIC POWER CO. for 1922 amounted to £101 004 (against £74 316), whilst £23 260 was brought forward, the available balance being £124 264. The dividend on the ordinary shares is 8 per cent. (the same), of which 3 per cent. has been paid, and a sum of £25 000 (against £15 000) is placed to general reserve, leaving a balance of £26 538 to be carried forward.

The directors of the METROPOLITAN RAILWAY CO. announced that they will recommend a dividend on the ordinary stock for the past half-year at the rate of 4½ per cent. per annum, making 3½ per cent. for the year, and carrying forward about £33 000, after placing £57 000 to depreciation and renewals and £15 000 to general reserve. The dividend for the corresponding half-year in 1921 was at the rate of 3¼ per cent. per annum, making 2¼ per cent. for the year when £50 000 was placed to general renewals fund and £17 797 carried forward.

An announcement, "for public information only," is made by the LANCASHIRE ELECTRIC LIGHT AND POWER CO., to the effect that it has accepted an offer made by the Power Securities Corporation to purchase the following of its shares—namely, £75 000 six per cent. (tax free to 6s. in the £) cumulative convertible first preference at 21s. per share, £75 000 seven per cent. cumulative participating preference shares at the price of 21s. per share, and £75 000 ordinary £1 shares at par. The company has also given an option to the Corporation to purchase an additional 22 637 ordinary shares at par up to June 30th, 1923. The transaction will increase the issued share capital of the company to £979 863, against an authorised capital of £1 100 000.

New Companies.

BOSDEN RUBBER CO., LTD.—Private. Reg. January 30th. Cap. £3 000 in 5s. shares. Manufacturers of and dealers in asbestos and any materials for insulating purposes, etc. Reg. office: 12, Weber Street, Collyhurst, Manchester.

ELECTRIC WELDERS (LEEDS), LTD.—Private. Reg. Feb. 2nd. Cap., £1,000 in £1 shares. Oxy-acetylene, arc, butt, spot, ferrous, non-ferrous, copper and aluminium welders, engineers, etc. Registered office: 42, Hunslet New Road, Leeds.

JAMES FERGUSON AND MUNRO, LTD.—Private. Reg. in Edinburgh January 27th. Cap., £3 000 in £1 shares. Electrical engineers and manufacturers of switches, etc. Registered office: Stepps Engineering Works, Stepps, by Glasgow.

VALVCRYST, LTD.—Private. Reg. January 31st. Cap., £500 in £1 shares. Manufacturers of apparatus for wireless telephones and electrical fittings of all kinds, electricians, mechanical, electrical and general engineers, etc. Reg. office: 51, Hockley Hill, Birmingham.

PREMIER ELECTRICAL SUPPLIES, LTD.—Private. Reg. Feb. 2nd, Cap., £1 000 in £1 shares (500 10 per cent. cumulative preference). Manufacturers of and dealers in electric appliances. electrical engineers and contractors, etc. Registered office: 3, New Oxford Street, London, W.C.1.

W. AND M. WIRELESS CO., LTD.—Private. Reg. January 29th. Cap., £100 in £1 shares. Manufacturers of and dealers in wireless apparatus and accessories of all kinds, etc. E. Wainwright, 44, Montalt Road, Woodford Green, Essex (director of Wainwright Manufacturing Co.), is a subscriber.

ELECTRIC WINDING AND DOUBLING CO., LTD.—Private. Reg. Feb. 2nd. Cap., £15 000 in £1 shares. To adopt an agreement with F. C. Lomax, and to carry on the business of electric winders and doublers, etc. F. C. Lomax is permanent governing director. Registered office: North Dean Mill, Pendlebury.

ABERDEEN RADIO CO., LTD.—Private. Reg. in Edinburgh January 31st. Cap., £1 000 in £1 shares. Manufacturers and sellers of all kinds of apparatus and accessories for the transmission and reception of broadcast wireless messages. W. W. Inder, 41½, Union Street, Aberdeen, wireless engineer, is a subscriber.

WALKER VEHICLES, LTD.—Private. Reg. Jan. 18th. Cap. £100 000 in £1 shares (50 000 participating preference and 50 000 ordinary.) To acquire from the Walker Vehicle Co. of Chicago, U.S.A., any property or rights; to enter into arrangements with D. G. Peters and Co., Ltd., to carry on the business of electrical, mechanical, hydraulic and general engineers and contractors, manufacturers of and dealers in all classes of machinery, apparatus, vehicles, engines, aircraft, tools, appliances, etc. Reg. office: Caxton House, Westminster, London, S.W.

Institution Notes.

The annual dinner of the BIRMINGHAM AND DISTRICT ELECTRIC CLUB will be held on March 2nd.

The annual dinner of the INSTITUTE OF METALS will be held at the Trocadero Restaurant, London, W., on March 7th.

The ordinary general meeting of the RÖNTGEN SOCIETY, which was to have been held on February 6th, has been postponed till February 23rd. On that date a joint meeting will be held with the PHYSICAL SOCIETY. The subject for discussion will be "The Measurement of X-Rays."

The second anniversary meeting of the KING'S COLLEGE ENGINEERING SOCIETY will be held in the large theatre of the Institution of Electrical Engineers on February 12th at 5.30 p.m. Mr. F. Gill will occupy the chair, and Mr. C. H. Wordingham will read a paper on "The Development of the Electrical Supply Industry," dealing especially with the legislative and commercial aspects.

At a meeting of the Council of the INSTITUTION OF ELECTRICAL ENGINEERS, held on February 1st, the following resolution was passed: "That in view of the present state of trade and employment, the Council request members who place, or who advise upon the placing of, orders, to specify, as far as practicable, that the plant and material ordered shall be of British manufacture."

A meeting of electrical contractors in Croydon was held on January 31st, at the Greyhound Hotel, when officials from the central office of the ELECTRICAL CONTRACTORS' ASSOCIATION (Inc.) were present. A sub-branch of the Association was formed, comprising electrical contractors in the Croydon area. Mr. A. D. Dean was elected chairman, his son, Mr. J. A. Dean, hon. secretary. Meetings will be held on the last Wednesday in every month.

An arrangement has been made between the INSTITUTION OF ELECTRICAL ENGINEERS and the AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS for the mutual granting of facilities and privileges as visiting members to members of the two societies visiting each other's country. Members who intend to visit the United States and wish to avail themselves of this arrangement should apply to the secretary of the Institution for a letter of introduction to the American Institute, stating in what branch of the profession they are engaged and giving the name of the firm or company (if any) with which they are connected.

A general meeting of the ROYAL INSTITUTION was held on Monday, Sir James Crichton-Browne, treasurer and vice-president, in the chair. The deaths of Lord Kinnaird and the Hon. R. C. Parsons, members, and of Professor G. Lemoine and G. Lunge, honorary members, of the Institution, were reported, and resolutions of condolence with the families were passed. The special thanks of the members were returned to Dr. Ernest Clarke for his donation of £100 to the fund for the promotion of experimental research, and to Sir Humphry Rolleston for his gift of Sir Humphry Davy's honorary diplomas. Mr. and Mrs. Macnab were elected members.

Business Items.

Additions to his premises at York House, Goodmayes Road, Ilford, have been opened by Mr. F. W. RYLAND, electrical contractor.

CLEWORTH, WHEAL AND CO. are now being represented in the London area by Dektereff, Francke and Reppman, 118, Queen Victoria Street, E.C.4.

BARTLAM AND SON, of Torquay and Selby, have taken over the business of W. Hunt and Son, electricians and lighting engineers, High Street, Barnstaple.

Mr. JOHN E. FOWLER announces that in future he will carry on alone the business of Gilrain and Fowler, electric light and power engineers, 12, Grove Road, Wakefield.

The business of Champ, Kay and Co., of Warwick, has been taken over by the EAGLE ENGINEERING CO., and will form the nucleus of the electrical and wireless department of that firm.

The STANTON IRONWORKS CO. are putting three further blast furnaces into operation on March 1st, and will then be working twelve out of their seventeen furnaces. They have also acquired Mr. Israel's patent for centrifugally lining metal pipes with concrete.

As from February 1st, the name of Brook, Hirst and Co., has been changed to BROOKHIRST SWITCHGEAR, LTD. No alteration in the personnel or representation of the firm is involved, but they are now making oil immersed a.c. switchgear in addition to automatic d.c. motor starting panels.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

COLLINS, W., AND SONS, 12–14, Mill Row, Kingsland Road, E., electrical engineers. £18 14s. 4d. December 15th.

HUTCHINSON AND CO., 101, Dartmouth Road, Forest Hill, electrical engineers. £23 0s. 1d. December 18th.

McEWAN BROTHERS, Prudential Chambers, Stockton, electrical engineers. £10 6s. 7d. December 21st.

NORTHERN CLEARING HOUSE CO., Jenkinson Street, Booth Street West, All Saints, Manchester, electrical engineers. £14 10s. 8d. December 21st.

THOMAS AND EVANS, Salubrious Place, Swansea, electrical contractors. £14 16s. 6d. December 13th.

WARD ELECTRICAL CO., 1, Rosser Street, Neath, electrical engineers and contractors. £15 19s. 9d. December 14th.

Receiverships.

MAXIM ELECTRICAL CO., LTD.—J. F. Poynter, of 75A, Canonbury Road, N.1, ceased to act as receiver or manager on January 22nd, 1923.

TOFIELD AND ROBINSON, LTD., electricians and electrical contractors, etc. A. C. Ridgway, of Exchange Buildings, New Street, Birmingham, was appointed receiver on January 25th, 1923, under powers contained in certain debentures issued on July 9th, 1921

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

ANTI VIBRATION ELECTRIC LAMP CO., LTD., London, E.C. Registered January 22nd, £2 000 debentures; general charge

NEWQUAY ELECTRIC LIGHT AND POWER CO., LTD. Registered January 26th, £8 000 debentures; general charge. *£7 500. January 13th, 1922.

SCOTT INSULATED WIRE CO., LTD., London, E.C. Registered January 25th, £2 000 debentures to bank; general charge.

STANDARD ELECTRIC SIGN CO., LTD., London, W. Registered January 25th, mortgage securing £187 10s. now due and quarterly instalments of £93 15s. each, commencing April 1st, 1923, for remainder of term of five years from October 1st, 1922, unless previously determined, to Frank Mason and Co., Ltd., Maxwell House, Arundel Street, W.C.; charged on instalments payable under an agreement dated March 7th, 1922. *Nil. December 26th, 1921.

WATFORD ELECTRIC AND MANUFACTURING CO., LTD. (late THOMAS KESNOR AND CO., LTD.). Registered January 29th, £8 000 debentures; general charge (subject to mortgage for £5 000). *£5 000. November 27th, 1922.

WHITSTABLE ELECTRIC CO., LTD. Registered January 24th, £10 000 debentures (filed under section 93 (3) of the Companies (Consolidation) Act, 1908), present issue £10; general charge (subject to existing debentures). *£5 366 13s. 4d. December 23rd, 1918.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-Up Voluntarily.

E.B.C. ELECTRICAL CO., LTD. F. Rowland, F.C.A., 3, Thames House, Queen Street, E.C.4, appointed liquidator.

Bankruptcy Information.

SATTERTHWAITE, Albert (trading as GREGSON AND CO.), 22, Dutton Street, Liverpool, electrical engineer. Receiving order, February 1st. Debtor's petition.

Partnerships Dissolved.

BARROW AND CO. (Cyril Franklin BARROW, Arthur BARROW, Thomas TOMLINSON, and Albert Henry MORRIS), electrical engineers, at 6, Stanley Street, and Horrocks Fold, Bury, Lancs., and formerly at 346, Church Street, Westhoughton, so far as concerns C. F. Barrow, by mutual consent as from October 31st, 1922. Debts received and paid by A. Barrow, T. Tomlinson and A. H. Morris, who will carry on the business.

BOSWELL, P., AND CO. (Percy BOSWELL and Louis SUBTIL), electrical manufacturers and agents, 110, Ebury Street, Victoria, S.W., has been dissolved as and from January 15th, 1923. Debts received and paid by P. Boswell.

CARTER AND CO. (James Henry CARTER and Frederick CARTER), electrical and mechanical engineers, 37, Manchester Road, Nelson, in the county of Lancaster, as from January 1st, 1923, by mutual consent. Debts received and paid by F. Carter,

GARTY AND DANIEL (Julius Banquet GARTY and Reginald DANIEL), motor and electrical engineers, 16, Balham Hill, London, by mutual consent as from December 6th, 1922. Debts received or paid by J. B. Garty, who continues the business.

Bankruptcy Proceedings.

PROJECTOR PUBLICITY CO. (THE), LTD., 11, Denman Street, Piccadilly Circus, W. Meetings of creditors and shareholders in the compulsory liquidation of this company were held last week at the Board of Trade offices, 33, Carey Street, W.C. The Official Receiver reported that the company was formed in December, 1921, with a nominal capital of £500, to carry on business as merchants of all kinds of electrical fittings and devices, including electric novelties for advertising. A statement of the company's affairs showed liabilities £315 and assets valued at £181. In regard to shareholders an additional deficiency of £500 was disclosed, making a total deficiency of £634. The meetings were formally adjourned, there being no quorum present.

Forty Years Ago.

"The Electrician," February 10th, 1883.

VIENNA ELEVATED RAILWAY.—A concession has been granted by the Austrian Emperor for the construction of this long-talked-of-railway. It is said that it will be constructed by an association formed by the Messrs. Fogerty, of Middlesbrough. Electromotors are to be used on it.

THE LIGHTING OF BATH.—The Town Council of Bath have awoke to the fact that the present lighting of the streets is "discreditable." To improve it they are going to substitute 6 ft. for 4 ft. burners, and introduce large gas lamps at certain points, and for this they are going to pay £57 more per annum than at present. The town council are by no means unfavourable to electric lighting.

Books Received.

"Mechanical World" Electrical Pocket Book, 1923. (London: Emmott and Co.) Pp. 389. 1s. 6d. net.

"The Mathematical Theory of Relativity." By A. S. Eddington. (Cambridge University Press.) Pp. 247. 20s. net.

"Letters of a Radio-Engineer to His Son." By John Mills. (London: Routledge and Sons.) Pp. 265. 10s. 6d. net.

"The Practical Testing of Dynamos and Motors." By C. F. Smith. (Ninth edition.) (Manchester: Scientific Publishing Co.). Pp. 271. 7s. 6d. net.

Prices of Metals, Chemicals, etc.

TUESDAY, February 6.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£69 10 0	—	—
Electro Wirebars ..	,,	£72 10 0	—	10s.
H.C. Wire, basis ..	per lb.	10½d.	—	1/16d.
Sheet	,,	10½d.	1/16d.	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2¼d.	—	1/16d.
Brass 60/40—				
Rod, basis	,,	7d.	—	—
Sheet, basis	,,	9¾d.	¼d.	—
Wire, basis	,,	10¼d.	—	3/16d.
Pig Iron—				
Cleveland Warrants	No. 3 per ton	£5 5 0	—	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£18 10 0	10s.	—
Lead Pig—				
English	,,	£29 5 0	—	—
Foreign or Colonial	,,	£28 2 6	—	2s. 6d.
Tin—				
Ingot	,,	£183 0 0	—	£3 2 6
Wire, basis	per lb.	2s. 5¼d.	—	¼d.
Aluminium Ingots ..	per ton	£100 0 0	—	—
Spelter	,,	£35 0 0	—	£1 12 6
Mercury	per bottle	£10 10 0	—	—

Sulphur (Flowers)—Ton £9 *Sodium Chlorate*—Per lb. 2¾d.
,, (Roll-Brimstone)—,, £8 10s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.— ,, £26 per ton, £7 10s.
Boric Acid (Crystals) ,, £55 *Sodium Bichromate*.—Per lb. 4⅛d.
Rubber.—Para fine 1s. 5d.; plantation 1st latex 1s. 5⅜d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd. and the rubber prices by W. T. Henley's Telegraph Works Co.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

189 410 WESTERN ELECTRIC CO., LTD. (WESTERN ELECTRIC CO., INC.). Treatment of magnetic materials. (16/7/21.) (Divided Application on 188 688.)
188 293 BEAVER, C. J., and CLAREMONT, A. W., and CLAREMONT, L. B. (LEGAL REPRESENTATIVES OF CLAREMONT, E. A. (deceased), and GLOVER & CO., LTD., W. T.) Insulation of electric cables. (26/7/22.) (Addition to 182 510.)
189 474 A. C. BOOTH and A. S. WILLMOT. Telegraph keyboard perforators. (1/6/21.)
189 482 N. MANCINI. Device for supplying electric current. (30/6/21.)
189 483 P. R. JACKSON (SPERRY GYROSCOPE CO.). Electro-magnetic clutches. (1/7/21.)
189 484 I. SWEETLAND. Electric hand drills. (25/7/21.)
189 497 A. SELVATICO. Electric heaters. (4/8/21.)
189 500 J. JUDGE. Commutators or ignition current distributors. (23/8/21.)
189 509 W. P. THOMPSON (SPLITDORF ELECTRICAL CO.). Magnetos. (26/8/21.)
189 516 L. G. PRESTON, Dr. B. HODGSON, C. E. HORTON and G. W. HARRIS. Direction-finding apparatus for use in wireless telegraphy. (29/8/21.)
169 157 N. CARRIGO and F. C. HUGHES. Mending resistance elements. (11/9/20.)
189 541 W. THOMPSON. Electric couplings. (1/9/21.)
169 691 GES. FUR DRAHTLOSE TELEGRAPHIE and Dr. H. GEWECKE. High-frequency telegraphy and telephony. (29/9/20.)
189 573 C. W. DENNY. Switches for use with electric irons, etc. (8/9/21.) (Cognate Applications, 26125/21 and 6202/22.)
169 438 SIGNAL GES. Acoustical apparatus for telephonic communication. (27/9/20.)
189 574 J. H. RUNBAKEN and W. TORRANCE. Testing devices for ignition systems. (8/9/21.)
189 576 F. POOLEY, F. C. AUSTIN and W. L. WREFORD. Portable electrically-driven combination tools. (14/9/21.)
169 175 AKT.-GES. BROWN, BOVERI ET CIE. Protecting polyphase circuits on occurrence of earth connection. (16/9/20.)
189 577 EFANDEM CO. and J. EATON. Electric terminals. (16/9/21.)
183 789 T. A. T. RYDBERG. Electro-mechanical motion-transmitting devices for automobiles. (26/7/21.)
189 589 G. and J. OLDHAM. Galvanic batteries. (29/9/21.) (Cognate Application 17734/22.)
189 591 W. A. COATES and METROPOLITAN-VICKERS ELECTRICAL CO. Operating-mechanisms for electric switches. (29/9/21.)
189 594 ELECTRIC CONTROL, LTD., and O. ELLEFSEN. Electric control systems for lifts, haulage gear, etc.
189 604 A. WISEMAN and J. W. HARRIS. Supports for conductors. (15/10/21.)
189 617 ELECTRIC CONSTRUCTION CO. and F. W. CLOSE. Overload trip retarding device for circuit breakers or automatic switches. (21/10/21.)
171 688 MASCHINENFABRIK OERLIKON. Clamping arrangement for sheet-metal stator teeth of electrical machines. (17/11/20.)
189 641 L. F. SUMMERS. Terminal ends for electric wires and cables. (22/11/21.)
189 645 L. B. TUMER. Wireless telegraph receivers. (1/12/21.)
189 652 C. A. M. BUCKLEY. Starting motor for engines. (7/12/21.)
189 664 ELECTRIC CONSTRUCTION CO. and F. W. CLOSE. Safety vents for motor cases, etc. (15/12/21.)
189 678 G. H. BOOT. Trolley wheels. (6/1/22.)

APPLICATIONS FOR PATENTS.

January 22nd.

1 884 A. D. CONSTABLE and F. P. FLETCHER. Electric submersible pun ps.
1 901 E. D. YOUNG. Electric transmitter microphones.
1 915 E. H. ALDAM. Masts for wireless telegraphy.
1 916 S. MARCH and H. NUNNS. Electro-magnetic phonograph transmitters.
1 930 A. H. S. MACCALLUM. Electrical apparatus for high frequency circuits.
1 940 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Switches.
1 943 WESTINGHOUSE ELECTRIC AND MANUFACTURING CO. Electric amplifying apparatus. (20/1/22, U.S.)
1 955 WESTERN ELECTRIC CO. Electron discharge devices.
1 959 J. G. MAITLAND-EDWARDS and J. W. HALL. Panels or connection boards for wireless apparatus.
1 964 A. BLAKE. Vacuum tubes or valves.
1 965 R. W. REYNOLDS. Electric heater resistance elements.
1 975 A. H. W. CLEAVE. Apparatus for electrolytic deposition of metals.
1 986 AUTOMATIC TELEPHONE MFG. CO. Telephone systems. (25/5/22, U.S.)

January 23rd.

1 996 R. W. BROWN and F. C. POULTON. Wireless telegraphy, etc.
2 028 A. BOLTON. Electrolytic rectifier.
2 039 A. P. WITHERS. Electric railway signal.
2 046 G. HARRISON (LUMA WERKE A.G.). Coupling starting motors with engines.
2 047 C. S. ELLIOTT and L. BRONKHORST. Thermionic valves.
2 048 W. J. RICKETS. High frequency intervalve transformers and condensers.
2 049 and 2 050 W. J. RICKETS. Loud-speaking telephones.
2 055 J. W. BARBER. Wireless receiving apparatus.
2 057 BRITISH THOMSON-HOUSTON CO. and H. TRENCHAM. Switches.
2 058 BRITISH THOMSON-HOUSTON CO., A. P. YOUNG, and J. H. BUTCHER. Wireless receiving apparatus.
2 065 WESTERN ELECTRIC CO. Telephone systems.
2 066 W. T. HOOFNAGLE. Electric flat-irons.
2 075 O. CORADI. Electric annealing, etc., furnaces. (24/1/22, Switzerland.)
2 081 J. W. MILLER. Radiotelegraphy, etc.
2 083 E. C. R. MARKS (ROBERTS). Electric cooking stoves.
2 087 BOSTON INSULATED WIRE AND CABLE CO. Electric wires. (6/2/22, U.S.)
2 089 CENTRAL ELECTRIC TOOL CO. Systems for operating reciprocating motors. (6/3/22, U.S.)
2 092 C. & W. BOKNERT. Electric table, wall, etc., lamps. (26/1/22, Germany.)
2 093 AUTOMATIC TELEPHONE MFG. CO. Mine signalling systems, etc.

January 24th.

2 115 C. KRATT. Electro-mechanical toys, etc.
2 130 HARRIS & SHELDON and F. E. BROWN. Electric horns.
2 132 C. J. HUNTER and T. N. TATE. Earthing and short-circuiting device for switchgears.
2 141 H. H. SHILTON, C. P. MILLER and J. A. PLATTS. Variable electrostatic condensers.
2 156 W. LANGDON-DAVIES and A. SOAMES. Arc welding.
2 158 A. R. ANGUS. Devices for charging accumulators.
2 162 W. DE RENZI. Limiting pressure from explosion inside switchgear cases, etc.
2 163 MULLARD RADIO VALVE CO. and T. W. PRICE. Thermionic valves, etc.
2 175 I. CALVETE. Suspenders for electric hairwaving machines.
2 182 L. N. ANDERSON. Heating elements.
2 184 E. E. TASKER. Electrostatic transformers.
2 185 ALLMANNA SVENSKA ELEKTRICKA AKTIEBOLAGET and B. NORDFELDT. Phase and frequency converter.
2 193 ELECTRO-MECHANICAL BRAKE CO. and M. J. PATTISON. Electric controllers.
2 199 D. F. CAMPBELL. Differential heat effects produced in conductors by induced currents.
2 209 P. L. WOSTEAR. Sound amplifying device.

January 25th.

2 244 G. H. TONKS. Suspension devices for electric lamps, etc.
2 246 B. W. HURD. Electric pump and blower sets.
2 250 H. INGHAM. Induction coils.
2 255 V. A. FOOT. Electric aids for the deaf.
2 259 A. M. CHALMERS and A. MARR. Crystal detectors.
2 261 A. PAGE. Wireless receiving sets.
2 262 A. S. A. CLUNIE. Crystal detector.
2 291 PHILIPS GLOEILAMPENFABR. Gas-filled discharge tubes. (15/2/22, Holland.)
2 295 H. MANDELSTAM. Transmission of sound in wireless apparatus, etc.
2 306 G. A. MORLEY. Wireless receiving apparatus.
2 312 E. Y. ROBINSON. Insulation of fluid-cooled parts of electrical devices.
2 313 E. Y. ROBINSON. Vacuum tubes.
2 314 METROPOLITAN-VICKERS ELECTRICAL CO. Insulators. (1/4/22, U.S.)
2 322 J. BETHENOD. Electric transmission of signals. (2/2/22, France.)
2 345 R. K. SPENCER. Wireless receivers.

January 26th.

2 350 E. H. GODDARD. Mechanical device for sensitive tuning of wireless telephone instruments.
2 382 H. J. OSBORN. Manufacture of tungsten wire.
2 396 A. C. SMITH. Switches.
2 408 C. SMITH. Transmission of code signals for fire alarms, etc.
2 420 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Automatic reclosing circuit breaker system.
2 426 SILUMINITE INSULATOR CO. and F. V. WYTHES. Method of treatment of paper for insulator.
2 432 J. T. PRESTIGE and W. J. THOMPSON. Secondary battery plates or electrodes.
2 433 T. LENAGHAN. Printing telegraph systems.
2 457 DUBILIER CONDENSER CO. (1920) and P. R. COURSEY. Resistances.
2 464 W. STRANGE. Portable electric lamps.
2 471 K. A. B. GILFILLAN. Switchgear or cut-outs.

January 27th.

2 480 C. W. COX. Fuses and fuse boxes.
2 490 J. R. STEPHENS. Magneto couplings.
2 498 W. WILSON, C. C. GARRARD and A. H. RAILING. Starting and speed control of motors.
2 503 H. A. STEVENSON. Wireless apparatus.
2 537 METROPOLITAN-VICKERS ELECTRICAL CO. Electron tubes. (1/4/22, U.S.)
2 541 H. HUNT. Electric heaters for cooking.
2 547 METALLBANK U. METALLURGISCHE GES. AKT. GES. Increasing conductivity of alloys. (27/1/22, Germany.)
2 566 W. DUBILIER. Variable electrostatic condensers.
2 571 J. BETHENOD. Electric transmission of signals. (4/10/22, France.)

Arrangements for the Week.

FRIDAY, FEBRUARY 9th (To-day).

PHYSICAL SOCIETY OF LONDON.

5 *p.m.* At the Imperial College of Science, South Kensington, London.
1. Annual General Meeting.
2. Paper on "The Eotvos Torsion Balance," by Captain H. Shaw and Mr. E. Lancaster-Jones.
3. Demonstration of the Flame-phone, by Mr. H. W. Heath.

JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At 39, Victoria Street, Westminster, S.W.1. Lecture on "The Effect of Temperature on the Properties of Engineering Materials," by Prof. F. O. Lea.

EDINBURGH ELECTRICAL SOCIETY.

8 *p.m.* At the Philosophical Institute, 4, Queen Street, Edinburgh. Lecture on "Some of the Less Obvious Uses of Electricity," by Mr. W. F. Martin.

SATURDAY, FEBRUARY 10th.

BIRMINGHAM AND DISTRICT ELECTRIC CLUB.

7 *p.m.* At the Grand Hotel, Colmore Row, Birmingham. Paper on "Advertising and Salesmanship in relation to the Electrical Industry," by Mr. J. W. Beauchamp.

TUESDAY, FEBRUARY 13th.

JUNIOR INSTITUTION OF ENGINEERS. (NORTH-EASTERN SECTION).

7.15 *p.m.* At Armstrong College, Newcastle-on-Tyne. Paper entitled "Notes on Shop Management," by Mr. L. C. Edmondson.

INSTITUTION OF ELECTRICAL ENGINEERS. (SCOTTISH CENTRE).

7.30 *p.m.* At The Rooms, 207, Bath Street, Glasgow. Fourth Ordinary Meeting.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.

7.30 *p.m.* At the Rankine Hall, Glasgow. Ordinary General Meeting.

INSTITUTE OF INDUSTRIAL ADMINISTRATION.

8 *p.m.* At the London School of Economics. Lecture entitled "Practical Hints on Buying and Selling," by Mr. Frank Mott.

WEDNESDAY, FEBRUARY 14th.

INSTITUTION OF RAILWAY SIGNAL ENGINEERS.

3 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Annual General Meeting.

INDUSTRIAL LEAGUE AND COUNCIL.

7.30 *p.m.* At Caxton Hall, Caxton Street, London, S.W.1. Lecture entitled "Home and International Labour," by Sir Lynden Macassey.

ASSOCIATION OF ENGINEERS-IN-CHARGE.

8 *p.m.* At St. Bride's Institute, Bride Lane, Fleet Street, London. Paper on "Hydraulic and Electric Lifts," by Mr. C. H. J. Day.

THURSDAY, FEBRUARY 15th.

INSTITUTION OF ELECTRICAL ENGINEERS.

6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London. Paper on "Some Problems in High-Speed Alternators and their Solution," by by Mr. J. Rosen.

CHELMSFORD ENGINEERING SOCIETY.

7 *p.m.* At the East Anglian Institute of Agriculture, Chelmsford. Lecture on "Modern Hoisting Practice," by Mr. C. H. Woodfield.

BELFAST ASSOCIATION OF ENGINEERS.

7.30 *p.m.* At the Municipal College of Technology, Belfast. Lecture on "Railway Locomotives," by Mr. E. M'Master.

FRIDAY, FEBRUARY 16th

INSTITUTION OF ELECTRICAL ENGINEERS. (SOUTH MIDLAND CENTRE). (STUDENTS' SECTION).

Lecture entitled "Protection . . ." by Mr. F. R. Coombes.

INSTITUTION OF MECHANICAL ENGINEERS.

6 *p.m.* At the Institution, Storey's Gate, London, S.W.1. Annual General Meeting.

BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION.

7.30 *p.m.* At Caxton Hall, Caxton Street, London, S.W.1. Salesmanship Conferences. Lecture on "Electric Power in the Home—Motor-Driven Appliances," by Mr. L. J. E. Genner.

JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette entitled "Notes on Some Insulating Materials," by Mr. T. L. Allison.

INSTITUTION OF ELECTRICAL ENGINEERS. (SCOTTISH CENTRE). (STUDENTS' SECTION).

7.30 *p.m.* In Room 149, Royal Technical College, Glasgow. Lecture entitled "Light and Illumination," by Mr. G. Lennie.

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THE ELECTRICIAN

ESTABLISHED 1861.

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CONTENTS.

Notes of the Week	157	Mr. W. T. Kerr Sentenced	175
Supply and Finance	159	Plant for Removing Tramway Standards	176
The Maintenance and Test of D.C. Electric Track Circuit Relays. By R. C. Woods. Illustrated	160	Mangnall-Irving Thrust Bore	176
The New I.E.E. Centre	161	Unemployment Insurance by Industries	176
An Air Cooler of Wide Application. Illustrated	161	Lectures by Prof. Miles Walker	176
The Bavarian Power Scheme. By A. Menge. Illustrated	162	Institution Notes	176
The Supply of Steady Direct Current for Telephone Purposes	166	Legal Intelligence	177
The London District Constituted	167	New Metropolitan-Vickers Showrooms	177
Electrical Resistance Furnaces	168	Personal Items	177
Railless Traction at Birmingham. Illustrated	169	Imperial Notes	178
Electrical Winders at the Hilton Collieries. Illustrated	170	Foreign Notes	178
Reviews	171	Business Items	178
Correspondence	171	Electricity Supply	179
Merchandise to Sell and Profit By. Illustrated	172	Companies' Meetings, Reports, etc.	180
Price Lists, Catalogues, etc.	173	New Companies	180
British Industries Fair	174	Tenders Invited and Accepted	180
Faraday House Scholarships	174	Electric Traction	181
Death of Professor Röntgen	174	Wireless News	181
A Large Power Station	174	Commercial Intelligence	182
"The Blue Book" Ready Next Week	174	Forty Years Ago	183
Post Office Engineers' Dinner	175	Prices of Metals, Chemicals, etc.	183
Electrical Imports and Exports	175	Patent Record	184
		Arrangements for the Week	184

Notes of the Week.

The London Scheme.

THE Commissioners are of opinion that the lion and the lamb will not lie down together, unless they are confined in separate cages. The scheme for London and Home Counties, with which we deal in full elsewhere in this issue, therefore provides, in addition to a Joint Authority of twenty seven members and an independent chairman, for a Local Authority Committee and a Company Committee. To these bodies will be delegated pretty wide powers of management and operation, though to deal with finance will be the duty of the main body alone. There is also to be a Technical Committee, representative of all shades of opinion, whose duties are mainly advisory and a Finance Committee whose duties require no elucidation. Lastly, the North Metropolitan Electric Power Supply Co. and the Metropolitan Electric Supply Co. are invested with the responsibility of putting forward schemes in their outlying areas, this being a compromise on the original suggestion that they should be outside the scheme altogether. In fact, the word compromise, with all its implications, might be applied to the scheme generally were it not that it will, at least, enable a start to be made and in time we hope, with the Commissioners, will lead to a greater measure of co-ordination.

New Terms of Purchase.

THE terms for the transfer or lease of the existing generating stations and transmission lines contain an attempt to settle two much debated problems. In the case of municipal undertakings leased to the authority the rental will be based on the capital charges already payable. In the case of transfer no standard basis is laid down. Instead of the company undertakings being acquired on tramway terms the purchase price will be assessed on the capital actually expended, less an amount of depreciation calculated at Inland Revenue rates. Where the undertakings are leased the rent will be at the rate of 6 per cent. per annum on the capital expended less depreciation at Inland Revenue rates. Inland Revenue rates are defined to be 3 per cent. on the written down value of cables and 5 per cent. on the written down value of plant. It is doubtful whether these terms will be much of an encouragement to sell. Tramway terms with all their theoretical disadvantages are at present favourable to sellers and would actually be better both for purchase price and rent than those suggested.

The Guillotine Postponed for Forty Years.

THE powers of purchase of the London County Council and the other municipal bodies are to be transferred to the Joint Authority but are to be suspended for forty years from August 1931 in the case of those companies which come into the scheme, and as a set-off to this the dividends payable by these companies are to be "regulated" in a way, we suppose, similar to that already in force by the gas companies, though the details have not yet been agreed. The position with regard to the companies is therefore that they are permitted to form a body, under the protection of the Joint Authority, to look after their interests, that the operation of the guillotine is postponed and that their dividends will be subject to regulation. It corresponds closely with the provisions of the London Electricity Joint Committee's Bill, upon which we commented last week, and is open to the same objections. It is better than the Bill in this one particular that its operation may only be temporary and we hope it is not too late for the companies to sink their individualities in a scheme which would provide for London as a whole.

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The Technical Scheme.

OF the technical scheme little need be said. The Limehouse station of the Stepney Corporation will become a secondary capital station in the municipal group, as will the Bankside and Deptford stations in the company group. Certain other stations in each group are scheduled for limited extension, and certain others for use without further extension. A number of stations are to be utilised only until other supplies are available. These groups are detailed in full elsewhere. In order to allow effective use of the generating stations employed a large scheme of interconnection is proposed, and here it is interesting to notice that certain municipal areas will be supplied by companies and *vice versa*. We hope this arrangement will be greatly extended. The scheme as a whole will be the subject of a further inquiry in London on March 12th, when certain outstanding questions which now appear within square brackets in the printed document will be finally decided. We hope at least that sufficient agreement will be reached to enable the obstacles which prevent a forward movement to be displaced. Meanwhile the Commissioners are to be congratulated on having done the best possible under trying circumstances.

Advance Railless Traction.

IN a Paper which he read recently before the Institution of Automobile Engineers, Mr. C. W. J. TAFFS, though he tried to be judicial, made out a very good case for the trolley bus compared with the orthodox tramcar and the motor bus. Its capital cost, he showed, was considerably less than either, and its running charges would be 12d. per car mile, compared with 11·6d. for the tram and 16d. for the motor bus. The economic fare charged would be less than either, and the total working expenses would be 16·92d. per car mile for the tramway, 20·17d. for the motor bus and 13·17d. for the trolley bus. As might be expected, these figures were not allowed to pass without challenge in the discussion, but they are already to some extent borne out by experience with railless traction at Birmingham, and time will shortly either confirm or contradict them. Like most compromises, railless traction has had to withstand the antagonism of the whole-hearted supporters of both the tram and the bus. It has been accused of possessing all the disadvantages of both, and few of their advantages. And, for the reason that it has been little used except in outlying districts, these arguments have been hard to answer. Birmingham will give a chance to do this.

The Birmingham Equipment.

THE first interesting thing about the Birmingham installation is that on economic grounds it replaces a tramway. It was found it would be cheaper to employ it than to relay the track. A certain amount of carrying capacity is sacrificed, but the large reduction in capital expenditure is made possible and the lower running costs, if Mr. TAFFS is to be believed, will also act advantageously. The second interesting thing is that the cars are double decked, the top deck is covered in, and they carry 51 passengers, thus comparing favourably with a small tramcar. Lastly, electrically speaking, they are all that can be desired and should perform their work well and economically. They cause little interference with other traffic, and thread their way in and out of other vehicles as easily as the motor bus. A great advance with this system of traction has been made, which presages well for its future. Mr. C. A. BAKER is to be congratulated on his enterprise.

The Ethics of Trading Abroad.

THE representations to Government officials by the Federation of British Industries and the British Empire Producers' Association on the subject of municipal contracts being given to foreign firms has been quickly followed by resolutions by the Institution of Electrical Engineers, the London County Council and the St. Marylebone Council on the same subject. The last two bodies have the matter in their own hands, and what British manufacturers require from them is appropriate action rather than pious resolutions. The Institution's resolution goes a step further than any of the others. It requests members to place all their orders with British firms and to specify only material of British manufacture. On the other hand, we have Mr. WUTHRICH protesting that Great Britain's position as an exporting country is best secured by assisting Swiss industries and thereby enabling Swiss manufacturers to place orders with British manufacturers and producers. This seems almost too paradoxical to be true, especially as Swiss manufacturers may not reciprocate.

Municipal and Private Trading Distinguished.

WE should like, especially at the present time, to see orders for goods in this country given exclusively to British firms. But it is unlikely that this ideal will ever be reached, and it might not be to the entire good of the community if it were. The case of the private buyer is simple. He purchases in the market where he can obtain what he wants at the cheapest rate. It is hard to blame him, and vociferous as he often is about the shortcomings of others, he would be a little surprised if his actions in this matter were called in question. The health of his business is all he cares about and he acts accordingly. With a municipality or public body the case is different. The balance-sheet is not the sole factor. Politics come into the question, and to make the matter quite clear cut it would be better that purchases should be restricted to British firms. On the general question there is no doubt that our own industry should be given the utmost support. Once before we have let key industries go, and we should by this time have learnt a lesson from which great profit can be derived.

Standardisation and the "All-Electric" Idea.

WE may perhaps be forgiven for pointing out that two of the principal objects of our "All-Electric" House Competition is to ensure that houses now being built are adequately provided with outlets so that electrical apparatus of various kinds can be used as easily, and that the necessary installation shall be effected as economically, as possible. If this is to be done it is obvious that at least the plugs and sockets used must be interchangeable so that those great advantages of electricity—flexibility and portability—may be obtained. As is well known, the British Engineering Standards Association have a specification for two-pin wall plugs and sockets, and by using plugs and connectors to standard dimensions we shall gradually overcome the chaos which exists to-day besides reducing the cost of the fittings and facilitating the use of electrical apparatus. Unfortunately, the B.E.S.A. plug in its entirety is at present expensive. We gave some hints a week or two ago as to how this cost might be reduced. But, whether it is reduced or not, there is no reason why plugs with the B.E.S.A dimensions should not be used and all those thirty different patterns and sizes now said to be available consigned to limbo. We are glad to see the British Electrical Development Association taking the matter up. It means a lot to them.

The Empire Exhibition and the Electrical Industry.

WITH the adoption of Sir WILLIAM JOYNSON HICKS' report by the Executive Committee it is to be hoped that the lassitude which has hung about the doings of those responsible for the British Empire Exhibition will be dispelled, and that every effort to achieve success will be made before it is too late. That the whole exhibition should be a success is for obvious reasons important, but, from our point of view, it is of greater importance that the engineering section, and especially the electrical sub-

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section, should be representative of all that is best in British industry, and should attract to the various stands those connected with the industries of other countries. Unfortunately, there seems a disinclination on the part of certain electrical firms to take space either individually or in combination, with the result that though the heavy side of the industry will be well represented there may be a gap at the place where contact with the public ought to be made. It is not too late to remedy this, and remedied it should be without delay. The B.E.A.M.A. has done good work so far, and their efforts should receive assistance from the whole industry.

Rontgen's Work for Humanity.

WITH the death of Prof. William von Röntgen the world loses a man whose discoveries have alleviated the sufferings of humanity, have increased our knowledge of the properties of materials, and have formed the foundation of much research, whose practical application is yet to be found. His discovery of the X-rays was world famous, and of world-wide effect; the rest of his life was devoted to the study of purely physical problems, about which the general public knew and cared little. But the effect of his discovery on modern surgery and medicine is, in its way, likely to be as profound as that of LISTER, PASTEUR, or JENNER. It has enabled, in the case of tuberculosis especially, early detection of disease to be effected, and tendencies to be eradicated before they become too deep seated. In engineering the use of the X-rays in the testing and examination of materials is familiar to all readers of THE ELECTRICIAN. As a starting point for researches into emanations of the higher order his discovery is of the very greatest importance. It may with truth be said that few, if any, recent scientific discoveries have had so profound and so far reaching effect on civilisation.

Supply and Finance.

Electricity has become such a vital factor in industry that the success or failure of the various supply undertakings acts as an accurate barometer of the state of trade. When we say failure, we speak in comparative terms. For deficits, though not unknown, are rare in supply undertakings, and we must therefore take as our criterion the rate of progress that one year exhibits over those preceding. An examination of the accounts of the various municipal electricity supply undertakings for the year ended March 31st, 1922, which have been coming to hand during the past few weeks, indicates two things—the state of "slump" that existed in industry generally during that period and that careful management, even though it is sometimes a little conservative, has enabled most of the concerns to weather the storm. This examination indicates too that manufacturers see in the electric drive a solution of some of their problems and that progress will depend on one rather important item of policy.

Some Figures from Bradford.

We may illustrate these statements by referring to results that were obtained at Bradford. Bradford, it is hardly necessary to say, is the centre of the woollen industry which, during the period under review, was in a depressed condition. This, combined with the coal strike, caused the total kilowatt hours sold to fall to 53 297 419, a reduction of 2 386 099 over the previous year. But though this is the net decrease, it is satisfactory to find that there were satisfactory increases in the kilowatt hours sold to domestic consumers, and that the total income, £444 013, was the highest in the history of the department. The number of consumers was 9 295, an increase of 1 585. The coal costs amounted to 0·52d. per kWh sold, the total working costs to 1·29d., and the average price obtained was 1·87d. There was a surplus on the year's working of £8 317.

High and Low Coal Costs.

In Edinburgh, on the other hand, the number of kilowatt hours sold increased from 10 687 219 to 12 138 604, the average price obtained being 2·5d., with coal costs at 1·05d. on an output of nearly 30 million kWh, and the total working costs stood at 1·91d. The surplus on the year's working was £30 000, and the reserve fund stands at no less than £117 000. At Beckenham, a small undertaking, where the load is mainly of a domestic character, a deficit of £3 156 in the previous year was turned into a balance of £5 739, mainly, we should think, owing to a decrease in the expenses. In this area the number of consumers increased by 317, making a total of 2 744 connected at the end of the period. The chief saving was on coal, the costs for which stand at the satisfactorily low figure of 0·94d. per kWh on an output of 1 511 563 kWh, yet the total working costs are 3·32d., repairs and maintenance and management charges bringing the figures up. The reduction in coal costs is explained by the installation of new plant, and even better results are expected during the present year.

The Low Water Mark of Costs.

It is claimed that the low water mark of costs is obtained at Darlington, and an examination of the figures for 1921–22 shows that there is a good deal in the claim. Though the output was the comparatively small figure of 10 000 000 kWh, or 2 000 000 less than the year before, and the total income fell from £65 000 to £61 323, a surplus of £4 925 was obtained on the year's working, and, most important of all, the price of electricity was reduced to pre-war figures. To be exact, and it is worth while in this case, the average price obtained for private supply was 1·47d., for public lighting 1·85d., and, including traction, an average price for total supply of 1·43d was recorded. This excellent result is eclipsed, but is only made possible, by the working results. Coal costs amounted to only 0·38d. per kWh, and the total working costs were 0·89d. The kilowatt hours sold per head of population were 144·7, which is considerably above the average, and we don't much wonder.

Two Important Deductions.

We could multiply these instances with others nearly as good, and with others a good deal worse, but we do not propose to do so, for the evidence that we have put forward enables us to draw two important deductions which should be acted upon by everyone. At Darlington, taking the best example, it will be noticed that both the coal costs and the surplus are low. Every municipal undertaking must finish up its year's working with a balance on the right side, but that balance should be as low as possible; and must not be artificially increased by neglecting the reserve fund. For a municipal concern to have a large "profit," and to contribute from that profit to the relief of the rates, is bad finance. Sometimes ratepayers demand this relief, and, as at Swansea, are quite rightly told that they cannot have both cheap electricity and rate relief. Sometimes they get this relief, and then the cry arises, as at Bristol, that the charges are too high. It is axiomatic that one of the greatest obstacles to electrical development is the fear of the cost. That fear is largely chimerical, but there is some truth in it. It is the duty of supply engineers to make it entirely chimerical.

Attention to Coal Costs.

One way in which they can do this is by attention to their coal costs. The examples we have given indicate the large and almost inexplicable discrepancies in this figure. Why Darlington should generate 10 million kWh at a cost of 0·38d. per kWh and Edinburgh 30 million kWh at 1·05d. per kWh certainly requires examination. It is essential that much effort must be given to the selling end of electricity supply, but to fail to give closer and closer attention to what goes on in the boiler house would be like trying to fill a barrel with a colander.

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The Maintenance and Test of D.C. Electric Track Circuit Relays.

By R. C. WOODS.

THE maintenance of a high standard of efficiency in railway signalling is of considerable importance, and this is true especially of that vital part of the electric track circuit, the relay. On its correct functioning the safety of the system depends, and as little apparatus having moving parts is wear or climate-proof, it requires cleaning, overhaul and readjustment periodically. Where, as is mainly the case, the track circuits on a system number

RELAY Nº.....		RESIST.	TYPE	SUPPLIER–	
TESTED	BY	ISSUED	TRACK	BY	WITHDRAWN
OVERHAULED	BY	ISSUED	TRACK	BY	WITHDRAWN

FIG. 1.

hundreds, if not thousands, some system of working is necessary, both as regards handling and recording.

It is generally accepted that the average track relay can be relied upon to function without the necessity for attention for a period of at least two years. Occasionally the routine test of the track shows that the adjustment is not quite satisfactory before this time has elapsed, but such cases are rare, and call for individual attention. If, then, the relays are exchanged once in two years, it would appear that a fair margin of safety is allowed.

The Advantages of the Card System.

For record purposes the card system has undeniable advantages, being simple, direct, cheap and more easily

TRACK Nº.....	SECTION	LOCALITY–
RELAY	ISSUED	REMARKS

FIG. 2.

understood than booking methods. For the relay a card such as Fig. 1 would supply all the necessary information as to its life. The "withdrawn" and "overhauled" columns afford a check on the idle periods. The back of the card may be used for recording faults, if any. The track card, Fig. 2, provides a record of the life of relays on the track, a recurrence of any circumstance peculiar to the track being immediately indicated. If desired, coloured ink may be used to call attention, on either set of cards, to a change due to failure.

As the periodic changing of relays falls naturally into divisions of locality, a series of cards bearing the name of the locality and the numbers of the tracks should be made, new cards being added as new track circuits are installed. Dates of change only need be recorded, keeping the cards in date order and transferring each card to the back of the set as the relays for that locality are changed. Thus the front card always gives the relays next for attention, and should the order of change be altered, it will only be necessary to find the appropriate card and transfer to the back, or destroy existing cards and make new ones where a change is made in a locality. No record should be kept on these cards, which are comparatively few and only indicators of the sequence of work due. The record cards are for notes and information. It is advisable, as far as reasonably possible, to have both cleaning and readjustment done by the same individual throughout, thus ensuring better attention to detail and localising responsibility.

Relay Maintenance Details.

On withdrawal the relays should be stripped, those parts which are not strictly interchangeable being placed in suitable containers. Nuts, washers, pins, terminals, etc., which have been exposed to the air are best cleaned by dipping, stringing on copper wire of about 20 S.W.G. in convenient quantities, boiling in strong soda solution, and scouring with pumice, or preferably using one of the proprietary cleaners used by electro-platers, washing, and

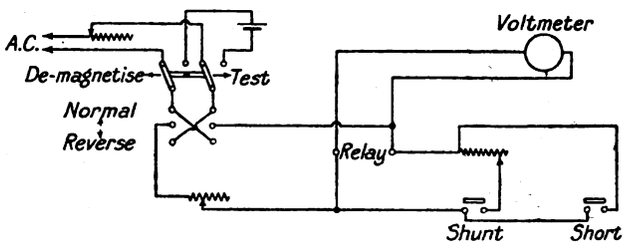

FIG. 3.

cleaning in a commercial dip solution. If it is preferred to make the dipping acid, the following method will give good results. Transfer to preliminary bath

	Lb. wt.
Nitric Acid 36° Bé	200
Common Salt	1
Lampblack	2

Allow to remain till clean, wash in running water, dip in hot water, shake dry and dip in bright dip.

	Lb. wt.
Nitric Acid 40° Bé	75
Sulphuric Acid 66° Bé	100
Common Salt	1

When mixing pour sulphuric slowly into nitric acid. An excess of salt will reduce the activity of the bath. To obtain a pure, lustrous finish avoid the introduction of water—hence the hot bath previous to dip. Wash well and dry in sawdust after a hot-water bath.

Attention to Contacts Necessary.

A wire brush will serve to clean contact screw-stems and other parts which it is not advisable to dip. Carbon contacts may be resurfaced with a flat file or a grinding disc; the latter gives a better surface but is not so convenient for levelling a row of contacts. Any contacts which show signs of "digging" should be replaced, not resurfaced, and the striking angle of the platinum contacts should be given attention on the relay concerned. Crocus paper is satisfactory for resurfacing and cleaning platinum contacts. All iron parts should be cleaned, vaselined, and wiped dry. A sufficient quantity of spare parts,

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insulators, etc., should be kept, and any components not quite to standard should be replaced.

Pivot holes may conveniently be cleaned by means of thin splinters of pine or similar soft wood. It is preferable, from a maintenance point of view, to have relays in which the armature pivots are harder than the screw material, even where the screws carry the pivot-holes, as it is simple and economical to replace a worn pair of screws. No oil should be permitted on pivots. Assembly and mechanical adjustment should be done to gauge as if a new relay were being made. If it is worth while paying attention to contact clearances, armature air gap and side play, it is worth while using a gauge.

Testing Arrangements.

For testing it is convenient to have a small board incorporating the necessary instruments, switches, etc., and providing a rigid stand of such a height that the relay contacts are brought to the eye-level of the operator. The stand should have fitted a white background. The circuit, Fig. 3, is permanently wired, the series resistance mounted to the left, the shunt resistance, shunt switch and short circuiting switch to the right, so arranged as to be easily operated by hand without stretching or taking up a strained position. The voltmeter is mounted at eye-level near the relay stand. Resistances of the tubular, slide type are robust, cheap and obtainable in any range. Connections are made to the relay by short flexible leads from the "Relay" terminals on the board.

After an insulation test with a 100 V Megger, operations are commenced by connecting to a convenient low-frequency supply and demagnetising by means of the slide rheostat, taking the current from one in excess of the maximum working condition to a negligible value. The two-way switch is then moved to the cell contacts with the reversing switch in *normal* position, and the voltage across the relay is set by the series resistance. The relay is then adjusted, using the shunt resistance and the two switches.

The adjustment completed, the reverse switch is thrown to *reverse*, and the adjustment figures checked. This forms some indication of the quality of the iron. Return the key to *normal* and either demagnetise or preferably transfer the relay to a circuit giving it normal voltage for twenty-four hours, then re-test, and, if necessary, readjust slightly. The relay is then ready, and its armature should be clamped and the seal affixed. If the clamp is used so as to take the stress off the contacts, the relay can be carried to the track and connected direct into the circuit without any need to re-open and expose the moving parts to the atmosphere.

The New I.E.E. Centre.

Liverpool Officers to be Appointed on Monday.

As announced by the President at the annual dinner, the Council of the INSTITUTION OF ELECTRICAL ENGINEERS have granted the petition of the corporate members of the Liverpool sub-centre to create a Centre, with headquarters in Liverpool. The North-Western Centre committee supported the Liverpool members in their application to the Council.

The sub-centre was instituted in 1919 with Dr. E. W. Marchant as chairman. The membership was then 220, and is now 467. The area of the Centre is defined as follows:—"That bounded by straight lines between the following towns, and inclusive of the towns mentioned—Southport, Wigan, Warrington, and in the direction of Wrexham, up to the county boundary, also the following counties: Flint, Denbigh, Merioneth, Montgomery, Carnarvon and the Island of Anglesey."

A meeting of corporate members and associates is convened for February 19th at 6.45 p.m., at the Laboratories of Applied Electricity, Liverpool University, to appoint officers and a committee for the new Centre. Under the very active chairmanship of Mr. B. WELBOURN, the sub-centre committee this session have been co-operating with the North-Western committee in making arrangements for the summer meeting of the Institution to Manchester, Liverpool and North Wales, and the continuance of this support has been promised to the North-Western centre.

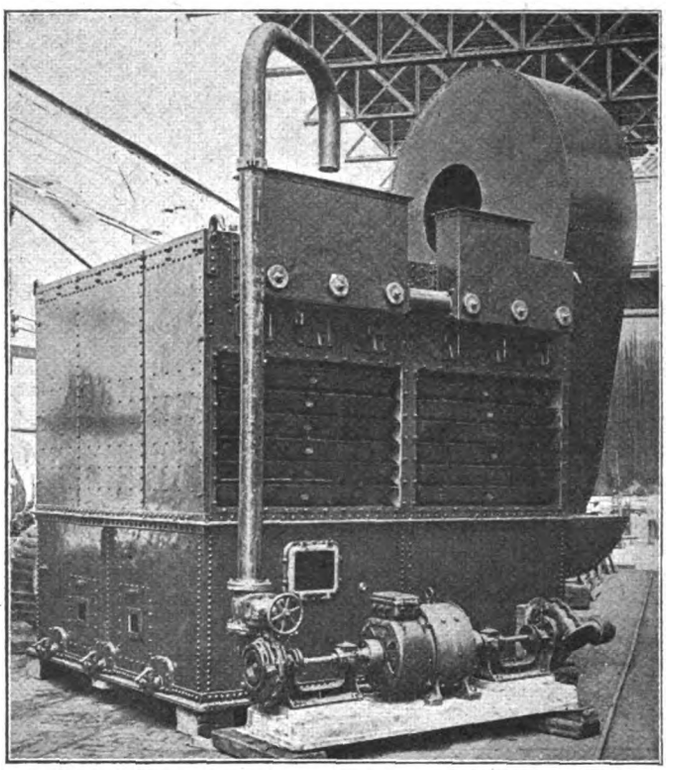
We regret that the article on "The Problem of Effective Heights of Aerials," which appeared on p. 134 of our last issue, was wrongly ascribed to Mr. P. P. Eckersley. The author was Mr. T. L. Eckersley.

An Air Cooler of Wide Application.

A subject cognate to that of the filtration of the air that is used for cooling turbo-alternators is that of cooling air for ventilation purposes in hotels, theatres, cinemas and other large buildings. Connected with these, again, are the problems of cooling the circulating water in internal combustion engines, condensers and air compressors, of the humidification of air in textile factories, of the dehumidification of air in ammunition factories, of the purification of air and of the cooling of oil. HEENAN AND FROUDE'S air filters are well known in the electrical industry. We expect that the same description will soon be applicable to the air cooler of which we give some details below. It can be used for all the purposes we have just mentioned.

The cooler, which is made in a number of sizes, is of the stationary type. The outer casing is rectangular and is built up of stout mild steel plates, stiffened where necessary with angles. The base of this casing forms a tank into which the cooled liquid drains, previous to re-circulation.

The cooling effect is obtained by evenly distributing the heated liquid over a number of screens set up one above the other in the body of the cooler. The liquid to be cooled after passing through a strainer enters at the top of the cooler and falls on to the screens, coming into contact with a current of cold air which is forced upward through the screens by means of a centrifugal fan, the discharge from which is introduced to the underside of the lowest screen. The screens are formed of metallic wool of standard size and thickness and are held together between wire netting, the frames being formed of angle steel.



LARGE V COOLER (SIZE 612) SUPPLIED TO HARLAND AND WOLFF, CLYDE FOUNDRY, GLASGOW.

The fan runner is keyed to a shaft which passes through the upper part of the cooler, a pulley being mounted on the opposite end of the shaft. The fan and casing form an integral part of the cooler. The circulation is maintained by a small centrifugal pump mounted alongside the cooler. Where the cooler works in a system from which water is drained before being delivered to the cooler a level regulator of the ordinary ball type is fitted.

The metallic wool screens are quite accessible and easily removed for cleaning or inspection purposes, but experience shows that this is seldom necessary. In the upper part of the cooler casing is fixed a number of eliminators, consisting of steel blades, suitably curved. These are designed to arrest the diffusion of loose particles created by the discharge of the heated air from the top of the cooler.

One of the advantages of the cooler is the small space it occupies, and it can equally well be used in as out of doors.

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Power Supply in Bavaria.*

Precautions to Ensure Supply—Transmission Line Details—The Use of Hydro-Electric Power.

By A. MENGE.

The Bavarian power scheme is intended to supply the whole of Bavaria with electrical energy as cheaply as possible. For this purpose a 110 kV network is being built to enable (1) large water powers to be utilised; (2) the interlinking of existing and new stations; (3) the exchange of energy with neighbouring countries according to the conditions of supply and demand.

The scheme originated with Dr. Oscar von Miller, who was commissioned by the Bavarian Government in 1918–19 to carry out his projects. In July, 1921, the work was taken over by the Bayernwerk Aktiengesellschaft. The work under construction is shown in Fig. 1.

The 110 kV Network.

The transformer stations, Munich, Meitingen, Nuremberg, Amberg, Regensburg and Landshut are connected by a ring main to ensure uninterrupted service and to provide for developments. From this ring main, lines are taken to Mainaschaff and Hof.

By the autumn of 1923, the Walchensee Works should be in a position to supply 100 million kWh annually, with a peak load of 50 000 kW at cos $\varphi = 0{\cdot}8$. By February, 1924, the Middle Isar stations should be supplying 200 million kWh annually, with a peak load of 45 000 kW. The river stations are interconnected by a 60 kV line. The total length of the 110 kV lines will be about 950 km., of which 855 km. will be double. The work will be carried out by five German electrical firms, which combined their interests for this purpose.

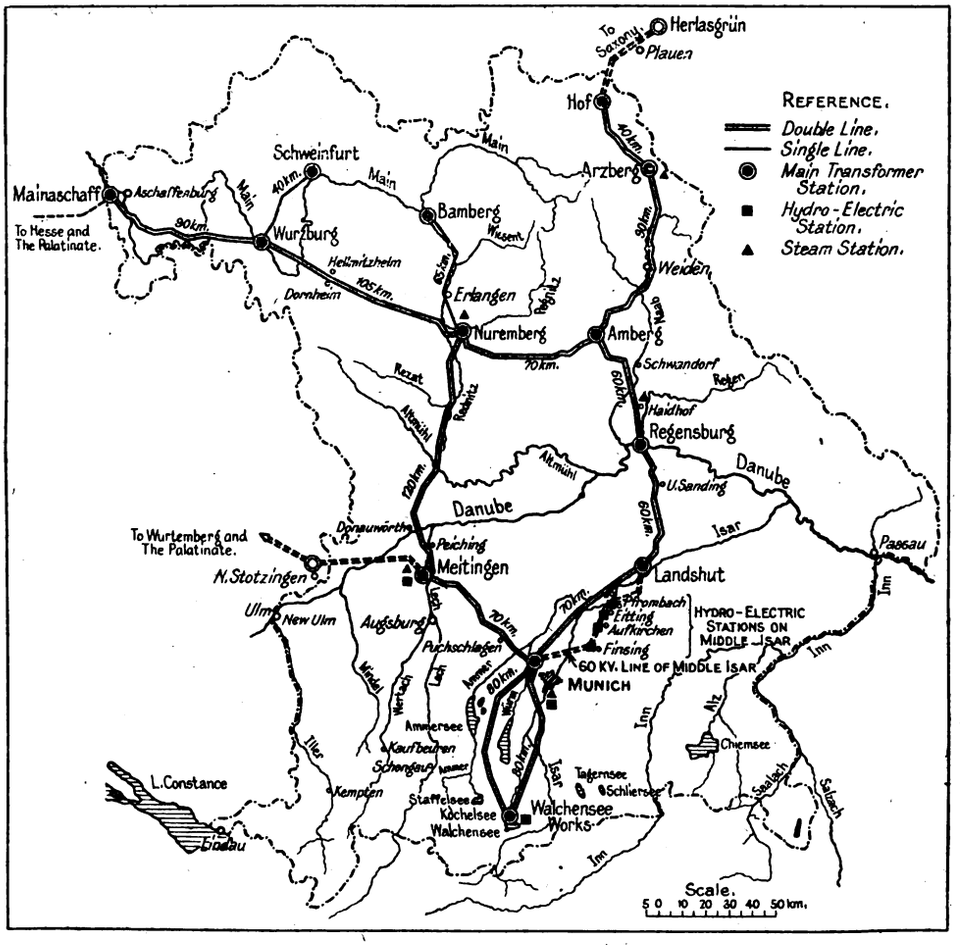

FIG. 1.—100 kV NETWORK OF THE BAVARIAN POWER SCHEME.

Some details of the standard poles are shown in Figs. 2 and 3, while the arrangements for crossing the lines are shown in Fig. 4. The poles are normally 250 m. apart. Isolating switch poles are erected every 30 to 35 km. for use in case of locating faults. To meet load requirements, the conductors for the ring main are stranded copper and consist of 37 strands of 2 mm. diameter with a total cross-section of 120 mm². Pure aluminium will be used for the other conductors, as this has proved to be satisfactory and can be produced in Germany. The aluminium lines will be stranded, there being 37 strands, giving a cross-section of 120 mm². It will be delivered in lengths of 3 500 m. The guard wire is an iron wire with seven strands, with a total section of 50 mm². The tension on the copper lines is 16, on the aluminium lines 9, and on the guard wires 16–20 kg. per mm². For the present it is intended to use Hewlett insulators, because of the good experience gained with them. Normally there will be seven suspension links per chain, and eight per chain where there are double copper lines. Recent advances in other types of suspension insulators, such as the cap type with spherical top and without cement, however, make it unlikely that the Hewlett type alone will be used. The six-link cap type costs much less than the seven-link Hewlett type; so that the former is also being tried.

Two 8 000 kVA rotary condensers installed in the Nuremberg transformer station and joined to the 110 kV lines through transformers will render wide pressure regulation possible. Work on the transmission lines is well advanced.

Transformer Stations.

These have been designed on the following principles. Separation of high- and low-voltage buildings; erection of transformers and oil-switches on ground floor; ease of accessibility and removal of parts; greatest protection from fire from oil conflagrations.

Two types of oil-switches are being used—the cell type, where each switch has its own cell, which requires a second storey for the leading-in wires, isolating switches and busbars; and the sunken type, where the switches are arranged in the floor of a large switch room. Nine sub-stations have the former and three the latter type. The 100 kV switches are designed for a short-circuit power of 480 000 kVA, and have a charging resistance to suppress surges. The busbars consist of iron tubes suspended from the roof by five-link suspension insulators.

On the low-voltage side, cables are used for voltages up to 20 kV, and overhead lines for higher values.

Transformer Details.

The high-voltage transformers will be 110 to 120 kV and the low-voltage 50, 35, 20 or 10 kV. The normal units will be for 6 000, 10 000 and 16 000 kVA. The transformers will be delivered filled with oil, but with the insulators removed. The transformers are of the core type with the high-voltage windings joined in star and the low-voltage windings in delta. There are no transformer tappings—where voltage regulation is needed, an auxiliary transformer is used or regulation is effected at the consumer's sub-station. The star point on the neutral side is connected through earthing coils to the neutral bar. It is specified that the no-load current shall not exceed 7 per cent. of the full-load current, nor the short-

* Abstracted from the festal number of the "Elektrotechnische Zeitschrift," issued to commemorate the meeting of the V.D.E. in Munich, 1922.

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circuit pressure more than 8 to 10 per cent, of the normal. The following tests are applied for one minute :—

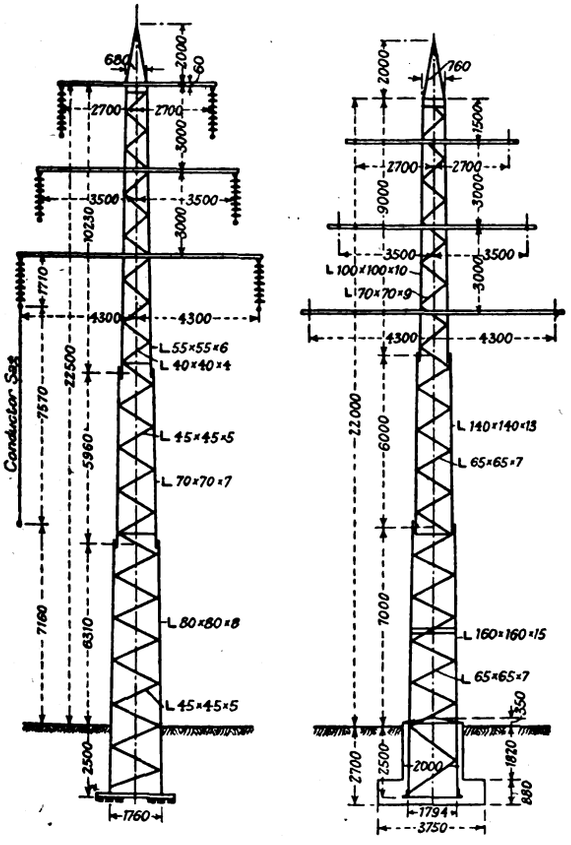
Line Pressure.	*Test Pressure.*
Up to 20 000 V.	3 times the line pressure.
21 000–50 000 V.	2·5 ,, ,,
51 000–110 000 V.	2 ,, ,,
Above 110 000 V.	220 000 V.

The insulation between turns must withstand at least the phase pressure, and between end turns the line pressure for 5 seconds.

The reinforced insulation extends over 2 per cent. of the turns at each end of a phase. The transformers are cooled by pumping the oil through coolers. All transformers have a 5 mH choker on the high-voltage side.

Protective Devices.

All possible precautions have been taken to ensure the greatest reliability. In the first place the installation is being well constructed with ample distance between the conductors, and ample insulation. Further, all oil switches have protective resistances, reinforced insulation is used between the turns of the transformer windings, while the short-circuit transformer



Supporting Pole. *Pull-off Pole.*

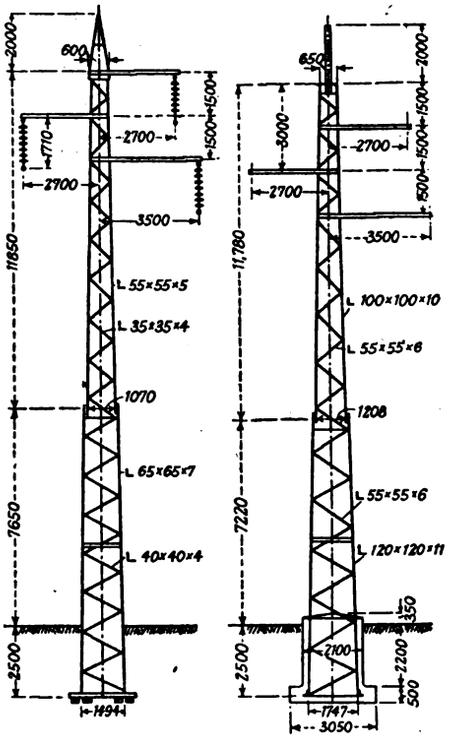
FIG. 2.—POLES FOR DOUBLE LINES.

reactance is increased and additional protection afforded by choking coils. All material is subjected to rigorous tests.

Protection against Effect of Earth Faults.

The current in case of an earth fault will attain the very high value of 418 A, and, after extensions are completed, 530 A. To suppress this, choking coils are provided in the neutral-point circuit on the high-voltage side. The inductance thus introduced acts against the capacity of the network and thereby reduces the current at the fault to a safe value.

Though electrically a single coil would have sufficed, practically it was better to divide the power between several coils distributed over the network. Instead of providing tappings for the different lengths of line in operation, several separate coils are used which can be cut out of circuit with particular sections. To compensate for 418 A, four 5 100 kVA coils and two 2 850 kVA coils are used, for currents of 80 and 45 A respectively. In case of an earth fault, the neutral-point choking coils have across them the phase pressure of 63 000 V. The transformer neutrals are connected through standard



Supporting Pole. *Pull-off Pole.*

FIG. 3.—POLES FOR SINGLE LINES.

single-pole, 60 kV cut-outs to the neutral busbar, to which only a single transformer in operation is connected.

Selective Protection.

The chief failures to guard against are short-circuit, earth fault, break in conductor, busbar short-circuit. In case of a line fault, care must be taken that large areas are not cut out of circuit by the wrong switches opening; for even with the best devices, considerable time is needed to locate the faulty section. A solution has been got out by the A.E.G. and S.S.W. acting together.

For single lines, the selective device for cutting out the faulty section is secured by making the time of operation of

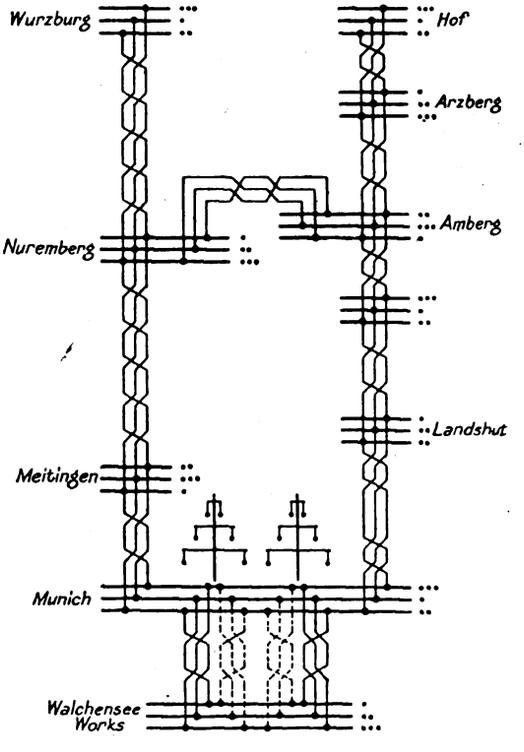


FIG. 4.—SHOWING HOW LINES ARE CROSSED.

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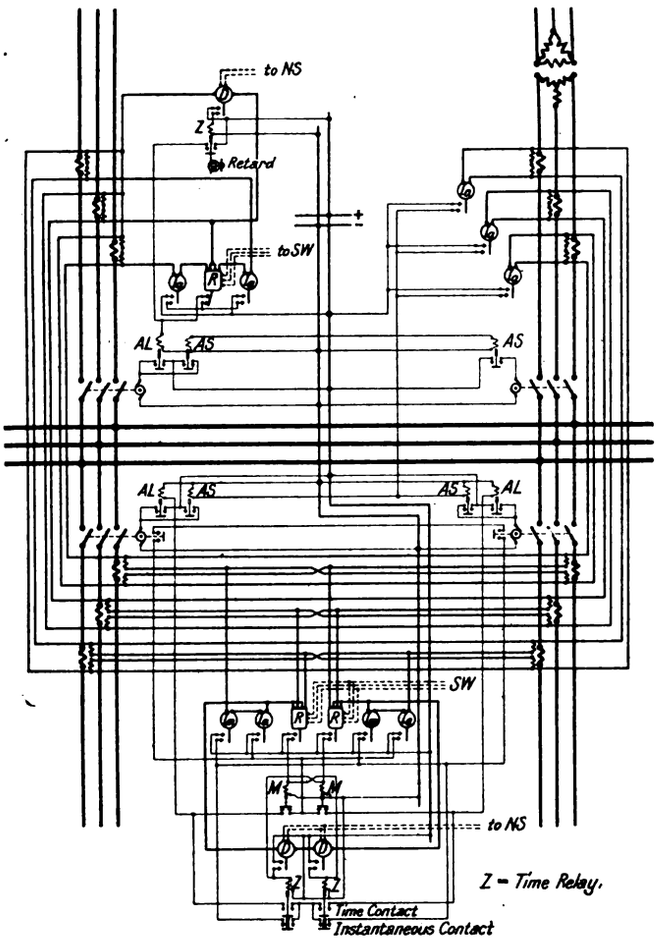
the outgoing cut-outs decrease and of the return cut-outs increase as the distance from the power station increases. Reverse-power relays prevent those switches opening which conduct energy from the line to the busbars of each transformer station; on the other hand, those switches through which energy flows from the busbars of each transformer station to the line are free to operate. Since the switches nearest the fault operate quickest, only the faulty section is cut out.

With double lines, protection is obtained by the out-of-balance which occurs between the currents when a fault develops in one of the parallel lines. When a defect occurs the unequal current distribution actuates the relays at both ends and cuts out the faulty line, while the sound line remains in circuit. This action, however, only occurs if the inequality exceeds 1 : 3, since the maximum relays are set for twice the normal current in a conductor. After one line has thus been cut out, the remaining single line is protected in the way just explained. For this purpose the quick-acting release of the



AL = Cut-out for Line Fault.
AS = Cut-out for Busbar Fault.
D = Earth Fault Relay.
Ia = Overload Time Relay dependent on Current.
Im = Independent Overhead Relay.
M = Intermediate Relay.
R = Polarised Relay.
SW = Pressure Transformer.
NS = Zero Pressure Coil.

FIG. 5.—SELECTIVE PROTECTION OF A TRANSFORMER STATION.

sound line is cut out by auxiliary contacts on the switched-off oil-switch, so that the maximum-current relays alone can operate the switches.

To protect the lines selectively against earth faults, special earth relays are provided which are connected unsymmetrically to the current transformers and act on independent time relays. These are also graded in the same way as the dependent maximum-current time-relays.

Merz-Price Device Used.

The Merz-Price differential device is the protection used against busbar short-circuits. When a short-circuit occurs, more energy flows into than out of the transformer station. The secondary windings of the current transformers of the same phase are joined in parallel with a maximum-current relay, and when a short-circuit occurs the difference of the in- and out-going currents in the relay, which controls the releases of all the switches in the transformer station, cuts the station off from the network. Special transformers are not needed for this, because the current transformers for the selective protection can be used. The secondaries of the transformers for the double lines are divided, so that they can be used for the busbar protection. A complete plan for the protection of a transformer station with a single line, a double line, and a transformer branch is shown in Fig. 5.

Control Office.

In the transformer station at Munich, there is a control office from which instructions for all switching operations, as required by the load, are given. For this purpose the Bavarian works will have their own communication lines. It is also intended to have a wireless service.

Energy Distribution.

In accordance with the agreement with the Bavarian State, the "Bayernwerk" will only supply energy to large distributing undertakings. It is estimated that the early demand for about 250 million kWh annually will severely tax the stations on the Walchensee and the Middle Isar, if the peak load in the winter months is to be met without assistance from the steam stations at Franken and Arzberg. Consequently it becomes important to forge ahead with the plans for further high-head hydro-electric stations with storage

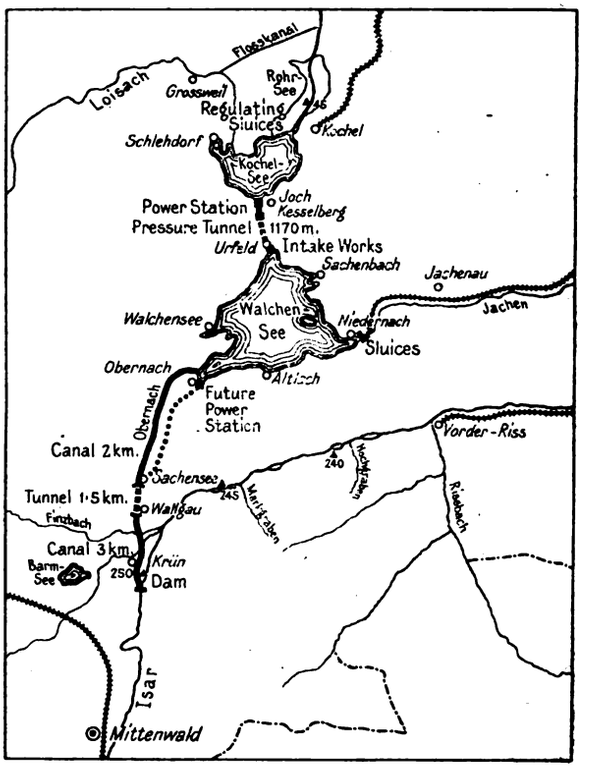


FIG. 6.—PLAN OF THE WALCHENSEE WORKS.

capacity, such as the Lower Iller. The situation will be easier when the Rhine-Maine-Danube Company have completed their hydro-electric schemes, for the Bayernwerk has priority rights in this scheme. To utilise the available excess in summer, it is intended to supply energy in bulk to Wurtemberg and Hesse, Baden and the Palatinate. An extension of 40 km. beyond Hof will be sufficient to link up with the Saxony State network.

The Walchensee Works.

This new station will be ready to supply power at the end of 1923, when the Bayernwerk commences operations. It will be able to supply not only the peak loads but can also be used for normal working at the outset, since the Railway Administration, which will require one-third of the possible 150 million kWh, will not commence to take energy until 1924. This station will utilise the 200 m. head between Lake Walchen and Lake Kochel (Figs. 6 and 7). Since the collecting ground is insufficient for a large power station, water will be tapped from the Isar. For this purpose the Isar will be dammed up by a 4 m. weir one km. above Krünn whereby a maximum of 25 m^3 of water per second can be supplied to the Walchensee. It is intended to erect an automatic station

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for utilising the 60 m. head from River Isar to Lake Walchen, and so obtain an additional 12 000 H.P.

Large Storage Capacity Available.

The chief value of the Walchensee is its storage capacity. In the winter months 12 m³ of water per second will be available, of which 10 m³ will be drawn from the Isar. In dry winters the Isar cannot supply this quantity, and the deficit must be drawn from the lake. Normally the level of the Walchensee will not be lowered more than 4·6 m., but it is possible to go to 6·6 m. The fall occurs from October to March, but the melting of the snow should restore the normal level by the end of May. The average 24-hour output of the Walchensee in winter is about 20 000 kW; in summer, 25 000 to 28 000 kW, assuming the Isar to supply 20 m³ per second. The installation is designed for a peak load of 100 000 kW.

Water is led from the lake through a 1 200 m. tunnel capable of carrying 60 m³ per second at a velocity of 3 m. per second. The water tower, which is 26·5 by 17·6 m. and 22·5 m. high, can deal with sudden load fluctuations. There are six pressure pipes of 2 250 mm. diameter. The machine room is 105 m. long by 22 m. wide, and contain 8 sets with a total output of 125 000 kVA and auxiliaries of 1 000 kVA. The foundations are very solid to ensure smooth running—the rotors of the single phase generators weigh 118 tons, and of the three-phase generators 67 tons. The transformer and switch room runs parallel with the machine room, to which it is equal in length, while the width is 29·5 m.

From the water tower onwards, the installation is divided into a three-phase and a single phase part, the former having 4 pipe lines and machine sets for general supply, and the latter 2 pipe lines each with two machine sets for the traction load. Owing to the relative slow speed and the large overload capacity of the single phase generators, and also to the large single phase transformers, the single phase part of the station is as large as the three-phase part.

Details of Generating Plant.

The single phase sets run at 250 revs. per min. The turbines are of the twin impulse type and are rated at 18 000 H.P. The single phase generators give 10 650 kVA at a power factor of 1·0 to 0·75, the terminal voltage being 6 000 to 6 900 V, and the frequency 16⅔ cycles. They can give 16 000 kVA for one hour and 20 000 kVA for 3 minutes. They are being made by Brown, Boveri and Co., and are the largest on the Continent.

A complete three-phase set is shown in Fig. 8. The three-phase generators are driven by Francis turbines at 500 revs. per min. The turbine shaft is rigidly coupled to the generator shaft, and runs in two water-cooled bearings with ring lubrication. When the load is suddenly removed, the regulator prevents the pressure in the pipe line increasing more than 10 per cent. The makers, Voith of Heidenheim, guarantee the following turbine efficiencies: Full load, 80 per cent.; ¾ load, 82 per cent.; ½ load, 78 per cent. The three-phase generators are built for 20 000 kVA at a power factor of 1·0 to 0·8, with a voltage of 6 000 to 6 900 V at 50 cycles. The overspeed is 80 per cent. Each generator is equipped with a direct-coupled 220 V exciter set, consisting of two exciting machines. This arrangement obviates the use of a series resistance and leads to a large reduction in the exciting currents controlled by the voltage regulators. The regulation is very fine; on lagging power factors the steps are less than 2 per cent., and on leading less than 4 per cent. Since the Bavarian network will eventually have a charging component of 60 000 kVA, the generators have to be stable on capacity loads.

The three-phase generators are able to give 15 000 kVA at 6 600 V at a leading zero power-factor, or 8 600 kVA at 5 000 V under like conditions. The generators are protected against excess pressures in the cables connecting to the transformers, and against the high-voltage by earthing the neutrals through a resistance of 0·8 Ω capable of carrying 4 500 A for 10 seconds. In addition to the V.D.E. tests the generators can withstand 15 000 V between phases and earth and 7 000 V between the turns of a phase.

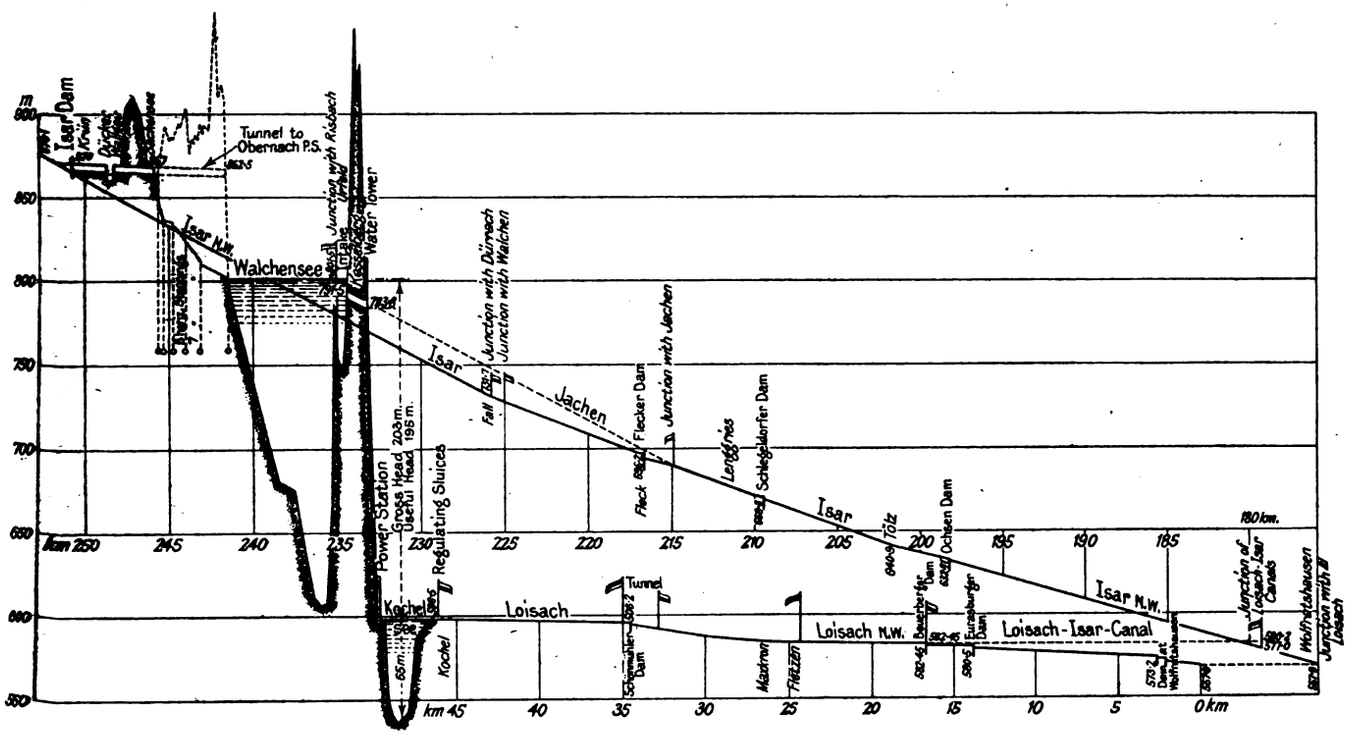

FIG. 7.—ALTITUDE PLAN OF WALCHENSEE WORKS.

The Suppression of Hunting.

Hunting is suppressed by damping windings. The amplitude of the harmonics at full load and unity power-factor is only 3 per cent. of the fundamental. The instantaneous short-circuit current does not exceed fifteen times, nor the steady short-circuit current three times the normal current with full-load excitation at 6 600 V. Forced cooling is adopted and the heated air can be ejected into the machine room when required in winter.

The moment of inertia is 160 tm² and the rotor takes 40 min. to come to rest. This is reduced to 5 min. by the special brakes provided, or to 1 min. in case of emergency.

Each generator has its own transformer rated at 20 000 kVA with a ratio of 6 600 to 115 000 V at no load. This corresponds to 6 930 to 115 000 V at cos $\varphi = 0{\cdot}85$. The switch and transformer rooms are arranged on the cell principle, both for three-phase and single phase sides. For testing, two water resistances for 2 000 A are provided.

Owing to geographical conditions transport was difficult. Neither a branch line nor the road offered a suitable solution. It was therefore decided to build a 130-ton ferry to carry the parts from the railway across the Kochelsee. The ferry consists of two pontoons 30 m. long, which carry rails. During loading or unloading the ferry is sunk on to a concrete bed

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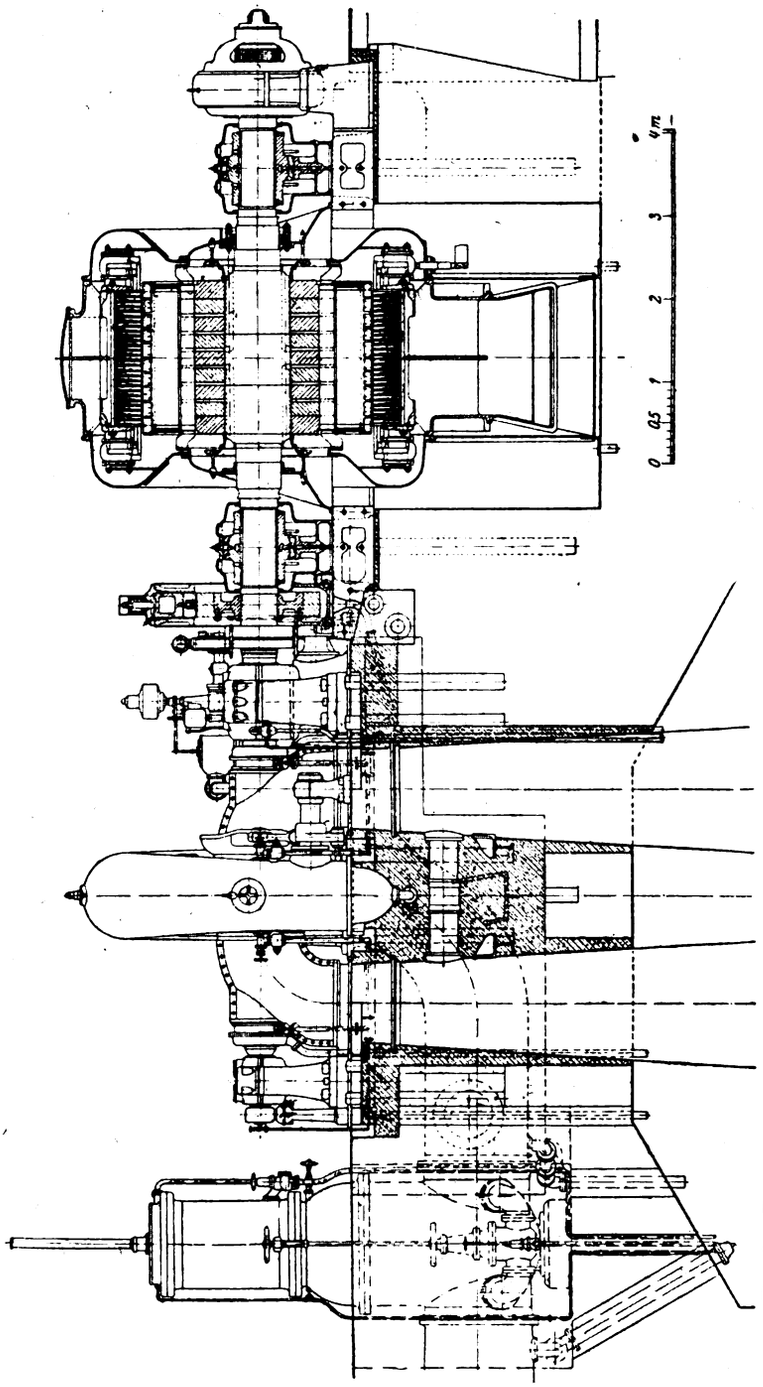
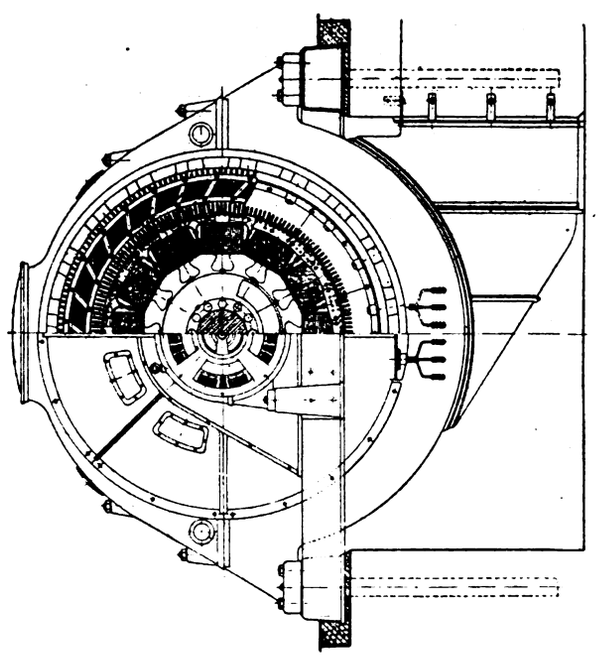


FIG. 8.—FRANCIS TURBINE AND THREE-PHASE GENERATOR.



and a railway wagon is run on to or off it. Water is then pumped out until the pontoon floats as required. A winch hauls the trucks from the loading place to the power station. For safety the 110 kV transmission lines are taken round both sides of the lake.

The Stations on the Middle Isar

The stations on the middle Isar will be available in 1924, and are intended to supply 200 million kWh annually. The stations utilise the 88 m. fall in the River Isar between Munich and Moosburg. The average flow varies between 80 and 100 m³/sec.; in the winter six months between 60 and 80 m³/sec. A weir at Oberföhring will raise the level of the Isar 4·5 m. The intake is just above the weir and leads into a storage pond of 25 million m³ capacity. The latter enables the full load of 109 000 kVA to be obtained during peaks, even in dry winters (three-phase, 74 000 kVA; single phase, 69 000 kVA).

The four stations are:—

Station.	Head in m.	Mean Output in kW.
Finsing	11.0	7 150
Aufkirchen ..	26.4	17 150
Eitting	25.3	16 450
Pfrombach ..	21.1	13 600
Total ..	83.8	54 350

The low-head station at Finsing generates three-phase power only. There are two turbine sets, each consisting of four Francis turbines, one of which is supplied from the intake canal and drives a 7 500 kVA generator at 150 revs. per min., while the other is coupled to a 6 500 kVA 125 revs. per min. generator and can be fed from the storage pond. The medium-head stations at Aufkirchen, Eitting and Pfrombach are all similarly equipped for producing three-phase and single phase energy in equal parts. The stations each contain four vertical axis, single-runner turbines. The Aufkirchen and Eitting stations will each have two three-phase generators, each capable of giving 10 500 kVA at $\cos\varphi = 0.8$, and two single phase generators for 12 000 kVA at $\cos\varphi = 0.7$. Speed = 166⅔ revs. per min. At Pfrombach station the generators are rated at 9 200 kVA and 10 500 kVA respectively. All generators are wound for 6 000 V, while the transformers raise the three-phase pressure to 60 kV and the single phase to 110 kV.

The several river stations are also connected by a 20 kV double line, used both for their own requirements and local concessions. The exciters are driven by the induction motors used for the oil pumps. The cell system is used for the switches and transformers. It is hoped to commence operations either this year or in 1924.

The Supply of Steady Direct Current for Telephone Purposes.

At the last meeting of the INFORMAL SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS Mr. J. Coxon opened a discussion on "The Supply of Steady D.C. for Telephonic Purposes." He confined his remarks to those telephone exchanges which were large enough to require a special power installation, and which may have an equable load through the night to 8 a.m., rising rapidly to a peak load of several hundred amperes about 11 a.m. He described the ripple obtained with the ordinary d.c. generators of commerce. This was due to the slots of the commutator and the pull of the pole pieces, which made some other source of supply essential. He spoke of the attempt to obtain a generator which through a choking coil would deliver a smooth current, but after a fair measure of success the search seemed to have been abandoned.

He then described and criticised the standard double-battery systems, which were extravagant, as one battery was only standing by while each had a capacity equal to full load for thirty-six hours, and he reviewed the method of overcoming waste of battery capacity by means of a floating battery discharging during heavy hours.

Mr. Coxon exhibited several slides of the homopolar dynamo, and appealed for the interest of designers in special d.c. generators as a practical method of abolishing the batteries. He said the main difficulties of the homopolar machines had been due to the high peripheral velocity required to obtain normal commercial voltages, but with telephone circuits low voltages only were required.

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The London District Constituted.

A Joint Authority and Two Committees—Purchase Clauses Amended—Interesting Technical Details.

The Electricity Commissioners have issued an order constituting the London and Home Counties Electricity District and establishing and incorporating the London and Home Counties Electricity Authority. They will hold a local inquiry into the scheme on March 12th, and representations or objections in regard to it must be submitted to the Secretary of the Commissioners not later than March 3rd.

The formal part of the order follows the usual lines to a large extent, with the exception that it contains a clause preventing the breaking up of any park, open space or embankment vested in the London County Council except so far as any part of such park, etc., forms part of a street. Any tunnel, subway or sewer vested in the same body is similarly protected—*i.e.*, the consent of the Council must be obtained in each case.

Constitution of the District.

The schedule to the order constitutes the district on the same lines as was laid down by the Commissioners after the inquiry held in June and July, 1921.* The district therefore includes the whole of the administrative county of London and the administrative county of Middlesex, the county boroughs of Croydon, East Ham and West Ham, and parts of the counties of Berks, Buckingham, Essex, Hertford, Kent and Surrey.

The usual provisions are also made for the establishment of a Joint Authority, and this joint authority is to appoint two Committees, one known as the Committee of Local Authority Undertakers, which will consist of the eight members elected by those undertakers, and the other a Committee of Company Undertakers, which will consist of the six members similarly appointed by the companies. The joint authority is also to appoint a Technical Committee consisting of two members nominated by the Local Authority Committee, two members nominated by the Company Committee, one member representative of the power companies, one member representative of the railway companies, and three members nominated by the joint authority. One of the members nominated by the Local Authority Committee and the Company Committee respectively and the three members nominated by the Joint Authority need not be members of the Joint Authority, but shall be persons possessing the requisite technical qualifications to enable them to assist in the functions of the committee. The Joint Authority is also to appoint a Finance Committee and may appoint other Committees as they think fit.

Delegation of Powers.

The Joint Authority may delegate to the Local Authority Committee and to the Company Committee powers and duties relating to the transmission of electricity and to the supply of electricity in bulk to authorised distributors, the management and operation of the generating stations and transmission lines transferred or leased to the Joint Authority by the local authority undertakers and the company undertakers respectively, the carrying into effect of that part of the technical scheme which relates to the utilisation, extension or shutting down of generating stations, the construction of interconnecting mains and the carrying out of negotiations for bulk supplies. These Committees shall continue in being until the whole of the generating stations and main transmission lines of the local authorities and the companies respectively have become the property of the joint authority.

While the Joint Authority is given permission to delegate certain of its powers to committees, it is provided that the borrowing or raising of money, the issue of precepts for contributions from constituent bodies and the making of contracts for sums exceeding £5 000 are not to be delegated.

The technical committee is to advise on the carrying out of the technical scheme for the whole district, the utilisation of the Barking supply, interconnection questions, and the supply of electricity for railway purposes.

Purchase and Rental Terms.

The annual rental payable for municipal stations leased to the authority shall be equivalent to the annual charges for interest and repayment of loans on generating plant and main transmission lines, with such additional rental as may be agreed in consequence of differences in methods of repayment of such loans or by reason of capital expenditure having been defrayed out of the revenue. The annual rental payable for company stations or main transmission lines leased to the joint authority shall be equivalent to interest at 6 per cent. on the capital expended, less depreciation calculated at Inland Revenue rates, that is to say, 3 per cent. on the written-down value of cables and 5 per cent. on the written-down value of plant. An annual sum of not less than 3 per cent. on the capital cost is to be set aside by the authority and will be applied to the purchase of plant and transmission lines transferred by the lessors. The existing purchasing powers of the London County Council and other local authorities in the area are to be transferred to the Joint Authority, and these powers of purchase are to be suspended for a period of forty years from August 26th, 1931, in respect of systems within the county of London. In the case of those companies who are affected by the suspension of these powers of purchase, the dividends payable shall be regulated in a manner which is yet to be determined. The distribution systems of the companies affected by the suspension clause shall be purchasable by the Joint Authority after August, 1971, on Inland Revenue terms, upon six months' previous notice being given.

Local Authority and Company Committees Jointly Responsible.

The Joint Authority is to take all necessary steps to ensure the carrying into effect of the technical scheme, the Local Authority Committee and the Company Committee respectively being responsible for the undertakings under their control and the owning undertakers being responsible for those stations which are not transferred. The Joint Authority is to submit proposals within two years for the supply of electricity in any area which has not yet a supply, and within the same time the North Metropolitan Electric Power Supply Co. and the Metropolitan Electric Supply Co. are to submit proposals for the improvement of the supply of electricity in their areas.

Systems of Supply.

The systems of supply shall be as far as practicable on a uniform standard, and where alterations are necessary the undertakers are to carry these out without expense to the consumers. The expenses of the Joint Authority are to be met by an annual contribution of £500 by the London County Council, of £50 by each other county council and of £100 by the Railway Companies' Association, while the various undertakers will pay on a scale in proportion to the number of units sold by them to the total number of units sold. The contribution of the North Metropolitan Electric Supply Co. is limited to £250.

Constitution of Joint Authority.

The first annex to the order contains provision for the appointment of a Joint Authority of twenty-seven members, eight of whom will be appointed by local authority undertakers, six by company undertakers in the County of London, and one by the power companies. The London County Council will appoint six members, the County Councils of Middlesex and Buckingham one jointly, the County Councils of Essex and Hertfordshire one jointly, the County Councils of Surrey and Kent one jointly, and the Railway Companies' Association two. An independent chairman, not appointed from the members of the Joint Authority, will be elected. Each representative of undertakings will have one vote, with an additional vote for each 500 000 kWh sold above the first 500 000 kWh sold. Only British subjects resident in the United Kingdom are qualified for appointment on the Joint Authority, and those holding any paid office under the Joint Authority or concerned in any contract entered into by the Joint Authority are disqualified, with certain exceptions. The usual provisions for filling vacancies and relating to elections, meetings and proceedings are included.

Technical Features.

The second annex deals with the technical scheme, and lays down that the standard type of current is to be three-phase at a frequency of 50, though systems generating at 25 cycles and 33⅓ cycles may be continued and further extended. The main transmission pressure is to be 33 000 V and the secondary transmission pressures 6 600 or 11 000 V. The Stepney, Bankside and Deptford stations are to be extended to form

* See THE ELECTRICIAN, Vol. lxxxvii, p. 762, Dec. 16th, 1921.

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secondary capital stations. The stations at Battersea, Fulham, Hackney, Hammersmith, St. Marylebone, West Ham, Woolwich, Bow, Grove Road, Croydon, Guildford, Sevenoaks and Woking are to be utilised and extended to a limited amount. The stations at Barnes, Guildford, Islington, Poplar, St. Pancras (King's Road), Shoreditch, Walthamstow, Wimbledon, Gravesend, Wood Lane (Kensington and Knightsbridge), Horseferry Road (Westminster), Blackwall Point (South Metropolitan), Richmond Road (Brompton and Kensington), Beckenham, Finchley, Hornsey, Kingston, Reigate, Twickenham, Uxbridge and Watford are to be utilised without further extension. The following stations will only be used until other supplies are available at rates justifying their shutting down :—Barking (Urban District Council), Bermondsey, Bexley, Dartford, East Ham, Erith, Leyton, St. Pancras (Regent's Park), Southwark, Chelsea, Cheval Place (Kensington and Knightsbridge), City Road (County of London), Loughborough Junction (South London), Notting Hill, Wandsworth (County of London), Ealing, Epsom, Gray's Thurrock, Heston, Ascot, Bromley, Chiswick, Caterham, Dorking, Egham, Leatherhead, Surbiton, Slough, Tottenham and Windsor.

New Transmission Lines.

To make effective use of the generating stations transmission lines will be laid during the first stage of development between the generating or sub-stations mentioned :—Poplar and West Ham, Hackney and Walthamstow, Stepney and Shoreditch, East Ham and Barking, Barking and Ilford, St. Pancras and Islington, Gravesend and Dartford, Deptford and Blackwall Point, Chelsea and Richmond Road, Poplar and Bow, Shoreditch and City Road, Grove Road and St. Marylebone, Chiswick and Barnes, Kingston and Surbiton, Battersea and Windsor, Wimbledon and Wandsworth, Vineyard and Bankside, Bermondsey and Southwark. The Brimsdown station of the North Metropolitan Power Supply Co. is to be extended, but the stations at Hertford and St. Albans will be shut down when bulk supply becomes available at rates justifying that course. The two stations at Willesden, belonging to the North Metropolitan Power Co. and the Metropolitan Electric Supply Co. respectively, will be interconnected and main transmission lines will be established between Brimsdown and Hertford, Willesden and St. Albans, Hertford, Welwyn and St. Albans, and St. Albans and Harpenden. The Metropolitan Electric Supply Co.'s station at Willesden is to be extended by the addition of three-phase 50-cycle plant, and three-phase transmission lines are to be erected between Willesden, Ealing, Iron Bridge and Uxbridge, and between Iron Bridge, Heston and Twickenham.

Electrical Resistance Furnaces.

In a lecture on "Electrical Furnaces and Their Uses," which he delivered before the ROYAL SOCIETY of ARTS on Wednesday, February 7th, Mr. C. R. DARLING referred to the continually extending application of the electrical resistance furnace and discussed its advantages, which included a small escape of heat, a clean atmosphere, the accuracy and ease with which it could be controlled so as to maintain steady temperature, and the fact that skilled labour was not necessary. Owing to the amount of heat which escaped being small an enclosure could be heated more economically by electricity than by gas, although the cost of 1 therm produced by electricity at 1d. per kWh was three times as great as that involved by burning gas at 10d. per therm. When the enclosure was large enough to allow of the gas being burned internally, so that the exterior might be lagged, the thermal costs might then be in favour of gas, but the impurities in the gas often made internal firing objectionable.

Metal Wound Furnaces.

Dealing with metal-wound furnaces, he referred to the laboratory furnace introduced by Heræus in 1902. This consisted of a porcelain refractory tube round which a strip of platinum foil was wound in spiral form. One of its drawbacks was that, if placed directly across the power mains, arcing was likely to occur, and this resulted in the burning out of the winding. It was therefore necessary to use an external resistance in the circuit to reduce current at starting. In spite of this defect the platinum-wound furnace was found to be preferable to gas heating for many purposes, and was still used for temperatures between 1 000 and 1 500° C., though the high cost of platinum restricted the size of these furnaces to dimensions too small for industrial processes.

The Use of Nickel Chromium Alloys.

The chief factor in the great development since attained by metal-wound furnaces was the introduction of nickel-chromium alloys. These could be heated for long periods to 1 000° C. without oxidising or undergoing other deterioration, and offered a nearly constant resistance to electricity at all temperatures, so that a furnace wound with such material could be coupled directly to mains without danger of burning out. It was quite safe to say that metal-wound furnaces would never have found a place in industry had not these alloys, or others possessing similar properties, been discovered.

Although the safe continuous working temperature of modern nickel chromium furnaces did not exceed 1 000° C., the number of uses to which they could be applied was great. For instance, they were used in the laboratory for experimental work on the heat treatment of metals, for incinerations and chemical combustions, standardising pyrometers, etc., and in the workshop for hardening and tempering carbon steel articles, such as dies, punches, milling cutters, gear wheels, taps, gauges, and smaller objects. In some of the large American factories batteries of these furnaces were used for hardening gear wheels and other parts of machinery, the objects being heated to about 10 per cent. above the recalescence point, and then allowed to quench in a bath placed immediately beneath the furnace. This procedure ensured uniform results, and was cleaner and cheaper to operate than gas heating. The nickel-chromium furnace was worthy of a much wider application in this country than it had yet received.

High Temperature Cheap Alloy Required.

Up to the present no generally satisfactory metal-wound furnace had been designed for continuous use above 1 000° C., or, at the outside limit, 1 100° C. The need for a furnace for the treatment of high-speed steel, involving temperatures between 1 300° and 1 400° C. was generally recognised, but no metal or alloy had yet been found entirely suitable. Higher temperatures still were required for the annealing of the tungsten wire used for electric lamps, and what was really wanted was a cheap alloy capable of withstanding 1 800° C without oxidising, and which will have a low temperature coefficient for electricity. The cost of platinum and kindred metals, such as iridium, was too great to permit of their use for this purpose, and the metals of the highest melting points, such as molybdenum (2 600° C.), and tungsten (3 200° C.) although fairly cheap, oxidised rapidly in air. The annealing of tungsten wire was carried out in furnaces wound with molybdenum or tungsten, arrangements being made to maintain an atmosphere of hydrogen throughout the furnace—a troublesome procedure which must always act as a deterrent to their general adoption.

Such an Alloy Possible.

Mr. Darling believed that such an alloy as he had suggested could be made, because we had materials which melted well above 2 000°, and it was only a question of obtaining the right alloy to enable us to get a furnace which would treat high-speed steel in the workshop just as easily as the nickel-chromium furnace would treat carbon steel. Many people were working on the production of this alloy, and their efforts were fairly certain to be crowned with success.

With regard to suitable refractory materials for high temperature work, if we had to work at temperatures of 1 700 and 1 800° C. we must have a refractory that would stand up to the work. The best at present were the carborundum refractories, but there appeared to be difficulty in making them on such a scale and with such certainty as was needed for high temperature furnaces. The solution probably lay in the direction of zirconia or magnesia, or a mixture of the two.

Carbon Resistance Furnaces.

Carbon resistance furnaces were then considered, the three chief types being (1) tube furnaces, (2) granular carbon furnaces, and (3) furnaces in which the refractory chamber was heated by carbon rods or strips through which the current circulated. With regard to the carbon-tube furnace, useful for special operations demanding a temperature of 2 000 to 2 500° C., he described this, and pointed out that a special source of current was needed owing to the low resistance of the tube, through which the current might be 100 A at a pressure of 10 V. This involved the use of a special transformer when the furnace was operated from ordinary A.C. mains. Obviously, such a device was unsuited to general operations. Greater simplification was needed before tube furnaces could be used in workshop routine.

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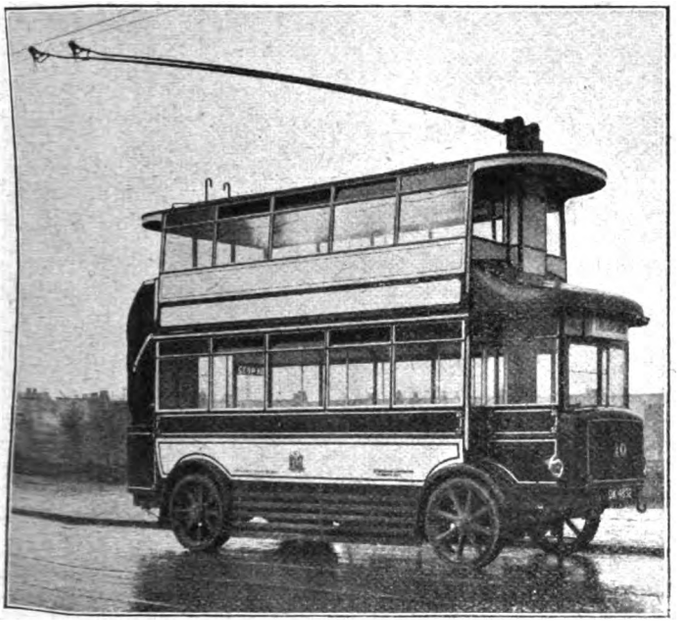
Railless Traction at Birmingham.

A Development with Some Interesting Features.

Recently we had an opportunity of inspecting an interesting development of railless electric traction, which has taken place in Birmingham. As is well known, this form of traction has usually been employed, as at Leeds and Bradford, on the less busy routes, generally as a feeder to the orthodox tramway system, or, as at York, where the traffic is light and the streets unsuitable for laying rails. Tramway managers usually argue, though they do not always carry their arguments to a logical conclusion, that for such uses railless traction has a place. They do not often agree that it can replace the ordinary tram with rails.

Some Interesting Features.

From more than one point of view, therefore, the Birmingham installation is interesting. It replaces the ordinary tramway route which ran from Old Square to Nechells, about three miles. On this route, owing to the war, the rails were badly worn and to replace them would have meant a deficit on the revenue account of over £3 000 per annum. By using railless traction a saving in capital cost of £54 000 was achieved, and



THE BIRMINGHAM RAILLESS CAR.

the effect on the revenue account was to turn a deficit of £3 000 into a saving of about the same amount. It is needless to say which choice was made.

The installation which has now been running about three months is further interesting from the fact that the cars used are the largest yet built. Moreover they are double-decked, and the upper deck is covered in. This is the first time this combination has been used. They have a total seating accommodation of 57. By removing the rails the Tramways Department are relieved from road maintenance charges, though they have had to pay for the re-instatement of the road to the City standard. The existing overhead equipment was used in a modified form as far as this was possible.

One Wire Railless Route.

There are two other electrical points of interest apart from the cars themselves. For a short distance the cars duplicate an ordinary tram route and separate overhead wires are provided for the two systems. Where the junction is made special insulating arrangements have to be provided. To enable the railless cars to return to the depot which is some distance from the Old Square-Nechells route a device which enables them to run over the ordinary tramway route has been devised. This consists of a flexible skate which is attached to a terminal and holdfast on the car, fits into the groove of one of the running rails and trails about four feet behind the car. By means of a change over switch this skate is connected to the negative terminals of the motors and the appropriate trolley arm is lowered. Contrary to what might be expected the device has given no trouble and no interference with the other traffic has been caused.

Details of the Cars.

The general appearance of the car can be seen from the accompanying illustration. Its height over the trolley standard is 16 ft. 3⅜ in., while the total length is 24 ft. 6 in., the wheel base being 13 ft. 6 in., and the over-all width 7 ft. 6 in. This compares with the 7 ft. 2½ in. of the London General Omnibus Co. bus, and the safe tilting angle is 36 deg. as compared with 34 deg. for the bus in spite of the roof. The weight is 7 tons 6 cwt., or 9 tons 18 cwt. when fully laden. The car has a roomy cab, which provides ample space for the driver, who is protected by a glass screen.

The chassis is of special design, and is constructed of pressed mild steel channel, the frame being stiffened by cross-members between the side members.

The front axle is a solid steel forging. The rear axle is of the live axle type, each road wheel being driven by a separate motor through worm reduction gear. Roller bearings, ball bearings and ball thrust bearings are used throughout. The road wheels are of cast steel with hollow spokes, with a rim diameter of 771 mm., and fitted with Dunlop tyres. Single tyres are fitted to the front wheels, and twin tyres to the rear wheels.

Braking Arrangements.

There are two independent brakes, each of which is capable of controlling and stopping the vehicle when fully loaded on a 1 in 10 gradient. The rear wheel brake is of the internal expansion type, operated by a cam by means of a foot pedal from the driver's platform. Compensating links ensure equal pressure on each wheel. This brake can also be operated by a hand lever with ratchet for holding the brake on after application by the foot pedal or hand lever. The external contracting brake is fitted at the driving end of each motor shaft, and is operated by a foot pedal. It is of powerful type, and is designed for use in case of emergency.

Electrical Equipment.

The chassis is fitted with two electric motors made by the English Electric Co., each having a capacity of 42 B.H.P. on tramway rating at 1 130 revs. per min., an unusually high speed, on a 525 V circuit. The motors are series wound with four main poles and four commutator poles, and are arranged for shunt field control. They are totally enclosed by the magnet frame and two end shields. The bearings are carried in the end shield, and are provided with Hoffmann roller bearings.

The controller has a main and a reversing barrel, and provides for forward and reverse running, and for connecting the two motors in series or in parallel. Provision is made also for shunt field control, and for cutting out either motor by controlling the other on the series notches. The reversing handle is detachable, but the power handle is fixed. The main barrel cannot be moved from the off position unless the reversing barrel is in one of the operating positions, while the reversing barrel cannot be moved unless the main barrel is in the off position. The main barrel gives nine positions, in addition to the off position, five series and four parallel, and the reversing barrel a forward and a reverse.

The controlling resistances in the motor circuit are of the E.M.B. steel grid type. The circuit breakers are of the standard traction pattern. The two trolleys are of the cam control type, fitted with ball and roller bearings. These special trolleys enable the vehicle to deviate on either side of the trolley wire to the full length of the trolley poles without risk of dewiring at any speed. The trolleys, which have a low upward pressure on the trolley wires have proved very satisfactory and are giving no trouble.

A four minutes' service is being given, and, including an average of seven stops per mile, the speed averages about ten miles per hour. A deviation of about 22 ft. at 20 miles an hour is possible. This is more than is usually allowed.

We understand that the average energy consumption for three months has worked out at 1·75 kWh per car mile; but 1·5 kWh is to be taken as the motorman's standard. Wattmeters are fitted to each car as is the practice of the Corporation. The cars were supplied by RAILLESS, LTD., to whom we are indebted for much of the foregoing information.

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Electrical Winders at the Hilton Collieries.

We have received some particulars of the geared electric winders recently installed at the Hilton Sinkings by the METROPOLITAN-VICKERS ELECTRICAL CO.

The following particulars of the winding equipment may be noted :—

The Winding Programme.

The design of winding equipment has been based on the following data :—

Depth of shaft	1 800 ft.
Output per hour	300 tons.
Nett weight of coal per wind	13 440 lb.
Number of winds per hour	50
Time of changing tubs	12 secs.
Weight of three-deck cage and chains	11 220 lb.
Number of tubs per cage	9
Weight of nine tubs	5 544 lb.
Weight of rope per yard	22½ lb.
Rope circumference	5·5 in. (locked coil)
Centres of headgear pulleys	5 ft. 6 in.
Horizontal distance between centre of drum and centre of pulleys	120 ft.
Vertical height of centre of sheaves from centre of drum	60 ft.
Type of drum	cylindro-conical
Drum diameter	11 ft. small. 21 ft. 6 in. large.
Turns on small diameter	3
Turns on scroll	5·5
Drum speed	35–45 revs. per min.
Motor rating	1 350 H.P.
Motor speed (synchronous)	300 revs. per min.
Estimated units per trip	16·4 kWh.

Electrical Equipment.

The winding motor itself presents no "striking" features except that the bearings, slip-rings and brushes had to be specially designed in view of the arduous nature of the work and frequent reversals. The controller is of the Weir type with fixed electrodes and an adjustable pumping arrangement for the electrolyte, whereby the rate of acceleration is not entirely dependent on the driver. Special features include a reverse-current braking device and a slip-reducing arrangement. On all liquid controllers some resistance remains in circuit with the controller in the "full on" position and maximum speed. Fig. 1 illustrates the arrangement of the slip-reducing device,

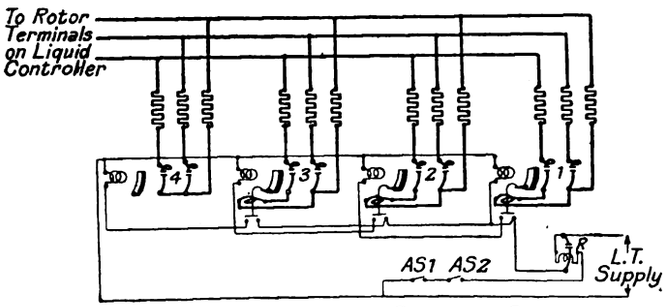

FIG. 1.—DIAGRAM OF CONNECTIONS FOR CONTACTOR SLIP-REDUCING DEVICE FOR USE WITH LIQUID WINDER CONTROLLER.

which has been found to be of considerable benefit. A number of double pole contactors connect successive banks of resistance in parallel with the controller when the winder is at full speed. The auxiliary switch AS1, Fig. 1, is coupled to the operating mechanism, and closed only when the weir is at the top of its travel. The switch AS2, operated from a small paddle in the solution, is closed only when the liquid reaches its highest level. When both switches are closed the relay R is also closed and this in turn closes contactor No. 1, this inserving the first bank of resistance. All contactors except the final one are provided with accelerating relays so that after the current peak due to the closing of No. 1 has subsided, the others close at regular time intervals. In the diagram four contactors are shown, but the number may be varied according to requirements.

The use of the slip-reducing device is distinctly beneficial and has led to increases in output of over 5 per cent. The elimination of the inherent resistance of the controller at full speed is also an advantage, as the solution may be weakened considerably without affecting output, thus increasing the facilities for manœuvering when coming to the bank, with a resultant saving in time. A slip-reducing device adds considerably to the value of an equipment since increased output is obtained at the same cost by the saving of energy otherwise dissipated in the controller.

Speed Curves.

Fig. 2 shows the speed curve of a winder running without controller. The full speed time line has a marked slope indicating the motor-slip due to the rope weight at the beginning

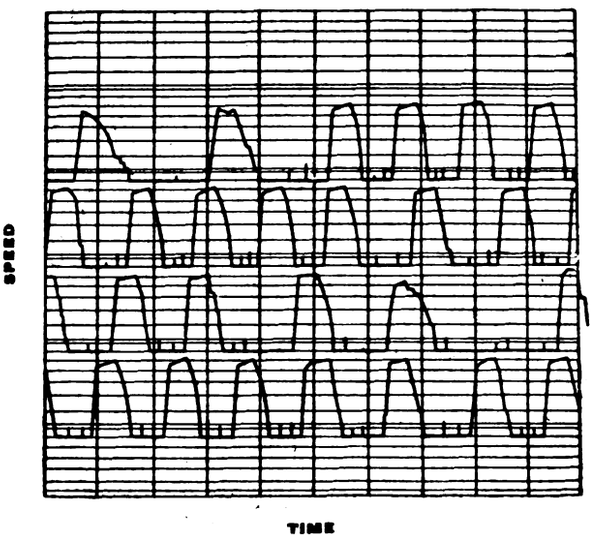

FIG. 2.—SPEED CURVE OF WINDER WITHOUT SLIP-REDUCING DEVICE.

of the wind. Owing to the overbalancing effect of the descending rope the slip decreases as the end of the full-speed period approaches.

Fig. 3, on the other hand, shows the levelling effect of the slip-reducing device during the full speed running period. By

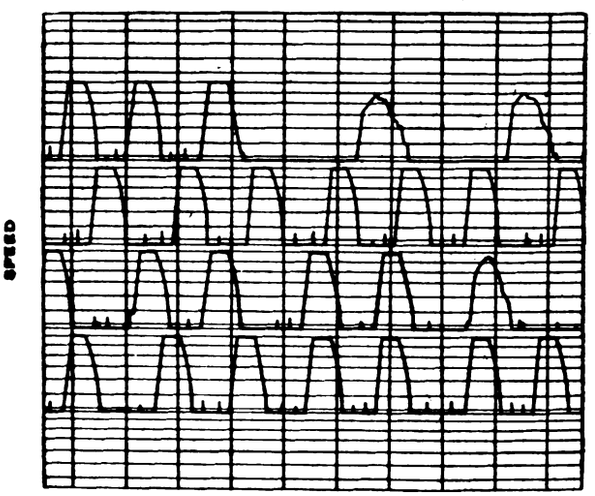

FIG. 3.—SPEED CURVE OF WINDER WITH SLIP-REDUCING DEVICE.
Note the levelling effect during the full speed running period.

short-circuiting the slip-rings the slip during this period is reduced to a minimum.

A patent overspeed and slow brake device has been fitted in order to form an additional protection during the full speed running and retardation period. By the addition of a slow brake the men are protected against shock and possible injury occasioned by the sudden stopping of the winder. This brake can be set to give any safe rate of retardation.

Other items of the installation include the M.V. patent friction driven limit switch, low air pressure trip, special platform electrical trip, etc. The switchgear controlling the winder is mounted in sheet steel cubicles and provision is made for a duplicate supply at medium pressure for the auxiliaries in connection with the winder, such as the oil pump for the winder gearing, the air compressor and the controller pump motor.

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Reviews.

A Dictionary of Applied Physics. Edited by SIR RICHARD GLAZEBROOK, K.C.B., D.Sc., F.R.S. Vol. II—Electricity. (London: Macmillan and Co.) Pp. 1 104. 63s. net.

This is a book which every electrical engineer ought to possess. Strictly speaking it is not a dictionary, but a series of monographs written by experts on broad selected subjects. Certain minor matters are passed over with a mere reference to their place in the general scheme of things. Thus, resistances for alternating current work are dealt with under the measurement of inductance and fuses under switchgear. This arrangement has the defects of its qualities, for it prevents any close study of details and makes the running to earth of information on any particular subject rather difficult. We must place against this, however, the extreme value of the articles themselves, their succinct treatment, copious reference and excellent bibliography. The balance will then be found to be much on the right side.

One great difficulty in compiling a book of this kind, a difficulty inseparable from all editorial work, is knowing what to leave out. The safe course in cases of doubt is to omit rather than to retain. This course has been generally followed in this book. But there is a tendency, natural perhaps in view of the title, to give more prominence to laboratory than to practical equipment. A case in point is the section on "Electrical Measurements" which, covering 63 pages, is dealt with almost entirely from the physical point of view. The next long article, "Electrolysis and Electrolytic Conduction" (14 pages), is almost entirely theoretical, and some references might have been made to the practical troubles which arise from these phenomena, though the effect is somewhat lightened by "Technical Applications of Electrolysis" which follows. The phenomena of electrolysis to which we have referred are dealt with fully under "Stray Current Electrolysis" which is not a good title, though it can be discovered by some search.

The articles on "Dynamo Electric Machinery" and on "Telegraphy" and "Telephony" are worth perusal. The former, though short, covers the subject adequately and is well illustrated. The other two by Mr. A. E. Stone and Dr. F. B. Jewett respectively, are worthy of their authors. The latter is both practical and theoretical in its treatment and useful sections deals with long distance transmission and with carrier currents. Thirty-five pages is given to thermonics and this includes a section by Mr. R. L. Smith-Rose on "Thermionic Valves" which, besides reviewing the subject in a masterly manner, gains additional value for its complete bibliography. In this corner of the field two short articles by Dr. F. W. Aston on "Positive Rays," and by Sir William Bragg on the "Electron Theory" may be mentioned, while Dr. W. H. Eccles deals with "Wireless Telegraphy."

In the heavier field we have already mentioned the "Dynamo-Electric Machinery" section. This contains no reference to dynamos of the homopolar type neither does the fact that it deals with motors, rotaries and converters appear from the index. In the case of the two last-named machines this is perhaps just as well as there does not seem to be any reference! It is somewhat surprising to find so much space given to arc lamps and arc lamp carbons, and so little to incandescence (*sic*) lamps. The word "gas-filled" appears throughout with a hyphen. Also the International Electrotechnical Commission's contractions for volts, amperes, etc., are not used (at any rate universally). To do so would have saved a great deal of space.

These small criticisms do not, however, detract from the great value of the book which is a mine of information in a field which, at present, is not adequately covered by any one work.

Magnetism and Electricity. By J. P. YORKE, M.Sc. (London: Edward Arnold and Co.) Pp. viii + 248. 5s. net.

This is a new edition, entirely re-written, of an elementary introduction to magnetism and electricity. The author states in the preface that, in its original form, it has been in steady demand during the last twenty years, and that it was, and is, addressed primarily to students of technical institutions who are out to learn and understand, and not merely to memorise, for understanding is essential for engineers.

The author it to be congratulated upon the success with which his ideal, that of every real teacher, has been realised in this volume. The general scheme is excellent, with respect both to the subjects included and the order in which they are treated. The exposition is clear and concise, and the numerous, well-executed diagrams are invariably helpful, notably the various delineations of magnetic and electric fields. A praiseworthy feature is the early introduction of simple measurements requiring only the simplest of apparatus. The realisation of the difficulties experienced by beginners and the mistakes to which they are prone, and of the explanations required to meet them, is characteristic of the observant teacher of long experience. A few pages of miscellaneous questions and a good index complete the volume, which is well printed on good paper. It may be unreservedly commended as an elementary and interestingly written introduction to its subject.

G. W. DE T.

Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

HIGH VOLTAGE POWER TRANSFORMERS.

To the Editor of THE ELECTRICIAN.

SIR,—The operating experience gained in the last few years with 110 000 V transformers shows that the principles of design of the *now* more common type—i.e., the upright core type, have been along round lines. This type gives the simplest mounting of the windings, also the best advantages in the event of repairs, etc. The old idea that the core type transformer is more liable to damage by short-circuits has been entirely removed. It is interesting to see that British manufacturers are concentrating their attention to the manufacture of this type.

The writer (and no doubt every reader of your journal interested in this subject) is greatly obliged to the various transformer manufacturers for the information recently contributed by them in answer to my request.

It may now go on record that *several* British manufacturers —thanks to the good working experience gained in the last few years with h.p. power transformers—have designed and built and now have in successful operation, power transformers on 110 000 V circuits; that quite a number of manufacturers are actually building, have already built, or have on order, power transformers to operate on 60 000 V circuits and that all these manufacturers are in a very satisfactory position to design, build, and to guarantee their respective transformer products for 110 000 V circuits. Therefore no reason is now left for *any* engineer or undertaking (with particular reference to the Colonies, India, etc.) to assume or feel that British manufacturers cannot supply them with necessary requirements, such as line insulators, transformers, etc., for 110 000 V, or even 132 000 V, in fact, in the writer's opinion, it can now be taken that for voltages of this order, difficulty or uncertainty in the matter of design, manufacture and assembly, etc., is a thing of the past.—I am, etc.,

WILLIAM T. TAYLOR.

London, N.10.
February 9th, 1923.

ANOTHER TRANSFORMER PROBLEM.

To the Editor of THE ELECTRICIAN.

SIR,—It is, of course, possible to connect a three-phase transformer to a three-conductor cable carrying alternating current at, say, 1 000 V between phases. I would like to ask, first: Is it possible to obtain from this transformer three entirely separate secondary currents of single phase, all at the same voltage, say, 200 V, or all at different voltages, say, 100 V, 200 V and 400 V, respectively?

And second, Would there be any difficulty if these secondary currents were very heavy, say, 5 000 A each?—I am, etc.,

WIREMAN.

In the interests of Anglo-American trade, the DECIMAL ASSOCIATION is urging that the litre should be adopted by the British and American Governments as the common unit of capacity, in place of the gallon. There is a 20 per cent. difference between the Imperial and American gallons. The American Association for the Advancement of Science has strongly declared itself in favour of the metric system.

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Merchandise to Sell and Profit By.

In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

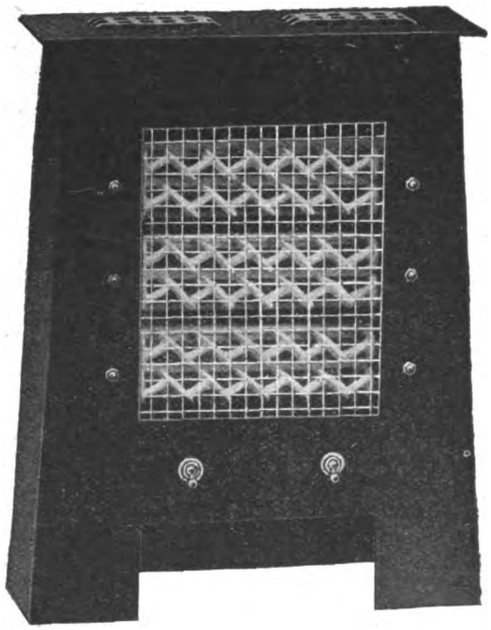
It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

An Electric Fire that is "Redot."

If there is any meaning in a trade name the "Redot" Fires distributed by J. and W. B. SMITH will prove a "red hot" line for retailers. It is a safe prophecy to make that a good selection of these fires displayed in a showroom will readily attract buyers. Among the many reasons which will make for this condition is first, the fact that the design of the cases is distinguished, and secondly the method employed in constructing the element is an entirely new one which, it is claimed, differs considerably from other fires at present on the market.

Our illustration is of catalogue number E. 73 277. This is rated at 3 kW and listed at 151s. It is not possible for us to show an



A TYPICAL "REDOT" FIRE.

illustration only of the element but a sample fire should be ordered from the makers and the design carefully studied. The briefest description of the element is that two tubular fireclays are mounted on a thick fireclay base. Into each of these tubular fireclays (which are of irregular design as will be seen from our illustration of the complete fire) is inserted a spiral coil of the best michrome wire closely wound. The whole element is then backed by a sheath of tinplate which, it is claimed, adds greatly to the strength and durability of the fireclay. Further, the fireclay bars are mounted in the various designs of frames rather closer than is usual—the finished effect being a pleasing, massed red hot glow.

G.F.C. Electric Light Fixtures.

We have received from the GENERAL ELECTRIC Co. a copy of a new edition of their catalogue of electric light fixtures (Section F of the complete catalogue). This new list, which is being mailed to the company's trade customers, contains some 216 pages of designs, many of them entirely new, which combine the requirements of modern lighting with artistic effect. It need hardly be said that the general get up of the catalogue is excellent, both technically and typographically. It is a credit to the producers and will, we feel sure, find an honoured place in those bookcases where catalogues are kept.

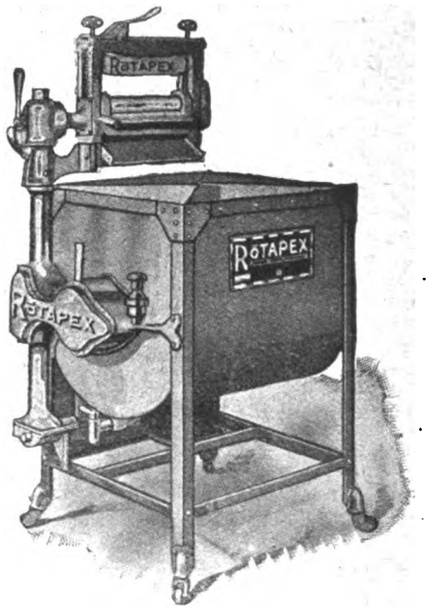
All list prices have been revised to include reductions in the cost of labour and material to date of issue, and it may be expected that these prices will now remain stabilised.

The list is a new departure in that it is produced throughout by the photogravure process. Four beautifully reproduced colour designs of typical fittings are included and altogether the list is, we imagine, the most comprehensive and complete volume of its kind. It should be used both for immediate study and future reference.

The arrangement of the sections of the catalogue is simple and logical and easy for reference. The excellence of the illustrations will render the list of the greatest value to dealers, architects and engineers in aiding them and their clients to make a selection.

"Rotapex" Electric Clothes Washer.

DUNCAN WATSON have just announced a substantial price reduction on the "Rotapex" electric washer. This will give the retailer the opportunity of boosting this line now that the price is more attractive. With the "sales helps" offered by Duncan Watson in the way of attractive lists and show cards, a boost will mean results in terms of orders. It is appreciated that the field for the washer is hard in the tilling because of the heavy initial cost of these



A CHEAP CLOTHES WASHER.

machines and also because of the inherent prejudice of housewives to what are described (through lack of education by the retailer) as "gadgets." It is this prejudice that hampers sales more than the initial cost. If it were possible to market a washer for £5 the seller would still be faced with this scepticism. Therefore our advice to the retailer is to plan his boost in such a way that the education of the housewife is given first attention. Leave the question of price until the last and then the forty odd pounds will be but a mere "bagatelle" compared with the service secured!

A "Wireless" Newcomer.

"Four pounds fifteen shillings complete, guaranteed for ten years and with a range of thirty miles," is the platform of the sales publicity issued by the CABLE ACCESSORIES Co. announcing the

ONE OF THE LATEST WIRELESS SETS.

"Revophone." This is one of the many recent newcomers in the wireless field. The equipment which we illustrate includes a "Revophone" crystal receiver in a high grade polished mahogany case, spare crystal, one set of head phones and all aerial equipment.

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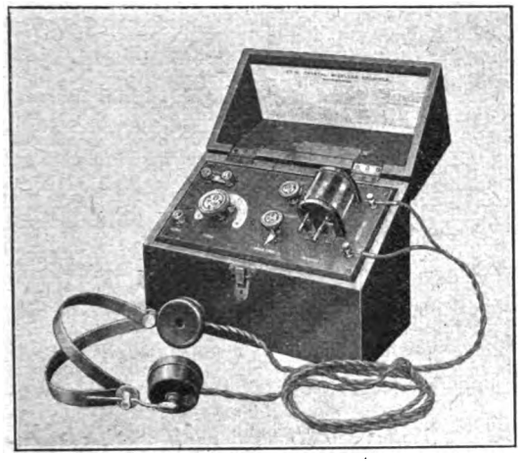
A B.T.-H. Contribution to the "Wireless" Boom.

The BRITISH THOMSON-HOUSTON Co. have just issued price list No. 7 312, fully describing the crystal receiving set which we illustrate. A "wireless set" manufactured by the B.T.-H. can be marketed by retailers with every confidence, and this is important because it is yet early to get the feel of the best sets on the market. The "wireless" boom may prove a "South Sea Bubble" to many retailers if care is not exercised in the selection of the sets handled.



A BOON TO BROADCASTERS.

Already it is apparent that sets (particularly crystal sets) are being built down to a price instead of up to a standard. The "B.T.-H." in the famous circle is, however, sufficient guarantee this is not being done in one case.

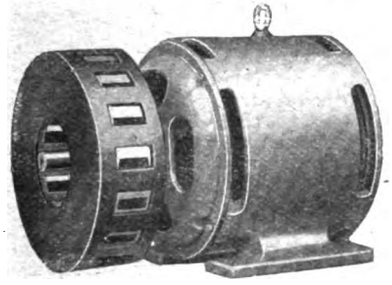
Our first comment must be on the distinctive style of walnut case in which the whole apparatus is enclosed. This is made like a stationery cabinet, and when the lid is opened the equipment appears as a sloping desk.

Space will not permit our enlarging on the technical details. A special feature, however, is the provision of two crystals, thus providing an alternative with which to "chop" and "change" at will, or, what is more important, one is always an auxiliary in the event of one jamming or temporarily put out of action. Each set is supplied complete with double earpiece, 4 000 O head telephone and aerial equipment, at a list price of £7 15s. Stocks are held by all "B.T.-H." local offices and "broadcasters" should make a point of seeing them before finally deciding on the purchase of apparatus.

A "Gent" Electric Motor Syren.

Those contractors who particularly cater for industrial work should carefully survey local possibilities for business in electric motor syrens. It is obvious from the sounds which rend the air in manufacturing districts at regular times during the day that the old fashioned bell and steam "bull" have not been entirely replaced. This would be further proved by a canvass of all the factories in the district. The selling points of the syren must be two at least, these being plenty of noise (that is, "scientific" noise), and a motor that will not fail at the critical moment.

These two talking points can be well backed up with the "Tangent" range of syrens made by GENT AND CO. The illustration which we show is of a tangent syren with a single rotor, suitable for d.c., and rated at ¼ H.P. Syrens are also made with 2, 4, and 8 rotors for both a.c. and d.c. Any criticism which is made that syrens make too much "noisy" noise can be met with these multiple rotor syrens. For example, in the case of the two-rotor machine the rotors have different numbers of voices, and the resultant notes, while more powerful, are less irritating in close proximity. Folder No. 57, published by GENT AND CO., fully describes the several types and should be consulted by those who desire plenty of noise created in a scientific fashion.

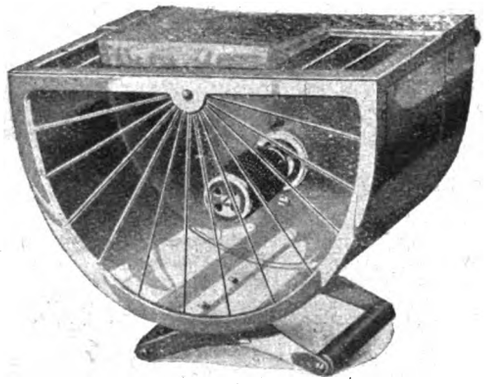


A SUBSTITUTE FOR THE STEAM WHISTLE.

The "Falco" Double Ray.

The "Falco" double ray combined table heater and toaster is an attempt by the FALKIRK IRON COMPANY to answer the criticism that the many types of "sunflower" heaters do not give a sufficient general heat. The problem cannot be better expressed than in the "Falco" folder thus:—"The old style is like a spotlight. . . . The double ray distributes a heat of a pleasant intensity over a definite area.

Besides being used as a heater it can also be readily employed as a toaster and is therefore a useful device for the domestic consumer. It is made wholly of polished copper with brass trimmings, ebonised handle and fibre legs. We show the Double Ray in position as a toaster.



THE "FALCO" DOUBLE RAY AS A TOASTER.

The sales distribution of all "Falco" appliances is made by the HOTPOINT ELECTRIC APPLIANCE CO.

Price Lists, Catalogues, etc.

The "Terry" mechanical time switch control is a new device just placed on the market. The BOROUGH ENGINEERING CO. have full selling rights from the patentees.

To quote HERBERT TERRY, "order is natural law," and their clips for the systematic arrangement of engineering tools, etc., should be an item to be noted for the internal arrangement of stores, etc.

The "Sterling" radio receiving sets (made by the STERLING TELEPHONE CO., and the "Magnavox" loud speaker, are illustrated in detail in publication No. 342. A copy will be sent to all *bona fide* retailers on application.

"The heat treatment of carbon and low alloy steels" is the subject of a pamphlet published by AUTOMATIC AND ELECTRIC FURNACES. As is well known, this company manufacture the Wild-Barfield electric furnaces.

An interesting heating and cooking list (abridged), together with two leaflets describing the advantages of the A.B.C. electric washing machine and "Sunflower" vacuum cleaner have been received from the SUN ELECTRIC CO. Buyers take note!

Readers of THE ELECTRICIAN who have to keep pace with modern development in transformers have no doubt studied "Transformer Abstracts" published by JOHNSON AND PHILLIPS. They will therefore require the index to these abstracts, which this company has just issued.

A new catalogue, No. 166, is of interest because it describes the new design of element embodied in "Redot" Fires marketed by J. AND W. B. SMITH. The designs of many of the cases show a distinct new line of thought. We refer in detail to these fires in our "Merchandise to Sell" pages.

The IGRANIC ELECTRIC, who are the agents in this country for the P. E. CHAPMAN CO. (St. Louis, M.O., U.S.A.) have now particulars of a very useful commutator soldering machine which is going to save a lot of time and trouble for those who need a machine and who want something different to the old style.

A very tasteful catalogue, "Simplex Lighting Fixtures," giving many new ideas for the home and business, is the note of this book. Retailers should see that the Simplex catalogue is in their list. The fixtures on the "Simplex" unit system and "Triple-Purpose" signs and weatherproof lanterns are items to be carefully studied.

Contractors and others who hold the 1921 catalogue of MARRYAT AND SCOTT will be interested in the new price list just issued. All prices in the 1921 catalogue are cancelled, and the new schedule of prices show a considerable reduction without in any way departing from the high standard which Marryat and Scott have set themselves.

SMITH AND ANSELL have issued a new catalogue of electric light fittings. The range of designs is comprehensive and many are distinctive. A particular feature of the list is that it is a very useful "pocket book" size which has some advantages over the bulky dimensions of many fittings manufacturers. The list is well worthy of study by fittings showroom buyers.

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British Industries Fair.

Electrical Exhibits at London and Birmingham.

The ninth British Industries Fair opens on Monday next at the White City, London, and at Castle Bromwich Aerodrome, Birmingham, simultaneously. Most of the exhibits connected with the electrical industry are at Birmingham, but visitors to the London Fair will be interested in the following stands :—

Joseph Bourne and Son, porcelain insulators and battery jars, stand G 73.

Fulham Pottery and Cheasin Filter Co., insulators, stand G 30.

Ever Ready Co. (Great Britain), electric batteries, etc., stand K 32.

Thos. Webb and Sons, electric bulbs, stands G 28 and 29.

G. C. Aimer, X-ray tubes, high frequency and wireless apparatus, stand B 8.

Erinoid, Ltd., electrical fittings made of "Erinoid," stand K 63.

The exhibitors at Birmingham include the following :—

Wm. Kenyon and Sons, driving ropes, boiler covering, etc.

Accles and Pollock, weldless steel tubing for trolley poles, transformers, wireless masts, etc.

J. H. Tucker and Co., Switchboards, switchgear, tumbler switches, lighting and heating accessories.

British Mannesman Tube Co., tubes, etc.

Hollings and Guest, hydraulic presses, pumps, etc.

W. and T. Avery, scales, weighing and testing machines.

Accles and Shelvoke, electric motors, etc.

Ackroyd and Best, lamps, etc.

Automatic and Electric Furnaces, Ltd., electric furnaces.

Batteries, Ltd., storage batteries.

Cable Accessories Co., electric light fittings.

Coalbrookdale Co., electric light pillars, etc.

Edison-Swan Electric Co., electric lighting and heating apparatus.

Coventry Electrical and Engineering Co.

Ebonestos Insulators, Ltd., insulating materials.

Edison Accumulators, Ltd.

Falkirk Iron Co., electric heating and cooking apparatus.

Industrial Appliances, Ltd., electric trucks.

Kelvin, Bottomley and Baird, Ltd., electric instruments, etc.

Park Royal Engineering Works, electrical machinery, etc.

Premier Electric Heaters, Ltd., electric heaters.

Charles Purden, Ltd., engineers' stores.

Rawlplug Co., "Rawlplugs" for electric installation work.

Rippingille's Albion Lamp Co., electric stores.

Rotax (Motor Accessories), Ltd., motor car electric lighting and starting outfits.

George Salter and Co., telegraph wire tension ratchets.

J. B. Stone and Co., belt fasteners.

Sturge and Baker, electrical machinery, etc.

Sutcliffe (of Crumpsall), Ltd., vulcanised fibre.

Tangyes, Ltd., gas engines, etc.

Tubes, Ltd., weldless steel tubes.

Venner Time Switches, Ltd., time switches.

Both sections of the Fair will remain open until March 2nd. The Duke of York, who will pay the Birmingham section a visit on February 22nd, has consented to receive a wedding gift of aluminium household utensils from the members of the British Aluminium Hollow-ware Manufacturers' Association. A similar present was made a year ago to the Princess Mary.

The number of exhibits is maintained, but there are not quite so many very large displays as was the case last February. On this occasion there will be an innovation in exhibits of manufactured goods from Canada, Australia and South Africa. Buyers from thirty-five countries have intimated their intention of being present. As usual, manufacturers only are exhibiting.

Faraday House Scholarships.

The Secretary of Faraday House Electrical Engineering College announces that the annual examinations for a Faraday scholarship of fifty guineas per annum tenable for two years in college and one year in manufacturing works, and for a Maxwell scholarship of fifty guineas per annum tenable for one year in college and one year in works, will be held at Faraday House, on April 10th, 11th and 12th. Exhibitions may also be awarded to candidates who acquit themselves creditably in the above examinations.

The subjects of examination for the Faraday scholarship are geometry, algebra, trigonometry, dynamics, statics and hydrostatics, geometrical and freehand drawing, chemistry and physics. For the Maxwell scholarship the subjects are mathematics, dynamics, statics and hydrostatics. Further particulars may be obtained from the Secretary, Faraday House, 62-70, Southampton Row, London, W.C.1.

The "European Commercial," dated February 10th, contains full particulars as to PASSPORT VISA REGULATIONS in Portugal, Finland, Esthonia, Latvia, Turkey, the Argentine, Brazil, and U.S.A.

Crosby Lockwood and Son send us their quarterly announcement of NEW PUBLICATIONS, and are prepared to send copies to all interested. The list contains particulars of several recent works on electrical engineering, wireless telephony, workshop practice, etc., published by the firm.

Prof. Rontgen Dead.

The Discoverer of the X-Rays.

The death is announced of Prof. WILHELM KONRAD VON RÖNTGEN, the discoverer of the X-rays. He died last week at Munich, aged 78. Educated in Holland and at Zurich, he became assistant to Kundt at Würzburg, and afterwards at Strasbourg; of the latter University he became a *privatdozent* in 1874. After a short period as Professor of Mathematics and Physics at the Agricultural Academy of Hohenheim, he returned to Strasbourg as Extraordinary Professor of Physics in 1876. Three years later he removed to Giessen as Professor of Physics and Director of the Physical Institute, and in 1885 to the corresponding Chair at Würzburg. After his discovery of the X-ray he was appointed Professor of Experimental Physics and Director of the Physical Institute at Munich; these posts he resigned in 1919.

In THE ELECTRICIAN of January 24th, 1896 and subsequent issue, an account of Prof. Röntgen's discovery appeared, under the title of "A New Form of Radiation." Many physicists had studied the behaviour of rarefied gases inside vacuum tubes, notably Sir William Crookes, but no one had suspected that any radiation could be obtained outside the glass. The discovery that some phenomenon was occurring outside was made almost simultaneously by Prof. Lenard and Prof. Röntgen, and for this they were, in 1896, jointly awarded the Rumford Medal of the Royal Society. Röntgen was also made an honorary member of the Royal Institution of Great Britain, and received the Nobel Prize for Physics in 1901.

His discovery was in a sense accidental, in that the material necessary for demonstration of the rays happened to be near a well-exhausted Crookes's form of vacuum tube, but he had the merit of noticing that the fluorescent screen was lighted up even when the tube was wrapped in black paper; and he studied the phenomena exhibited by the shadows of objects thrown on the fluorescent screen, finding that many things, such as books, threw only a mitigated shadow, thus proving themselves fairly transparent to the rays, while substances containing elements of high atomic weight were comparatively opaque.

There was much discussion at first as to the nature of the rays, and it was suggested that they might be a new kind of ethereal disturbance altogether, based on longitudinal instead of transverse vibrations. Further experimentation negatived this idea, and every one now accepts the view that the Röntgen or X-rays are entirely of the nature of light, but very high up in the region of the ultra-violet spectrum, the wave-lengths being so short that they are not deviated by prisms at all, nor measurable by any kind of artificial diffraction grating; the natural stratification of certain crystals being the only means whereby their wave-length has been determined—work which has been carried on brilliantly in this country by Sir William Bragg and others.

A Large Power Station.

Facts and Figures Concerning Detroit, U.S.A.

Mr. W. H. Patchell recently gave a lecture before the CHELMSFORD ENGINEERING SOCIETY on "The Development of Large Power Stations." Capt. H. Riall Sankey (president) occupied the chair.

Mr. Patchell described the electric supply system of the city of Detroit (U.S.A.) and the surrounding district, which is one of the largest and most highly developed systems in existence. The area covered is 730 square miles and the Electric Supply Co. generates 4 000 000 kWh daily. In Detroit electricity is used much more extensively than in this country. In Glasgow the consumption per head of population per annum is 157 kWh, whereas in Detroit this figure stands as high as 630 kWh.

This has been achieved largely by propaganda work on the part of the company, which has large show rooms, where every sort of electrical appliance is displayed. Washing machines, flat irons, etc., can be taken and tried for a week on approval and then returned if the prospective purchaser is not satisfied. The use of electricity has been increased in the country by charging the rural consumer at the same rate as the town consumer, instead of making the users of a new line pay for its construction.

With the generating plant, the tendency is to use very large units, the latest sets laid down being 45 000 kW single spindle machines. Although the efficiency of these large generators is much the same as the efficiency of a set of, say, half the size, yet an economy is effected because, approximately, the same staff can run either. The voltage for general use is 110, though for transmission over long distances, pressures up to 48 000 V are in use, and a line is now under construction to carry 100 000 V. There seem to be no regulations in America to safeguard the public when high tension lines are used.

The Blue Book.

Ready on February 21st.

The dispute in the London bookbinding trade has been submitted to arbitration. Meanwhile, work is to be resumed. In consequence, "The 'Electrician' Electrical Trades Directory and Handbook," the publication of which has been delayed by the dispute, will be ready on Wednesday, February 21st.

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Post Office Engineers' Dinner.

Telephone Developments Outlined by the P.M.G.

Major T. F. PURVES, Engineer-in-Chief, presided at the annual dinner of the Post Office Engineering Department at the Connaught Rooms on February 9th. He was well supported, the attendance exceeding 250.

The POSTMASTER-GENERAL, in giving the toast of the Department, said that the company might well consider any Postmaster-General at that function as a more or less embarrassed phantom, regarding his term of office as a passing phase in a variegated career. His own case was different, however, as he intended to remain in the Post Office for the rest of his life. Dealing with the work of the Department, Mr. CHAMBERLAIN referred to the difficulties which had beset the telephone system since it had been taken over. The result of the good work done since the War was now becoming apparent, and in 1922 new subscribers numbered 135 000. One thousand miles of new ducts had been laid and six hundred miles of cables drawn in and jointed.

Automatic exchanges were also being developed. These involved accurate prediction of what conditions would be years ahead. They were costly, but they represented greater accuracy and a saving in personnel.

His job, continued Mr. CHAMBERLAIN, was to see that the engineer was not hampered by lack of the resources which were essential if a great revenue-earning department was to function properly.

Paymaster and Postmaster, Too.

The CHAIRMAN, in reply, drew forth loud applause by expressing his hope that Mr. Chamberlain's attention to their department would involve his office of Paymaster-General as well as that of Postmaster-General. The Post Office, he continued, was now showing what it could do with the telephone system as a whole. It had had no real opportunity before. The time was now coming, however, when a cheap and reliable telephone system would be at the disposal of anyone who wanted it. Costs must be lowered by improving organisation and design and by research work. He hoped they would not be handicapped by lack of funds. Although they spent a lot of money, they were not reckless.

Responding to the toast of "The Visitors," proposed by Mr. R. McILROY, Mr. FRANK GILL referred to his election as president of the Institution of Electrical Engineers as a recognition of a lifetime spent in telephone and telegraph engineering. He urged that the public should be taught everything possible about the telephone service, citing American methods in this respect.

Mr. G. F. PRESTON, late Controller of the London Telephone Service, also replied.

Sir EVELYN MURRAY congratulated Major Purves on his appointment. His own interest in the engineering department, he said, was always benevolent, if critical.

Electrical Imports and Exports.

January Totals and Comparisons.

IMPORTS.—The following are official values of electrical machinery, apparatus and material imported into this country during January, 1923, with increase or decrease compared with January, 1922 :—

Electrical machinery, £110 976 (increase £64 105); telegraph and telephone cables, other than submarine, £8 393 (increase £4 896); telegraph and telephone apparatus, £24 860 (increase £7 665); other electrical wires and cables, rubber insulated, £15 400 (increase £10 793); with other insulations, £8 568 (increase £5 035); carbons, £4 207 (increase £1 560); glow lamps, £24 144 (increase £5 108); arc lamps and electric searchlights, £18 (increase £18); parts of arc lamps and searchlights (other than carbons), £2 543 (increase £1 976); batteries, £12 270 (increase £8 620); electrical instruments (commercial and scientific) and electricity meters, £10 177 (increase £6 344); switchboards, £80 (decrease £865); other electrical goods and apparatus, £62 466 (increase £12 266). Total of electrical machinery, apparatus and material (other than uninsulated wire), £284 102 (increase £125 521).

EXPORTS.—The exports of electrical machinery, apparatus and material during January, 1923, with increase or decrease compared with January, 1922, were as follows :—

Electrical machinery, £432 902 (decrease £132 362); including railway and tramway motors, £12 821 (increase £943); other motors and generators, £254 059 (decrease £90 440); and other electrical machinery, £164 022 (decrease £42 865); telegraph and telephone cables, submarine, £75 121 (increase £71 728); other than submarine, £54 909 (decrease £26 754); telegraph and telephone apparatus, £174 724 (decrease £46 347); other electrical wires and cables, rubber insulated, £118 261 (increase £62 141); with other insulations, £86 355 (decrease £37 611); carbons, £6 670 (decrease £73; glow lamps, £29 032 (increase £22); arc lamps and searchlights, £446 (decrease £505); parts of arc lamps and searchlights (other than carbons), £84 (decrease £453); batteries, £47 355 (increase £13 961); electrical measuring instruments (commercial and scientific) and electricity meters, £25 634 (decrease £10 832); switchboards, £15 508 (decrease £70 467); other electrical goods and apparatus, £127 089 (increase £4 169). Total of electrical machinery, material and apparatus, other than uninsulated wire, £1 196 090 (decrease £173 383).

Mr. W. T. Kerr Sentenced.

Three Years' Penal Servitude.

At the Hereford Assizes on Saturday last, Walter Talbot Kerr, formerly electrical engineer to Hereford Corporation, was found guilty on charges of converting to his own use money belonging to the Corporation, and was sentenced to three years' penal servitude, and also ordered to pay the costs of the prosecution.

The evidence for the prosecution was given in detail on page 147 of our issue last week, when the accused was charged at Hereford Police Court. It was alleged that he received two cheques of £90 and £810 from the Western Engineering Co. for electrical plant belonging to Hereford Corporation. These cheques he paid into his own private bank account. The total sum involved in all the charges was over £1 600.

Fraudulent Intention Denied.

In the witness box accused said he had never done anything as an accountant or as a business man, but he was allowed to trade by the Corporation, not only for himself, but for the Corporation. In regard to the £900 transaction, he said he told the chairman of the Electricity Committee about it, and the letters were written by Watson, his chief assistant. The letters were kept in the office in the ordinary way, and were open to inspection by the committee.

Counsel: What was the object of the money being paid into your account ?—Because the deal was to be that I should sell three sets and replace them by more powerful machinery of more economic design, and the committee report was that it was left to me to do the best I could.

At the time you paid the money into your account had you any intention of converting it fraudulently to your own use ?—Absolutely none.

In answer to further questions witness said the report that he had sold the Swansea plant for £640 was made out by somebody else—he had no intention that a false figure should be put in the report.

Mr. Justice Avory; What do you say about the report in which you stated you were still negotiating for selling a thing you had already sold ?—I suppose I must have been taking the three sets together. I am not sure how I arrived at the figures.

Counsel: Was £900 a high price for the plant ?—A very high price—unheard of.

Mr. Vachell, questioning Kerr on a statement that when he left the Corporation he was paid a cheque for £79 in settlement of part of his claim upon them, asked, "Had you forgotten at that time that you owed them £1 650 ? "—Oh, no.

Did you mention it ?—No, I did not.

Did you ever tell any officer of the Corporation that you had received £900 from the Western Engineering Co. ?—Not that I know of.

Mr. E. R. Dymond, formerly chairman of the Electricity Committee, said he had no recollection of Kerr telling him that he had received £900 from the Western Engineering Co. It was Mr. Kerr's duty to effect the sale and immediately enter it in the day book for the information of the Corporation.

George Henry Watson, chief assistant electrical engineer, said the sales were conducted in a perfectly open manner.

Judge on "Making an Example."

Summing up, the Judge said that forgetfulness and negligence were one thing and deliberate fraud was another. If they found a man telling deliberate lies for the purpose of covering up frauds he had committed, how was it possible to say that his conduct could be explained by mere negligence and forgetfulness ? It might be that the jury would think that had there been some other system adopted in the office of the Corporation those things would have been discovered. There was no system yet discovered, he regretted to say, which was proof against fraud; whatever the system was they had to trust somebody.

Without leaving the box the jury returned a verdict of guilty.

In sentencing the prisoner, the Judge said he took a most serious view of the case, and if anything could have aggravated his conduct, it was the attempt which he had made in the witness box to give false explanations of his dishonesty. If he had taken a different course, and had admitted his fault, he would have mitigated the sentence. But a man occupying such a position who set such an example to the other employees as he had done required to be made an example of himself. The sentence of the court was that he must go to penal servitude for three years, and the Judge directed him to pay the costs of the prosecution.

South African Mining Year Book.

The 1922-23 edition of the "South African Mining and Engineering Journal Year Book" is a special number in celebration of the production of minerals by South Africa to the value of one thousand million pounds. The volume contains a wealth of descriptive and reference matter in regard to South African mining. An engineering and industrial section contains particulars of some prominent British and South African firms which supply electrical and other mining machinery. The price of the book is half a guinea and it may be obtained from the London office of the Argus South African Newspapers, Ltd., 82, Fleet Street, E.C.4.

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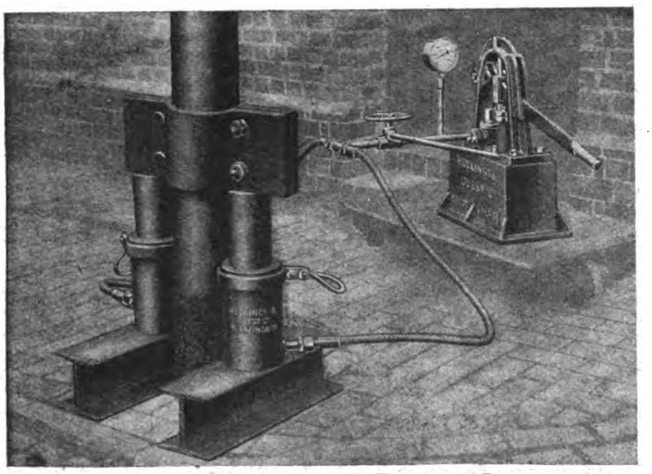
Tramway Reconstruction.

Portable Plant for Removing Old Standards.

Particulars of a novel and interesting machine which has recently been made for pulling out the old tramway standards are given herewith. Our illustration shows the machine in use at Birmingham, where the Corporation Tramways Department have recently pulled out a large number of old tramway poles in connection with laying down of the new railless cars which we describe elsewhere in this issue.

The removal of these standards by the old method of breaking up the concrete by hand was a slow and laborious job, and a Birmingham firm of engineers—HOLLINGS AND GUEST—therefore devised a small



HYDRAULIC JACKS PULLING OUT TRAMWAY STANDARD.

portable plant which quickly and easily raises the standards out of the ground. The plant consists of two small hydraulic jacks which are placed on the ground, one on each side of the standard to be lifted. A bearer plate is bolted to the standard at a suitable height from the ground, and under each end of this plate a hydraulic jack is placed. The power is provided by means of a hydraulic hand pump which pumps water into each of the cylinders of the jacks, thus forcing the ram up against the bearer plates. By this means the standard is forcibly pulled away from its foundations in a steady and noiseless manner. The bearer plate is then lowered down the standard and the operation repeated until the pole is right out of the ground. The top of the standard is steadied by the use of a pulley block carried on one of the familiar overhead travelling trolleys, and thus a great saving of time, hard labour, and public money is effected, to say nothing of rendering excavations in the footpath and horse road unnecessary.

Mangnall-Irving Thrust Borer.

Demonstration of Conduit Laying in North London.

A demonstration was recently given of the Mangnall-Irving thrust-borer laying Key fibre conduit below the Friern Barnet Road, London, N. Three 3 in. bore conduits had to be laid side by side across the road from footpath to footpath to take three cables on an extension of the North Metropolitan Electric Power Supply Co.'s system. The road is 34 ft. 6 in. in width from curb to curb, all on concrete, with double tram track and wood blocks in centre, patent asphalt roadway each side and concrete slab footpaths. Four 9-hour working days were taken to complete the operations, and with an average of 4 men employed at 1s. per hour the labour charges equal £7 4s.

Two borings driven on the first day were arrested a few feet short of the receiving pit. These borings were made at a rather shallow depth with the result that the pilot became embedded in the footing of the old road existing below the present new surface. This was proved by the pilot point after withdrawal being coated with powdered stone concrete. The next day the machine was taken to the opposite side of the road and boring was started 5 ft. 5 in. below the top of the footpath, and was sighted to terminate at a higher level in the pit opposite. The 3 in. pilot hole was driven through, and came out at exactly the desired level, although very heavy resistance of a stone or ballast nature was encountered under the centre of the tram track. In order to make sure of getting the final hole (5 in. diameter) through these obstructions, it was done in two stages, i.e., a 4 in head was driven through the 3 in. pilot hole and then a 5 in. driven through the 4 in. hole. The withdrawal mechanism of the machine was put into operation, and as the ground about the centre of the road appeared to be alternatively soft mud and hard ballast, the 5 in. head was drawn back to clear the way for the fibre conduit, which was pressed into the hole by hand length after length, as the boring tubes and 5 in. head were withdrawn.

No difficulty was experienced in pressing the conduit by hand through borings made in such varying strata. The work took four days to complete. In one case, on a slightly longer crossing nearly a fortnight was required, but even then a saving was made and a good road surface remained unbroken.

Unemployment Insurance by Industries.

Sir Lynden Macassey's Plan Outlined.

Sir LYNDEN MACASSEY gave an address on "Unemployment Insurance by Industries" at a special meeting of the Council of the Charity Organisation Society on Monday. He said that in a number of large works situated in London the whole system of unemployment insurance benefit was administered for two thousand or three thousand men with two books and one or two clerks. He suggested that it was perfectly practicable to administer a large scheme of unemployment insurance by industry itself. From the point of view of administration there was no antecedent probability that administration by a Government Department would be more efficient than administration by employers and employed. He thought the financial burden should rest on employers and labour combined, but he recognised that at present it was impossible to finance any scheme unless some State assistance was given.

The plan of dealing with industry as a whole he thought would be unsatisfactory. One of the objects to be aimed at was to secure a spirit of co-operation between employers and employed in eliminating unemployment, in making the scheme efficient, and preventing malingering, and one great aggregation of industries acting through one representative board would be no better than the present State scheme. As a counsel of perfection he would urge that the ideal type of organisation was insurance by each individual industry. But there were great difficulties. In some industries the normal rate of unemployment was high and others were very loosely organised. Thirty per cent. of the workers could not under present conditions be organised. But he considered that it would be worth while to organise the 65 or 70 per cent., who could be so organised in industries under which they would have their own unemployment insurance. Thereby would be created in them a corporate sense of loyalty and pride in the industry.

Other workers would have to be dealt with by some residual scheme. He would like to see it run by industry as a whole, but it required a considerable amount of organisation, and as he was at present advised he was afraid it would be a matter for the State. He suggested that there should be a central fund, as there was to-day, and that the payments out of that fund to each individual industry and the payments into it through the contributions of that particular industry should be adjusted in such a way as to provide a contribution from the self-insuring industries to the industries which could not provide their separate schemes and had to be covered by a State scheme. Such a fund might be arrived at by means of contracting out of the present State scheme.

Lectures by Prof. Miles Walker.

Further particulars are now available concerning the course of four lectures by Prof. Miles Walker on "The Control of the Speed and Power Factor of Induction Motors," arranged by the University of London. The lectures will take place at the Institution of Electrical Engineers at 5.15 p.m. on February 21st and 26th, and March 14th and 21st.

The syllabus is as follows:—Lecture I.—Chairman, Mr. Frank Gill: Characteristics of the induction motor; the method of inversion applied to the study of the circle diagram; effect of changing the power factor of the rotor circuit. Lecture II.—Chairman, Prof. E. C. Coker: Various methods of changing the speed of induction motors and their use in motor applications. Lecture III.—Chairman, Prof. E. H. Lamb: The use of double and triple circuits in series with the rotor; applications to ship propulsion; method of foretelling the characteristics. Lecture IV.—Chairman, Dr. S. Parker Smith: Phase advancers and a.c. exciters; speed changing by a.c. excitation; other methods of injecting a.c. voltage and their practical applications. This subject is of great importance, and special arrangements are being made to report the lectures in THE ELECTRICIAN.

The lectures will be illustrated by lantern slides. Admission is free, without ticket.

Institution Notes.

Revised figures issued by the ELECTRICAL TRADES BENEVOLENT INSTITUTION show that the contribution list in connection with the annual festival dinner totalled £852 9s. 3d.

A "ladies' night" concert was held by the ELECTRO-HARMONIC SOCIETY on Wednesday at the Caxton Hall, London, S.W., commencing at 8 p.m. Mr. Llewelyn B. Atkinson occupied the chair.

The Southern Division of the ELECTRICAL POWER ENGINEERS' ASSOCIATION has arranged a lecture on "High Power Mercury Arc Rectifiers, with special reference to Traction Service," by Mr. R. L. Morrison, at the Institution of Electrical Engineers on March 2nd. Non-members of the E.P.E.A. will be welcome. The lecture will, it is stated, be of special interest to railway and tramway engineers.

The annual meeting of the BRITISH INDUSTRIAL "SAFETY FIRST" ASSOCIATION takes place to-day (Friday) at Caxton Hall, Westminster at 3 p.m., followed by the annual dinner at the Trocadero at 7 p.m. The four years' experience of the ASSOCIATION has, it is stated, shown that in no industry has there been failure to effect a reduction in the accident record. In one electrical engineering undertaking, a decrease of 26 per cent. in the number of accidents was recorded as the result of two years' membership.

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Legal Intelligence.

Ferguson v. Electric Components.

Mr. Justice Darling, in the King's Bench Division, on February 9th, had before him an action brought by Mr. Richard Henry Ferguson, of London, against Electric Components, Winchester House, Birmingham.

Mr. C. W. Lilley, for Mr. Ferguson, said his client was an iron and steel merchant. His action was to recover £593, balance of price of goods sold and delivered by Mr. Ferguson to Electric Components, which was the name under which the defendant, Mr. Rippingille, carried on business in Birmingham. The goods were conduit tubing which came from Germany, and were delivered at Birmingham and Manchester. Defendant alleged that there were certain overcharges for packing, and plaintiff's contention in regard to that was that the agreement provided for the charges made.

Mr. Alfred Barnes, manager to the plaintiff's tube department, gave evidence.

Mr. Rippingille, who conducted his own case, quoted a clause in the agreement between the parties, "packing for sea voyage extra," and asked witness if it were a custom in the conduit trade to deliver free packing in this country.

Mr. Barnes said it was a custom to deliver free package in England, because there was no sea voyage. But from Germany, whence the goods came, there was a sea voyage.

Mr. Justice Darling: Defendant says it is not a sea voyage from Germany to Birmingham and Mr. Barnes says it is. That is the only point.

Mr. Rippingille: That is so. Proceeding, Mr. Rippingille said that packing for sea voyage referred to export orders, such as to New Zealand or Australia. His inference was that the goods would be delivered in this country packed, and that if he wanted to export them there would be an extra charge for packing, which was usual in the conduit trade. If the goods had to go to tropical countries they would have to be packed differently than if they came through England.

Giving judgment, Mr. Justice Darling said the real dispute was whether or not plaintiff was entitled to charge defendant for packing the goods as though for a sea voyage. He had come to the conclusion that defendant was right. It was perfectly plain to both parties that the goods were to come from Germany. Most people did not make an extra charge for goods coming from Germany, but if the goods were brought to England and then went abroad across the Atlantic, there would be an extra charge. He would allow defendant £109 on the packing charge, which would reduce the claim to £484. Plaintiff would have judgment on the claim for £484, with costs.

Mica Contract Dispute.

An action, brought by Fellows Magneto Co., Cumberland Avenue, Park Royal, Willesden, against Mica and Micanite Supplies, Ltd., Great Winchester Street, London, was finished by Mr. Justice Shearman in the King's Bench Division on February 9th.

Mr. R. A. Wright, K.C., and Mr. Samuels were for the plaintiffs, and Mr. C. T. Le Quesne for defendants.

In outlining the action, Mr. Wright said the claim was for the return of certain money paid by plaintiffs to defendants for supplies of mica; or in the alternative, for damages on the ground that supplies of mica complained of were n t in accordance with the contract. Defendants denied that there was any agreement to take back the mica which they had supplied to plaintiffs and repay the money, and also denied that the mica was not in accordance with the contract. They also counterclaimed for damages for plaintiffs not taking deliveries. Plaintiffs were large makers of magnetos for motor cars, and the mica sheets were for use in magneto construction. Orders were given to defendants by plaintiffs in February, 1920, and on following dates for large supplies. The goods rejected were examined to such an extent as to show, in the opinion of the plaintiffs, that they could be rejected as a whole.

Defendants said it was too late to reject as plaintiffs claimed to do, that was in 1921, and to that plaintiffs said they could reject because owing to the nature of their business they would not inspect the goods until they were wanted.

Plaintiffs alleged that the mica was defective owing to badly cut edges, thickness, bubbles and ripples, which defendants denied.

Considerable evidence was given on both sides, and his Lordship finally gave judgment without calling upon Mr. Le Quesne to address him for the defence. Mr. Justice Shearman said in his judgment that it was a mistake in the case of such a fragile article as mica to say, as plaintiffs did, that people need not examine it for a year after delivery. Plaintiffs had said it was regular practice, and that one could not be expected to find out whether the mica was up to the quality and fit for use unless it was required immediately for putting into work. If it were a regular practice to keep mica a year before examining it that would be grossly hard on the supplier. His impression was that the mica supplied was a good average lot and he was not satisfied that plaintiffs had suffered any grievance. He would dismiss the claim with costs. On the counterclaim plaintiffs said they did not refuse to take deliveries, but he was satisfied that they did refuse, and he would give defendants judgment on their counterclaim for £1 024, with costs.

A Notable Display.

New "Met.-Vick." Showrooms at Manchester.

The METROPOLITAN-VICKERS ELECTRICAL Co. have opened new showrooms at 14, Long Millgate, Manchester. On Thursday last these were appropriately decorated for the display of electric light fittings in true period designs. This makes the choice of the right fitting a much easier matter than when it is merely taken from its wrappings and set on a warehouse counter. The fittings are made by Harcourts of Birmingham (recently acquired by Metropolitan-Vickers Company), who have a reputation as ornamental brass founders extending back for 100 years. Fittings of a plainer type are also on view, and there is a special room where wiring materials and supplies are installed. There is also an electric kitchen in which cooking demonstrations are given by means of the well-known "Cosmos" utensils. This is shown in the accompanying illustration. The "Cosmos" radiophone in various types and sizes is also part of the showroom display, and visitors can listen to a broadcasting entertainment.

A VIEW OF THE ELECTRIC KITCHEN.

Personal Items.

Mr. F. CHILCOTT has been appointed temporary engineering assistant in Lancaster electricity department.

Mr. ALFRED L. LANN has been appointed by the Manchester Corporation resident engineer at their Stuart Street works.

MR. C. O. MILTON, electrical engineer at Maidenhead, has been taken ill and has been ordered to Bournemouth for three months.

Mr. ALEC D. CHALMERS, borough electrical engineer of Gillingham, Kent, has tendered his resignation. He has been associated with the undertaking for 24 years.

Mr. C. FURNESS, electrical engineer at Blackpool, accompanied a party of members of Blackpool Corporation to Nice, with the object of picking up hints for the Blackpool Carnival.

Mr. P. J. ADDYMAN, works superintendent to Worcester Corporation Electricity undertaking, has resigned. The Electricity Committee has recommended the promotion of Mr. KING, chief engineering assistant.

Doncaster Electricity Committee recommends that the salary of Mr. S. R. WINDLE, the electrical engineer, should be increased from £600 to £700, and then by annual increments of £50 to £800 per annum.

Mr. R. G. COOPER has been presented by members of the South Wales branch of the Association of Mining Electrical Engineers with a silver tray, suitably inscribed, in recognition of his services as hon. secretary to the branch.

Mr. J. DALRYMPLE, manager of Glasgow Corporation tramways, Mr. R. S. PILCHER, manager of Edinburgh Corporation tramways, and Mr. J. FRASER, convenor of Dundee Tramways Commitee, have been added to the Sub-Committee of the Municipal Tramways Association on track maintenance.

MR. JOHN CONWAY, lecturer in Electrical Engineering at the Technical College, Portsmouth, has been appointed lecturer in electrical engineering at Dundee Technical College and School of Art in succession to Mr. Robert D. Archibald, who has accepted an appointment at the Royal Naval College, Plymouth.

The Edison Medal for 1922 has been awarded to Prof. R. A. MILLIKAN for "his experimental work in electrical science." For many years Prof. Millikan was on the staff of the Chicago University, becoming professor of physics in 1910. Since 1921 he has been director of the Norman Bridge Laboratory of Physics at the California Institute of Technology, and he played an important part in the establishment of the National Research Council.

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Imperial Notes.

AUSTRALIA.

Melbourne Electric Supply Co.'s Good Year.

The net profit of the Melbourne Electric Supply Co. for the year to August 31st, after placing £80 000 to general reserve and £30 000 to loans redemption account, was £82 211, plus £57 039 brought forward, making £139 250. A further dividend was declared at the rate of 5 per cent., making 10 per cent. for the year, free of British tax. £22 344 was carried forward.

Big Loan for Electricity Works.

A loan of £1 576 000 for the works of the VICTORIAN ELECTRICITY COMMISSION is provided for in the Electricity Supply Loan Bill recently introduced in the Victorian Legislative Assembly. The items include :—Main scheme, power house, etc., £760 000 ; Morwell open cut, £60 000 ; accommodation of employees, etc., £75 000 ; briquetting plant, £20 000 ; acquisition of North Melbourne Tramways and Lighting Co., £136 000 ; South-western district scheme, £120 000 ; Sugarloaf scheme, £50 000 ; Gippsland scheme, £70 000 ; other expenditure, £250 000.

CANADA.

Hydro-Electric Power Figures.

A report issued by the Canadian Government states that the WATER POWER UTILISED IN THE GENERATION OF ELECTRICITY in Canada at the end of December last was 3 000 000 H.P., of which British Columbia had 310 000 H.P., and Ontario 1 330 000 H.P.

CEYLON.

Electric Lighting Schemes.

A scheme is to be carried out this year whereby the towns of Minuwangoda, Veyangoda, Kochchikado, Peliyayoda, Avisawella, and Jaela will be LIGHTED WITH ELECTRICITY. The necessary funds have been provided and work will begin soon. Another scheme that has been projected is to provide electric lights for Dehiwala, Mount Lavina and Nugegoda, but the funds necessary are not forthcoming. The idea is that these small installations shall, in time, derive power from the large central hydro-electric scheme which has been proposed for the whole of Ceylon.

INDIA.

Hydro-Electric Scheme on the Sutlej.

The PUNJAB ELECTRICITY BOARD has decided to recommend the Punjab Government to adopt the " Shaban " scheme for the development of the water powers of the Sutlej for the generation of electricity, and the Government of India is to be consulted as to the desirability of extending the supply to Delhi. In the event of the receipt of an unfavourable report from the Geological Committee on the " Shaban " scheme, the Board will recommend the adoption of the Nangat Project No. 7.

Mysore Hydro-Electric Developments.

At the MYSORE GOVERNMENT'S SIVESAMUDRAM POWER STATION six 4 000 H.P. Francis turbo-generators are being installed, to replace 1 150 H.P. units. In an article in " The Times " Trade Supplement, giving some details of the scheme, it is stated that a contract has already been made to supply 20 000 H.P. to the Kolar goldfields, and the total demand on the system, including the supplies to Bangalore and Mysore and other consumers, will be 2 000 H.P. in excess of the plant capacity after the six new turbines have been installed, which it is expected to accomplish before the end of the current year. The total capacity of the plant, after the six new machines have been installed, will be 34 000 H.P. A new transformer station, alongside the engine-room, will contain five banks of 1 750 kVA s.p. water-cooled transformers, and the transmission systems to the Kolar goldfields, Bangalore and Mysore will be operated at 70 000 V.

SOUTH AFRICA.

Electric Stoves Wanted in Durban.

We learn that the Durban Town Council has authorised the borough electrical engineer to obtain full particulars which will enable him to place a scheme before them of HIRING OUT ELECTRIC STOVES to consumers of electricity. There are now 11 000 customers connected to the mains and heating devices are very freely used, the price of current after the consumption of a certain minimum being ½d. per kWh. Manufacturers are therefore invited to send full particulars of their manufactures to the Borough Electrical Engineer's office, Durban, South Africa. Approximate prices of stoves in lots of 100 packed and delivered c.i.f. Durban, Natal, would be useful.

WEST AFRICA.

Electric Light for Nigeria.

A correspondent of the journal " West Africa " urges that the time is ripe for the introduction of ELECTRIC LIGHT INTO NIGERIA. He states that a group has been formed in England for the purpose, and is of opinion that the matter is one that should be left to private enterprise.

A new ELECTRIC TRACTOR for BOATS, invented by an engineer of Leige, has passed its trials successfully, and is reported to have given excellent results.

Foreign Notes.

EUROPE.

Germany's Aluminium Industry.

The Commercial Secretary at Berlin (Mr. J. W. F. Thelwall) has forwarded to the Department of Overseas Trade an extract from the " Berliner Tageblatt " dealing with the aluminium industry of Germany. The report states that the construction of the Innwerk will be completed at the end of 1923. Unlike the other aluminium works, it will be supplied with water power, and will be capable of producing 10 000 TONS OF PURE ALUMINIUM YEARLY. The productive capacity of the Erftwerk is about 15 000 tons, and that of the Lautawerk about 13 000. The production of the former should soon be considerably increased as a result of a more powerful supply of electricity by the Rheinische-Westfalische Elektrizitatswerk.

THE FAR EAST.

Hydro-Electric Plant in China.

According to the bulletin of the Chinese Bureau of Economic Information, the FOOCHOW ELECTRICITY CO. is making estimates for the erection of a hydro-electric plant at the waterfalls between Shihping and Lungting in the Kutien district, Fukien. An engineer has been sent to conduct surveys.

Japanese Electric Manufacturers Optimistic.

According to the " Japan Advertiser," there is an optimistic feeling among electrical appliance manufacturers in Japan. This, it is stated, is due to the many ELECTRIFICATION SCHEMES now being contemplated by the Railway Board and the increase in the number of industrial and domestic users of electricity. Prices in general have been coming down, but this is being more than compensated for by cheaper raw materials, of which copper and aluminium constitute the major portion.

Electrical Market in Siam.

In a report by Mr. T. H. Lyle, British Consul-General, on the COMMERCIAL SITUATION IN SIAM, it is stated that imports of machinery and machine tools in the year 1921–22 included £188 133 worth from the United Kingdom, £35 066 from the U.S.A., and £16 742 from Germany, the total from all countries being £278 254, compared with £442 711 in the preceding year. Electrical goods and apparatus from the United Kingdom were valued at £49 286, from U.S.A. £36 548, from Sweden £24 744, and from Japan £10 691, the total being £138 281, compared with £112 737. By the aid of lower prices, Germany is gradually acquiring the business in nails and wire, to the disadvantage of Belgium and Great Britain.

Electrical Developments in Japan.

Our Tokyo contemporary " The Electrician's Friend " (" Denkenstomo ") states that by the merger of Kumano and Taisho Electric Co. the Ujigawa Electric Co. has increased its capital stock to 52 270 000 yen, paid up. Two new plants, 3 000 kW and 3 600 kW, are under construction. A steam-driven plant of 10 000 kW is being installed at Fukusaki. By August next, a hydro-electric plant of 26 000 kW will be completed and will greatly assist in meeting the demand for power in Osaka and vicinity. The purchase of the ELECTRIC SUPPLY SYSTEM IN OSAKA by the municipality has long been under consideration. A proposal that the purchase price should be based on the mean quotation in the stock market for the last three years is under discussion.

LATIN-AMERICA.

Demand for Glassware in Chile.

A report has been prepared by the Department of Overseas Trade giving information on the demand for SCIENTIFIC AND ILLUMINATING GLASSWARE in Chile. Reference D.O.T./225/76/F.G./M.P. should be quoted.

Business Items.

The UNDERFEED STOKER CO. inform us that they have recently sold their travelling grates or ash conveyers for use at electric light and power stations in Hong Kong, Melbourne, Holland, Nankai (Japan), Brighton, Watford and Nottingham.

The D. P. BATTERY CO. inform us that they have in hand at the present time two batteries of 2 818 Ah capacity (ultimate capacity 4 933 Ah) for the Minories Telephone Exchange, London, and four batteries of a capacity of over 1 000 Ah each for Newport, Mon.

A commission agent in Buenos Aires is desirous of REPRESENTING BRITISH MANUFACTURERS of wireless telephone materials, electrical novelties, motor car accessories, including lamps, etc., wires for motor cars and motor meter apparatus (for indicating when the motor is out of order). Particulars from the Department of Overseas Trade. (Reference No. 188.)

RADIO INSTRUMENTS, LTD., 12, Hyde Street, New Oxford Street, London, W.C.1, inform us that in order to meet the increased demands for their wireless instruments, they have taken over the lease of buildings adjacent to their present works, which will enable them to double their present output. The additional premises will shortly be available for manufacturing purposes, and the combined works will be one of the largest in the country exclusively devoted to the manufacture of wireless apparatus.

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Electricity Supply.

Extensions and Developments.

New distribution cables are to be laid at LINCOLN at a cost of £1 750.

FELIXSTOWE is to take an increased bulk supply of electricity from Ipswich Corporation.

BROMLEY Electric Light and Power Co. is anxious to substitute single phase a.c. for d.c. in certain areas. The Town Council has appointed a sub-committee to discuss the matter.

CHESTERFIELD Corporation has evolved a scheme whereby electricity will be installed free in small houses, and the cost recovered by charging the consumer 8d. per kWh.

WEYMOUTH Council has instructed the electrical engineer to prepare plans and specifications and invite tenders for additional plant for the el ctricity works. The approximate cost will be £10 000.

GRIMSBY Corporation Electric Lighting Committee has decided to recommend the Town Council to proceed with a scheme of extensions at the power station estimated to cost £75 000. The scheme is not to involve any increase of the rates.

WALLASEY Electricity Committee reports that the number of consumers of electricity increased from 6 549 in December, 1921, to 7 183 December, 1922, and the number of kWh generated from 1 066 821 to 1 487 445. The largest increase was in the number of motors and radiators in use—from 1 388 to 2 259.

BARROW electrical engineer has reported that as it does not appear probable that terms will be agreed to with Messrs. Vickers with regard to the purchase of their Cavendish Park power house, he has proceeded with the preparations for the alterations to the boilers at the electricity works and proposes to obtain tenders.

GILLINGHAM (Kent) Town Council has appointed a committee to consider the building of a new power station and the installation of steam turbine generators. Alternative proposals are to instal another Diesel engine or to take an additional supply of electricity when required from the Gillingham Portland Cement Co. The committee is also to go into the question of the whole administration of the electricity department.

Loans Applied for and Sanctioned.

BLACKPOOL is applying for sanction to a loan of £980 for two transformer chambers.

DOVER Town Council has applied to the Electricity Commissioners for a loan of £40 000 for additional plant at the electricity works.

CARDIFF Rural District Council is applying to the Commissioners for sanction to borrow £2 000 for extensions to the electricity undertaking.

ALDERSHOT Town Council has applied to the Electricity Commissioners for a loan of £824 7s. 8d., excess expenditure on contracts in connection with the bulk supply of electricity.

Alterations in Charges, Proposed and Actual.

It is hoped to effect a reduction in the charges for electricity at NUNEATON by April.

The Electrical Installation Co has reduced the charge for electricity for lighting at WINDSOR by 1d. per kWh.

Charges to private consumers and for public lighting have been reduced by MOTHERWELL and WISHAW Town Council.

WREXHAM Town Council has completed negotiations with the North Wales Power Co. f r the supply of electricity in bulk.

A new scale of charges has been brought into force at WEST BROMWICH, the reduction varying from ½d. to 1d. per kWh.

WEST HARTLEPOOL Electricity Committee has reduced the maximum flat rate charge for electricity from 7½ to 6½d. per kWh.

Charges have been reduced at MANCHESTER from 7d. to 6¾d. per kWh for lighting, with corresponding reductions for power and heating.

DONCASTER Electricity Committee has recommended a reduction in the general lighting charge from 7d. to 6½d. per kWh as from January 1st last.

The ISLE OF WIGHT Electric Light Co. has applied for power to revise and increase charges. An inquiry is to be held at Sandown on February 21st. Shanklin Town Council is opposing the application.

SHEFFIELD Corporation is reducing charges for electricity from March next as follows:—Where the charge is over 2d. per kWh, from 30 to 25 per cent. on the basic rate; where the charge is 2d. per kWh or under, from 75 to 60 per cent. on the basic rate.

ST. HELENS Corporation has reduced the charges to ordinary consumers for lighting, power and heating, from 60 to 50 per cent. above pre-war charges. For outside shop signs and outside shop lighting the charge is to be 2d. per kWh, plus 50 per cent.

Tapping New Areas.

HURST Parish Council have invited the Reading Electric Co. to extend their supply to that district.

MALVERN District Council is being urged by ratepayers to continue its electricity mains to West Malvern.

OAKHAM Urban Council has decided to support the application of the Gas Co. for electric lighting powers in the urban area.

SANQUHAR (Dumfries) Gas Committee is to secure information concerning an electric lighting scheme and report to the Town Council.

REDCAR Town Council has appointed an electric lighting committee to consider the question of electricity for the town, and to prepare a report.

PETERHEAD Town Council is to introduce an electric lighting scheme, when trade revives, on lines suggested by Edmundson's Electricity Corporation

Herts County Council has decided to make no objection to the application of the WELWYN Garden City Electricity Supply Co. for powers to supply electricity within the Garden City Parish.

SILEBY Parish Council has been informed by Loughborough Corporation that that body will consider giving the Council a supply of electricity if the Council is prepared to take it in bulk at the borough boundary.

Five directors of the HORLEY District Gas Co. have applied to the Electricity Commissioners for an order to enable them to supply electricity to Horley and the surrounding districts. The site of the proposed generating station is in Balcombe Road.

Sir Charles Bright and Partners have asked SANDWICH Town Council whether it would support an application to the Electricity Commissioners for power to supply electricity in the borough. The Council has requested further particulars of the scheme.

STOCKPORT Town Council has completed arrangements for supplying electricity to the Hazel Grove and Bramhall Urban Council. The Macclesfield Electricity Co. has asked the Corporation whether it is prepared to supply electricity to them in bulk.

WALTON-LE-DALE Council have supported Preston Corporation's scheme for the supply of electricity and have appointed a deputation to attend the inquiry in connection with the undertaking at Preston on the 20th inst. The Council have decided to obtain a provisional order to enable them to light the district with electricity, and to supply electricity for other purposes, in anticipation of a supply from Preston.

Canterbury City Council has offered to give a supply of electricity in bulk to ASHFORD Urban Council based upon an ultimate maximum demand of 500 kW. The cable is to be the property of the Corporation, and Ashford is to pay a minimum yearly sum equal to the annual cost of repayment and interest upon the capital expended (£2 456); a sum of £2 10s. per kW of maximum demand for the use of the generating plant at the Canterbury station, 1½ per cent. of capital cost estimated at £162 for maintenance of trunk mains, etc., and in addition a sum of 1½d. per kWh on all electricity delivered.

Miscellaneous Supply Items.

BLACKPOOL Tramways and Electricity Committee has decided to supply electric current free for providing illuminations during carnival week to tradesmen who desire to make their premises attractive.

Negotiations are proceeding, says the "Scotsman," for the raising of the necessary capital in connection with the GRAMPIAN WATER-POWER SCHEME. It is anticipated that a definite start will be possible next month.

The COUNTY OF LONDON ELECTRIC SUPPLY Co. have applied to the Electricity Commissioners for a special order authorising the supply of electricity in Buckhurst Hill, Loughton, Wanstead and Woodford urban districts and in the parish of Chigwell. Any objections must be sent to the Secretary, Electricity Commission, Whitehall, London, by March 4th.

GORSEINON ELECTRIC LIGHT Co. have applied to the Electricity Commissioners for a Special Order authorising the generation and supply of electricity in parts of the parishes of Gowerton (in Swansea rural district) and Llanedy (in Llan lly rural district). Objections to the Secretary, Electricity Commission, Whitehall, London, by March 5th.

Subject to the consent of the Commissioners, REDDITCH electricity undertaking is to be handed over to the Shropshire, Worcestershire and Staffordshire Electric Power Co. The capital sum involved is stimated at about £109 000, while in addition the company agree to pay an amount not exceeding £5 000 towards any deficiency likely to be incurred in the current financial year, which ends in March next.

Application has been made to the Electricity Commissioners for a Special Order for the amalgamation of the undertakings authorised by the Banstead, Walton-on-the-Hill and Kingswood Electric Lighting Order, 1914, and the Chipstead and District Electric Lighting Order, 1915, and for the transfer of the amalgamated undertakings to the SOUTH METROPOLITAN ELECTRIC TRAMWAYS AND LIGHTING Co Objections to the Secretary, Electricity Commission, Whitehall, London, by March 5th.

The Newcastle Chamber of Commerce has decided to ask Mr. FRANK GILL, president of the Institution of Electrical Engineers, to visit the Chamber and give an address on long-distance telephony.

A dispute is in operation between the E.P.E A. and the HALIFAX CORPORATION. The general secretary of the E.P.E.A. requests all engineers to communicate with him before applying for any vacancy advertised by the Corporation.

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Companies' Meetings, Reports, etc.

A dividend of 10 per cent. is announced by the LONDON ELECTRIC SUPPLY CORPORATION.

A final dividend of 4½ per cent., making 8 per cent. for the year, has been declared by the RUSHDEN AND DISTRICT ELECTRIC SUPPLY Co.

The WESTERN ELECTRIC DISTRIBUTING CORPORATION has declared an interim dividend at the rate of 6 per cent. per annum on all classes of shares.

A final dividend of 5 per cent. on the ordinary shares, making 9 per cent. for the year, has been declared by the NORTHAMPTON ELECTRIC LIGHT AND POWER Co.

The directors of W. T. HENLEY'S TELEGRAPH WORKS Co. recommend a final dividend on the ordinary shares of 2s. per share, less tax, making a total of 3s. per share.

The profit of the CENTRAL ELECTRIC SUPPLY Co. for 1922 was £4 996. The directors recommend an ordinary dividend at the rate of 5 per cent. for the year, carrying forward £5.

A dividend on the ordinary shares of 7½ per cent. for the year is recommended by the SOUTH METROPOLITAN ELECTRIC TRAMWAYS AND LIGHTING Co. £18 500 is placed to reserve and £3 234 carried forward,

A dividend of 11½ per cent. on the cumulative preference shares is recommended by the METROPOLITAN ELECTRIC TRAMWAYS Co. This represents the balance of 2½ per cent. for 1920, 5 per cent. for 1921, and 4 per cent. for 1922. £99 168 is placed to reserve and £2 432 carried forward.

The directors of the CHARING CROSS WEST END AND CITY ELECTRICITY SUPPLY Co. recommend a dividend on the ordinary shares of the West End undertakings of the company for the half year ended December 31st, at the rate of 7s. per share (less tax), making with the interim dividend already distributed 12 per cent. for 1922, and a bonus of 2s. per share (free of tax).

Aldred and Co. are offering £200 000 six-and-a-half per cent. first mortgage debenture stock of the ST. MAURICE POWER Co., one of the subsidiary undertakings of the Shawinigan Water and Power Co. The stock is part of a total authorised amount of $12 000 000, of which $10 499 400 has been issued, $9 526 000 having been placed in the form of bonds in Canada and the United States.

The following companies were STRUCK OFF THE REGISTER OF JOINT STOCK COMPANIES on February 9th: Central Argentine Light and Power Co., City of Ely Electric Light and Power Co., Domestic Electric Co., Elpo Electrical Engineering Co., Lancashire Electrical Engineering Co., Lytham Electric Light and Power Co., National Electric Engineering Co., National Fire Alarm Co, Triplex Arc Lamp Co.

Dividends are announced by members of the Underground group of railways, as follows: DISTRICT, 1½ per cent. on the ordinary shares, making 3 per cent. for the year; UNDERGROUND ELECTRIC, 3 per cent., tax free (making 5 per cent. for the year) on 6 per cent. income bonds of 1948; LONDON ELECTRIC, 2½ per cent., making 4 per cent. for the year; CITY AND SOUTH LONDON, 4 per cent. on the consolidated ordinary shares.

The LONDON AND SUBURBAN TRACTION Co. announces that, subject to confirmation of their respective dividend announcements by various companies in which it is interested and subject to final audit of accounts, the revenue will enable it to pay 5 per cent. in respect of arrears on its 5 per cent. cumulative preference shares compared with 3½ per cent. last year, with a carry forward of £12 662, compared with £11 523 brought in.

The NORTH METROPOLITAN ELECTRIC POWER SUPPLY Co. recommends full dividends on the 6 per cent. cumulative preference shares, and the 8 per cent. cumulative second preference stock, and a dividend on the ordinary shares for the year of 10 per cent., the same rate as last year; £50 000 to be placed to reserve (an addition of £15 000 compared with the previous year), leaving £7 073 to be carried forward, compared with £5 006 brought in.

The net revenue of the TRACTION AND POWER SECURITIES Co. for 1922, after deducting expenses, amounted to £35 245, plus £14 137 brought in, making £49 382. The directors recommend final dividend of 4s. 6d. per share, free of tax, making 8s. per share, free of tax, carrying forward, subject to corporation tax, £15 218 The surplus of £1 325 over book cost was realised on sales of investments, and this has been carried to the reserve, which now stands at £21 437.

New Companies.

INSULATING SUPPLIES, LTD.—Private. Reg. Feb. 5th. Cap., £100 in £1 shares. To carry on the business as indicated by the title. Reg. office: 28, John Street, Bedford Row, London, W.C.1.

STAR LAMP Co., LTD.—Private. Reg. Feb. 5th. Cap., £2 000 in £1 shares. To adopt an agreement with E. J. Walker and R. Herrick, and to carry on the business of electric lamp dealers as formerly carried on by the said vendors. Reg. office: 10, Bush Lane, Cannon Street, London, E.C.

BRITISH HOMO WIRELESS Co., LTD.—Private. Reg. Feb. 5th. Cap., £1,000 in £1 shares. Mechanical and electrical engineers, scientific instrument makers, manufacturers of telegraphic, telephonic and wireless apparatus and accessories, etc. Reg. office: 28, Eagle Street, Holborn, London, W.C.

Tenders Invited and Accepted.

UNITED KINGDOM.

SALFORD CORPORATION.—Tramway special track work. Particulars from the General Manager, 32, Blackfriars Street, Salford.

DOUGLAS (ISLE OF MAN) CORPORATION, February 19th.—Electric wiring and fittings at the markets. Particulars from the Borough Surveyor.

KEIGHLEY GUARDIANS, February 20th.—Wiring and fitting nurses' home at St. John's Hospital. Particulars from the Clerk to the Guardians.

TORQUAY CORPORATION, February 26th.—Four three-phase to two-phase transformer groups. Specification from Borough Electrical Engineer, Town Hall, Torquay.

MARYLEBONE (LONDON) BOROUGH COUNCIL, February 28th.—(e) Suction and discharge pipework and valves; (f) high pressure steam pipe work and valves; (g) ash handling equipment; (h) electrically operated jib crane or transporter; (i) e.h.t. and l.t switch ear, and underground cables. Specification from Chief Electrical Engineer, Town Hall, Grosvenor Place, W.1.

MANCHESTER TRAMWAYS COMMITTEE, February 27th.—Stores and materials, including points, tongues and crossings, electrodes for welding, commutator segments, coils, brush-holders, lamps, bells, insulating material, carbon brushes, overhead equipment, cable, wires, tools, ironmongery, axles, paints, etc. Schedules from the General Manager, 55, Piccadilly, Manchester.

BIRMINGHAM EDUCATION COMMITTEE, March 5th. — Motor generators, transformers and switchgear required at the Municipal Technical School.

STOKE-ON-TRENT CORPORATION, March 7th.—Step switch resistance for speed and load regulation on each of two 600 kW induction motor alternators. Specification from the Borough Electrical Engineer, St. Peter's Chambers, Stoke-on-Trent.

COUNTY OF LONDON ELECTRIC SUPPLY Co., March 12th.—Condensing plant and auxiliary apparatus for Barking power station. March 26th.—Static transformers for Barking power station. Specifications form Mr. F. C. McQuown, Moorgate Court. Moorgate Place, E.C.

ARGENTINA.

ARGENTINE DEPARTMENT OF SANITARY WORKS, April 26th.—Nineteen groups of vertical centrifugal pumps, with electric motors and spare parts.

AUSTRALIA.

VICTORIAN RAILWAY COMMISSION, March 28th.*—Two 20 B.H.P. three-phase induction motors, starting apparatus and accessories (contract 35 772); also 20 B.H.P. d.c. motor, starting apparatus and accessories (contract 35 773). April 4th.*—Electric hoist, with trolley, for Newport workshops (contract 35 793).

EGYPT.

EGYPTIAN STATE RAILWAYS ADMINISTRATION, March 22nd.—Watertube boiler, h.t. cables, switchboard panel, transformers, etc., for Gabbary power house. Specification from Maj. J. S. Liddell, Queen Anne's Chambers, Westminster, S.W.1.

SOUTH AFRICA.

UNION OF SOUTH AFRICA POSTS AND TELEGRAPHS DEPARTMENT, March 14th.*—Insulators, galvanised spindles, arms, copper wire, stay rods, braided wire, etc.

HALIFAX CORPORATION have accepted the tender of Higginbotham and Sons, for wiring 54 houses at £378.

The VICTORIAN ELECTRICITY COMMISSION have accepted the tender of Babcock and Wilcox for boiler plant for driving briquetting plant at Morwell, at £71 026.

The tender of G. P. Trentham, Ltd., for doubling the tramway track and widening road from Balby Bridge to the south-east at £1 292 6s., has been accepted by DONCASTER CORPORATION.

The Metropolitan-Vickers Electrical Co. have received from the NIPPON DENRYOKU KABUSHIKI KAISHA, Amagasaki, near Osaka, Japan, an order for two 25 000 kW, 11 000 V, three-phase, 60-period, turbo-generators, to run at 1 800 revs. per min. The turbines will be of the company's multiple exhaust design and arranged for two-stage feed heating, and the generators will be provided with their closed circuit ventilation system. The order also comprises one 1 000 kW, 3 300 V, three-phase, 60-period, house service turbo-generator, operating at 3 600 revs. per min. All the plant hitherto purchased by the Japanese company has been obtained from America.

MARYLEBONE (LONDON) BOROUGH COUNCIL have accepted the following tenders:—General Electric Co., 12 500 kW alternator and condenser (Worthington-Simpson condenser) £45 000, and three 2 000 kW rotary converters, £22 365; Babcock and Wilcox, two 60 000 lb. marine type boilers, £42 493; Clyne Engineering Co., cooling tower and tank, £25 500. (Particulars of the tenders recommended for acceptance and the range of the remainder of the tenders were given in our issue of January 26th. The offers of the General Electric Co., £45 000, and Ateliers de Construction Oerlikon, £39 728, for the 12 500 kW alternator and condenser were both recommended for acceptance, the choice between them being left to the Council).

* Particulars from the Department of Overseas Trade.

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Electric Traction.

Tramway Extensions and Developments.

NELSON Tramways Committee has decided against allowing advertisements on the tramcars.

BELFAST Tramways Committee has expressed strong disapproval at the slow progress being made by the contracting firm which is re-constructing the tram track.

WEST HARTLEPOOL Town Council has declined to adopt a motion to rescind its previous decisions regarding the trackless trams scheme for the Foggy Furze route.

The running of motor omnibuses is being considered by the Corporations of NELSON and LYTHAM ST. ANNES. In the latter case, Mr. H. W. Laing, tramways manager, has been requested to report.

It is expected that the laying of the tramway track along the widened Bristol Road at Birmingham will be commenced shortly. The rails are to be laid on wooden sleepers, on the light railway system.

The Scottish Tramways Association is co-operating with the MUNICIPAL TRAMWAYS ASSOCIATION in an endeavour to obtain relief from the present burdens imposed on tramway undertakings in respect of the construction and maintenance of the roadway between the rails and tracks.

Double in place of the existing single lines are to be laid by GLASGOW Corporation in Coatbridge and Airdrie. The work will be done concurrently with the re-making of the roads. Competitive offers, including one from the Tramways Department, are to be invited for carrying out the work.

Fares, Receipts and Passengers.

A general reduction in tram fares has been made at LEEDS.

Lower fares on the BRIGHTON trams are urged by Preston Park ratepayers.

Since the introduction of lower fares, passengers and receipts have increased on the EDINBURGH Corporation Tramways.

Receipts for January on LONDON tramways under "Underground" control amounted to £183 691, as against £189 453 in January, 1922.

The newly-elected Chairman of BELFAST Tramways Committee, Mr. D. Anderson, has expressed the hope that a reduction in fares will be possible in a short time.

READING Corporation Tramway returns show receipts from April 1st, 1922, to January 4th, 1923, amounting to £60 970 9s. 0½d., compared with £63 480 10s. 11d. for the corresponding period of 1921–1922.

Labour Matters.

The threatened strike of tramway workers at ASHTON-UNDER-LYNE has been averted, the men having agreed to arbitration.

An agreement, dated February 7th, has been arrived at by the Special Committee appointed by the Metropolitan Municipal Tramways Council and the Electrical Trades Union providing for a REDUCTION OF THE WAGES of various grades of electrical workers employed on tramway work in the rolling stock and permanent way branches of the tramways department. The agreed rates after reductions are—armature winders and electricians, 1s. 8½d. an hour; semi-skilled men and light power attendants, 1s. 7d. an hour; mates and labourers, 1s. 4½d. an hour. The reductions became effective as and from February 8th, and the agreed rates are to remain unchanged until April 4th, when a further meeting will be held to agree to subsequent rates.

Electric Railway Items.

TORQUAY Town Council has confirmed an agreement with the Torquay Tramway Co. for the construction and working of a cliff railway from Babbacombe Downs to the beaches below.

The Great Western Railway goods station at TEMPLE MEADS, BRISTOL, is to be entirely re-constructed and provided with modern electrical machinery at a cost of over half a million pounds.

Mr. Thomas M'Connell, M.P., addressing the members of BANGOR Urban Council last week, hinted at the possibility of the electrification of the Belfast and County Down Railway Co.'s line to Bangor.

Books Received.

"The Simple Lathe and its Accessories." (London: Cassell and Co.) Pp. 152. 1s. 6d. net.

"Jahrbuch der Elektrotechnik, 1920." By Dr. Karl Strecker. (Berlin: R. Oldenbourg.) Pp. 232. 7s. 6d.

"A Dictionary of Applied Physics." Edited by Sir Richard Glazebrook. Vol. III.—Meteorology, Metrology and Measuring Apparatus. (London: Macmillan and Co.) Pp. 839. 63s. net.

"Les Marées et Leur Utilisation Industrielle." By E. Fichot. (Paris: Gauthier-Villars.) Pp. 254. 9 fr.

"Der funktelegraphische Wetter und Zeitzeichendienst." By H. Thurn. (Berlin: M. Krayn.) Pp. 82. 2s. 4d.

"Steam Vessels." Issued by the National Boiler and General Insurance Co., National Buildings, St. Mary's Parsonage, Manchester. Pp. xi. × 60. 2s.

On p. 141 of THE ELECTRICIAN of February 9th, in the report of the discussion on Mr. Robinson's paper, Mr. A. H. Baldwin should read Mr. F. G. C. Baldwin.

Wireless News.

Cardiff Station Opened on Tuesday.

Lord Gainford, chairman of the British Broadcasting Co., as well as the Lord Mayor of Cardiff, were present at the opening of the city's broadcasting station on Tuesday evening. The station has the call letters "5 WA" and a wave length of 395 m. This short wave length has been adopted with the idea of preventing interference from atmospherics. The station has the same power as those at London, Manchester, Birmingham and Newcastle.

In connection with the opening of the station, Siemens Brothers and Co., have made arrangements to give demonstrations of their receiving apparatus at their Cardiff office in St. Mary Street.

Imperial and Foreign Developments.

Although tenders have been invited for steel work for the masts which will be required at the wireless station which is to be erected by the SOUTH AFRICAN GOVERNMENT, the site of the station has not yet been decided upon. The alternative sites proposed are at Paarl, and a place 87 miles from Capetown on the railway from Kalabas Kraal to Hopefield. A boom in the sale of receiving sets during the next few months is expected.

The permission granted by the Siamese Government to vesssels equipped with wireless telegraphy to communicate temporarily with the WIRELESS STATION IN BANGKOK from Koh-Si-Chang on account of the submarine cable being out of order, has been withdrawn. The vessel supplied by the Siamese naval authorities, which has for some time past been anchored at Koh-Si-Chang for this purpose, is regarded by the authorities as providing a satisfactory wireless service.

Revenue Outlook of the B.B.C.

A conference has taken place at the General Post Office between representatives of the Postmaster-General's Department and the British Broadcasting Company on the present positionof broadcasting. The Postmaster-General (Mr Neville Chamberlain) was present. An exchange of views took place, it is understood, on the revenue outlook of the company. The whole question of evasion of the regulations by listeners-in who fail to secure a Post Office licence or who purchase unauthorised apparatus was discussed.

Miscellaneous Wireless Items.

There are now 1 800 holders of wireless licences in the MANCHESTER area.

The Cunard liner "Berengaria" has been fitted with a CREED APPARATUS for the automatic reception and transmission of high-speed wireless.

The General Electric Co. inform us that listeners-in in BELFAST have succeeded in hearing the station at Newark, U.S.A., with a "Gecophone" two-valve set.

The OXFORD WIRELESS SOCIETY has amalgamated with the Oxford and District Amateur Radio Society, which is affiliated to the Radio Society of Great Britain.

The inaugural meeting of the ST. BRIDE RADIO AND EXPERIMENTAL SOCIETY will be held at the St. Bride Foundation Institute, London, E.C.4, on February 21st, at 7.30 p.m. An address by the president, Capt. H. Riall Sankey, will be followed by a demonstration and general meeting.

Owing to the breakdown of the submarine cable between the islands of Tiree and Coll, telegraphic communication with Tiree has been interrupted for some time. After representations by the islanders to the Postmaster-General, the Post Office has now installed a portable wireless set, and COMMUNICATION WITH TOBERMORY Wireless Station has been established.

The suggestion has been made that the Talbot Street power station at NOTTINGHAM should be converted into a broadcasting station, with the existing chimney stacks as aerials. The "Nottingham Journal," however, suggests that the power station would be more suitable for conversion into a "Palais de Danse." Various cruel engineers have suggested that a museum would be even more appropriate.

On Saturday, a 6 000 kW turbo-alternator in OLDHAM Electricity Works exploded, and two men were injured. The explosion is attributed to the ignition of lubricating oil and insulating material.

A. REYROLLE AND CO. have sent us a handsome ash tray which we shall find very useful. Its principal feature consists in a bas relief of one of their well-known ironclad switch panels, and its application in this instance will serve to remind us of the fire-proof qualities of this type of gear.

Considerable interest attaches to the DEBATE ON COMMUNISM which is to take place under the chairmanship of Lord Askwith at the Kingsway Hall, on Thursday next, February 22nd. Sir Ernest Benn is to move: "That Communism would be a danger to the good of the people." Mr. J. T. Walton Newbold, Communist M.P. for Motherwell, who is now on his way back from Moscow, will oppose. The debate is arranged on sporting lines in three rounds. Mr. Newbold, having refreshed himself with the very latest developments of the Communist faith at its headquarters in Moscow, will probably be able to give a new interest to the meeting. Admission will be by tickets, half of which are to be distributed by the Communist Party, and half by the Industrial League, 82, Victoria Street, London, S.W.1.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

ARROTA ELECTRICAL AND MOTOR ACCESSORIES CO., LTD., Louth, electrical engineers. £28 16s. 11d. January 1st.

BURTON MOTOR AND ELECTRICAL ENGINEERING CO., Burton Latimer, engineers. £13 0s. 5d. December 19th.

CORT (J.) (DARWEN), LTD., Canterbury Street, Blackburn, electrical engineers. £73 7s. 6d. October 19th.

DUNN AND CO. (CHELTENHAM), LTD., electrical engineers. £10 15s. 8d. January 30th.

GREGSON AND CO., Dutton Street, Liverpool, electrical contractors. £14 18s. 7d. October 22nd.

LANE, G. E., 31, Edwin Street, Gravesend, electrical contractor. £29 11s. 3d. December 18th.

OXLEY, Henry H., 55, Culverden Park Road, Tunbridge Wells, electrical engineer. £17 12s. 5d. December 15th.

SCIENTIFIC INVENTIONS SYNDICATE, LTD., 31, Fitzroy Square, W., electrical engineers. £10 0s. 2d. December 22nd

Deeds of Arrangement.

WOODMASON, William Carey, 4, Great Colman Street, Ipswich and 14, Gordon Road, Lowestoft, electrical engineer. Filed February 6th. Trustee, A. E. Scrutton, Cornhill Chambers, The Thoroughfare, Ipswich, C.A. Liabilities unsecured, £1 694; assets, less secured claims, £500.

YATES, Frederick Joseph, trading as F. J. YATES AND CO., 72, High Street, Leicester, electrical contractor. Filed January 31st. Trustee, J. W. Rowley, 20, Friar Lane, Leicester, C.A. Secured creditors, £4 700; liabilities unsecured, £5 247; assets, less secured claims, £3 017. The following are creditors: Burndept, Ltd., London, £511; English Electric Co., Ltd., London, £112; Gilbert, A. E. and Co., London, £77; Tutor Accum. Co., London, £118; Bill and Berry, Birmingham, £87; Metallic Seamless Tube Co., Birmingham, £65; Ruston and Hornsby, Ltd., Grantham, £70; Edison-Swan Electric Co., Ltd., Leicester, £91; General Electric Co., Ltd., Leicester, £111; Gent and Co., Ltd., Leicester, £63; Downes and Davies, Liverpool, £89; Baxendale and Co., Ltd., Manchester, £147; Glover, W. T., and Co., Ltd., Manchester, £61; Yates, E. S., Manchester, £130.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

ANODE WIRELESS AND SCIENTIFIC INSTRUMENTS, LTD., London. At the statutory meeting, on Friday last, of creditors in this voluntary liquidation, it was resolved unanimously that application be made at once to the Court for the compulsory winding-up of the company. The company was formed in October, 1922. The vendors were a company called Anode Co., Ltd., and the sale agreement contained provision that they were to receive £800 in cash and 5 500 shares, but they had only received £200 of the £800. The Chairman said that there was a letter dated October 20th whereby the Anode Co. agreed to have the balance of £600 out of the future takings of the Anode Wireless and Scientific Instruments, Ltd., as and when convenient for the company to pay them. He (the Chairman) would like to add that the directors were Mr. Minvalla, who resigned his position on December 31st last, Mr. Peak, who was connected with the Anode Co., Mr. Lunnis, Mr. Gray, who was the sales manager, and Mr. Rayner, who was the technical director. The company took premises at St. Pancras, agreeing to pay a rent of £1 150 per annum, with rates in addition. A lease had been drawn up, but it was not signed, and the landlord issued a writ against the directors for specific performance, and was claiming six months rent. The sales of the company had approximated about £500. There was due to unsecured creditors £1 691, while the Anode Co. as vendors were claiming £52; against net assets £426, or a deficiency of £1 317. The following are creditors:—Idris and Co., £374; Igranic Electrical Co., Ltd., £173; General Electric Co., Ltd., £61; Graham, A., and Co., £39; Dubeline Condensing Co., £30; Varley Magnet Co., £30.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Bankruptcy Information.

COX, Charles John (trading as C. J. COX AND CO.), Pontefract Road, Castleford, Yorkshire, electrical engineer. First meeting, February 20th, 11 a.m. Official Receiver's office, 21, King Street, Wakefield. Public examination, March 8th, 11 a.m., Court House, Wood Street, Wakefield.

RAYBOULD, Frank, 48, King Street, Darlaston, electrical engineer. First meeting, February 21st, 12 noon, Official Receiver's office, 30, Lichfield Street, Wolverhampton. Public examination, March 21st, 10.15 a.m., Court House, Lichfield Street, Walsall.

SEDDON, Leonard, lately carrying on business at 276A, Buxton Road, Stockport, as THE ELECTRICAL ENGINEERING CO. Receiving Order, February 6th. Debtor's petition.

Notice of Intended Dividend.

HOGG, George James (trading as F. HOGG AND CO.), 66, Waterloo Road, Smethwick, Stafford, electrical engineer. Last day for receiving proofs, February 26th. Trustee, T. Easton, Official Receiver, Ruskin Chambers, 191, Corporation Street, Birmingham.

Partnership Dissolved.

RICHARDS, ELSTON AND THOMAS (Albert Sidney RICHARDS, George Leonard ELSTON, and John Sharwood THOMAS), electrical engineers, 52A, Bow Lane, London, by mutual consent as from February 2nd, 1923. Debts received and paid by G. L. Elston and J. S. Thomas, who will continue the business under the style of Elston and Thomas.

Bankruptcy Proceedings.

CORONA LAMP WORKS, LTD., 10, Ascham Street, Kentish Town, N.W. Under a winding-up order made against this company on June 13th last, on the petition of the British Thomson-Houston Co., Ltd., returned as creditors for £5 390, the statutory meetings of creditors and shareholders were held last week at the Board of Trade Offices, 33, Carey Street, W.C. The Official Receiver reported that no statement of the company's affairs was submitted until January 2nd, the delay being chiefly due to difficulties experienced by the accountants in adjusting the company's books of account. The company was incorporated as a private company in June, 1911, to acquire the business of a manufacturer of electrical lamps carried on by Mr. George N. Ogilvie under the style of the Corona Lamp Works at Southfields and Kentish Town. The nominal capital of the company was £2 000, divided into shares of £1 each, the whole of which were issued as fully paid under the purchase agreement. The company was formed by Mr. Ogilvie, who, in April, 1911, entered into an agreement with Mr. Stephen Horvath, a manufacturer of electrical lamps, to buy the business carried on by him at Southfields, with all the assets and liabilities, at the price of £5 000. In addition, he undertook to register within eight months a company to acquire the business having a nominal capital of not less than £100 000 and to obtain the allotment or transfer to Mr. Horvath of 9 000 fully paid shares of £1 each. The company's business had been that of manufacturers, importers and dealers in electric bulb lamps. Factories had been erected at Highgate, Wimbledon and elsewhere. Shortly after the outbreak of the war the company found it necessary to manufacture glass, and it established a works at Round Oak, Staffs. As the company's business increased it also became necessary to establish branches, and the following subsidiary companies, formed for the purpose of taking over the various branches were registered:—Balfour Baring Ltd., Kingsway Manufacturing Co., Ltd., Corona Lamp Works (Northern), Ltd., Corona Lamp Works (Ireland), Ltd., the name of which was afterwards changed to the Royal Sovereign Lamp Works, Ltd., and the Corona Lamp Works (Southern), Ltd. The company's interest in all those undertakings had, however, been disposed of before the date of the winding-up order. The company had throughout been financed by Mr. Ogilvie and his relatives, the total amount advanced by them being upwards of £60 000. In addition, Mr. Ogilvie had guaranteed the company's overdraft of £3 000. Debentures were issued by the company at various dates between July, 1911, and March, 1919. The debentures now outstanding, all of which were held by Mr. Ogilvie and his relations, amounted to £44 250. No interest beyond a sum of £75 had been paid on the debentures or the loans. The company had at various times been concerned in actions in respect of infringements of patents relating to the manufacture of electrical lamps. As a result of a final appeal in the House of Lords relating to gas-filled lamps, the company was ordered to pay the plaintiffs' costs of the action in the two appeals, and also to pay, with interest, a sum of £5 529 paid by the plaintiffs to the company in respect of the costs of the action in the first appeal. As the company failed to make that payment execution was levied on its goods in May last. The debentures thereupon immediately became payable, and on May 15th the debenture holders appointed Mr. V. G. Teale, C.A., as receiver and manager, and he was still in possession. The Official Receiver added that during the first 18 months of the company's trading the gross sales amounted to £10 190. They afterwards considerably increased until November, 1918, when the gross sales during 10½ months' trading amounted to £112 926. But during the ensuing 15½ months the sales dropped to £63 458. Although the company's business had

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been conducted at a profit during two or three years, its trading on the whole had resulted in a heavy loss, amounting in February, 1918, according to the audited accounts, to £24 097. The company had been insolvent for several years past, and but for the financial support provided by Mr. Ogilvie and his relations its activities would have ceased long since. Mr. Ogllvie had stated that although the business had been continued in the hopes that it would eventually become profitable he did not feel justified, after the adverse decision in the House of Lords, in providing further finance. The failure was attributed by him to that decision, the effect of which was to limit the company's productions, and to loss on trading and diminished sales and depreciation of stock owing to the general trade depression. The statement of the company's affairs showed liabilities £109 516, of which £82 265 were expected to rank, and assets £27 251, the whole of which were absorbed in payment of preferential claims (£134) and part payment of loans on debenture bonds (£27 110 out of £57 868). A total deficiency of £84 265 was disclosed with regard to the shareholders. According to the receiver for the debenture holders, the outside amount that he was likely to collect was £24 000, and if that proved to be a correct forecast there was no chance of the unsecured creditors receiving anything. The liquidation was at both meetings left in the Official Receiver's hands.

HEATH, Edward Fuller Ernest, trading as FULLER, HEATH AND CO., electrical and mechanical engineer, 26, Buckingham Gate, S.W. This debtor, who was adjudged bankrupt on February 8th, 1922, attended at the London Bankruptcy Court last week for public examination on a statement of affairs showing gross liabilities £4 500. The unsecured debts were stated at £2 875, against net assets valued at £80. In January, 1919, according to the evidence, the debtor began business as an electrical engineer at 110, Cannon Street, E.C., under the style of Heath, Wingfield and Co. In the following March the business was removed to 6, Hans Road, S.W., where he continued for a year, but then, owing to losses through bad debts, executed a deed of assignment to a trustee. He understood that dividends amounting to 5s. 7d. in the £ were paid on claims totalling £6 695. In September, 1920, he started as an electrical and mechanical engineer at 26, Buckingham Gate, and he had also traded as the Machinery Auction Rooms at 3 and 5, Earl Street, Horseferry Road, S.W. He was compelled by pressure of creditors to abandon both businesses in April, 1921. He attributed his insolvency to insufficient capital, to a bad debt of £1 000, and to bad management by a man employed in both the Buckingham Gate and Earl Street businesses, who subsequently died in a lunatic asylum. The examination was concluded.

THE ASSOCIATED ELECTRIC TRADERS, LTD., 2, Percy Street, Tottenham Court Road, W.C. Under a winding-up order made against this company, on the petition of Cox and Co., bankers, meetings of creditors and shareholders were held recently at the Board of Trade Offices, Carey Street, W.C. The Official Receiver said that the company was registered as a private company in September, 1920, with a nominal capital of £10 000, to acquire the business formerly carried on by Mr. John Leitch under the style of the British Electric Trading Co., and to carry on business as importers and exporters of and dealers in all kinds of electric fittings. The directors of the company had been Mr. L. C. Russell, governing director, Mr. A. F. Phelp, who resigned in May last, Mr. J. R. Williams, who resigned last February, and Mr. C. P. Wenzel, who in May last was made a permanent director and accorded the same powers as were held by Mr. Russell. In May, 1922, continued the Official Receiver, the capital of the company was increased to £30 000, and 10 000 shares were issued to Mr. Russell in consideration of his transferring to the company his half-share of the Marylebone Electric Fittings Co. An allotment of 10 000 shares was also made to Mr. Wenzel in consideration of his handing over certain foreign agencies and connections. On May 22nd, 1922, 25 debentures of £100 each were issued to Mrs. Wenzel in consideration of a cheque given on the same day to enable the company to extend its business. They were not, however, registered with the Registrar of Joint Stock Companies within the statutory period of 21 days, and, according to a memorandum in the minute book of July 4th following, new debentures were that day issued to Mrs. Wenzel, and were duly registered on July 14th. As they were then issued for a past consideration—the money having been paid to the company in May—and were issued within three months of the winding-up petition, their validity would be contested. The debenture holder in September last appointed a receiver, who, with the sanction of the Court, had sold the lease of the premises for £100 and the stock for £500. The receiver had also collected some book debts, and the total sum in his hands was £900, which was all the assets were expected to produce. In the statement of affairs they were valued at £4 042, an obviously misleading figure. If the debentures were held to be invalid, the debenture holder's claim (£2 500) would have to be added to the unsecured debts of £5 719, making a total of £8 219, against assets £900. The company's failure was attributed by Russell to depreciation of stock and a general fall in prices in the trade. Resolutions were passed for the appointment of the Official Receiver as liquidator.

Forty Years Ago.

"The Electrician," February 17th, 1883.

GAS IN PARIS AND LONDON.—In a recent lecture delivered by M. H. Aerts, manager of the Brussels Municipal Gas Works, the following comparison between Paris and London gas was instituted: —"The Paris burner consumes 105 litres, or nearly 4 cubic feet per hour. The London burner consumes 142 litres, or nearly 5 cubic feet per hour. The illuminating power required in London is 16 candles for 142 litres (5 cubic feet) of gas. The normal illuminating power of Paris gas, consumed in London burners, corresponds to 15.2 candles."

ELECTRIC RAILWAYS.—Electric power as a means of traction on railways seems to be gaining ground every day. We have instances at Berlin, some mines in Germany, Portrush (Ireland) and elsewhere. Electric railways are talked of in Switzerland and Vienna, and now we hear that the Chicago Town Council has been memoralised by a Mr. Hannahs on the subject. Mr. Hannahs wants to erect an elevated railway in Chicago, the motive power on which shall be supplied by electricity, whilst the carriages will be lighted by the same agency.

THE TRANSMISSION OF POWER.—The subject of M. Marcel Deprez's experiments occupied the attention of "The Times" Paris correspondent this week. We have already expressed our opinion on these experiments, and would not refer to them again, but for the sanguine way in which the above correspondent treats the matter. He says, "In one of the experiments the force was transported 35 kilometres, and having been of 10 H.P. at the starting point, it was still 5 H.P. at the point of arrival." We think "The Times" correspondent is mistaken, and until we are proved to be wrong, must reiterate our previous statement, founded on the evidence of eye-witnesses of the experiment that not more than one-third, if so much, of the H.P. put into the sending machine came out of the receiving one.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"Yorkshire and Furniture Design"; "Chippendale and Yorkshire"; "Practical Furniture Salesmanship."

THE CHEMICAL AGE.—"The Chemical Engineering Conference on Leaching and Evaporation"; "Some Experiments with a Growth Impregnated Charcoal Catalyst," by A. Pickles, M.Sc.; "Chemical Trade in January."

THE EUROPEAN COMMERCIAL.—"Germany's Coal Production"; "Import and Export Prohibitions in Czecho-Slovakia."

THE FRUIT GROWER.—"Imperial Fruit Show Arrangements"; "Selecting Eggs and Working an Incubator," by E. J. Davey; "Fruit and Vegetable Trades Benevolent Society."

GARDENING ILLUSTRATED.—"Raising Tomato Plants"; "Allotments in February"; "Seeds and Germination."

THE GAS WORLD.—"Gas Supply in Ceylon"; "Electricity Supply in Yorkshire"; "Refractory Materials."

THE HARDWARE TRADE JOURNAL.—"Domestic Labour-Saving Appliances"; "Hardware Exhibitors at the British Industries Fair"; "Hints on Re-metalling Bearings."

Prices of Metals, Chemicals, etc.

TUESDAY, February 13.

		Price.	Inc.	Dec.
***Copper*—**				
Best Selected ..	per ton	£70 0 0	10s.	—
Electro Wirebars ..	„	£73 0 0	10s.	—
H.C. Wire, basis ..	per lb.	10 1/16d.	1/16d.	—
Sheet	„	10½d.	—	—
***Phosphor Bronze Wire (Telephone)*—**				
Phosphor Bronze Wire, basis	per lb.	1s. 2 1/16d.	1/16d.	—
***Brass* 60/40—**				
Rod, basis	„	7d.	—	—
Sheet, basis ..	„	9½d.	—	—
Wire, basis	„	10½d.	1/8d.	—
***Pig Iron*—**				
Cleveland Warrants	No. 3 per ton	£5 10 0	5s.	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£18 10 0	—	—
***Lead Pig*—**				
English	„	£29 10 0	5s.	—
Foreign or Colonial	„	£28 7 6	5s.	—
***Tin*—**				
Ingot	„	£186 5 0	£3 5 0	—
Wire, basis	per lb.	2s. 6d.	½d.	—
Aluminium Ingots ..	per ton	£100 0 0	—	—
Spelter	„	£35 2 6	2s. 6d.	—
Mercury	per bottle	£10 5 0	—	5s.

Sulphur (Flowers)—Ton £9 ***Sodium Chlorate***—Per lb. 2½d.
„ (Roll-Brimstone)—„ £8 10s. ***Sulphuric Acid*** (Pyrites, 168°)
Copper Sulphate.— „ £26 per ton, £7 10s.
Boric Acid (Crystals) „ £55 ***Sodium Bichromate***.—Per lb. 4½d.
Rubber.—Para fine 1s. 5d.; plantation 1st latex, 1s. 5½d. to 1s. 6d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

189 684 SIEMENS BROS. & Co. and H. G. WOOD. Electric fuses and cut-outs. (19/1/22.)
174 617 BAYERISCHE ELEKTRIZITATS-INDUSTRIE ROTT & Co. Automatic fuse switches. (25/1/21.)
189 693 L. B. TURNER. Wireless telegraph receivers. (8/2/22.)
181 680 J. F. COEUILLE. Electric soldering irons. (15/6/21.)
189 704 H. BOOTH. Electric laundry irons. (27/2/22.)
189 716 JOHNSON & PHILLIPS and G. C. PEARSON. Telephone cables. (22/4/22.)
189 720 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Circuit controllers. (12/5/22.)
189 724 M. GOODFELLOW and EVER-READY Co. (GT. BRITAIN). Electric torches. (24/5/22.)
185 111 O. SIMMEN. Electrically-controlled valve-gears for reciprocating engines. (24/8/21.)
189 733 EASTERN TELEGRAPH Co. and B. DAVIES. Electric signalling over cables. (23/6/21.) (Divided Application on 17234/21.)
188 678 A. BLONDEL and M. TOULY. Generation and modulation of continuous waves for wireless telegraphy and telephony. (9/5/21.)
188 682 J. W. HALL. Magnetic clutches and the like. (13/5/21.) (Cognate Application, 1 756/22.)
188 688 WESTERN ELECTRIC Co. Magnetic material. (17/5/21.)
188 689 H. BARON (F. ALDENDORFF). Automatic exchange telephone system. (17/5/21.)
188 690 A. E. WHITEM (ELYRIA IRON & STEEL Co.). Electric butt welding. (18/5/21.)
167 744 GES FUR DRAHTLOSE TELEGRAPHIE and W. SCHAFFER. Regulating the speed of electrical machines. (9/8/20.)
188 697 EASTERN TELEGRAPH Co. and F. E. PERNOT. Artificial cables for duplex telegraphy. (11/6/21.)
188 701 F. E. PERNOT. Electric telegraphy. (14/6/21.)
188 706 SIEMENS BROS. & Co. and W. H. LE MARECHAL. Tungsten and tungsten filaments. (18/6/21.)
188 707 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Electron discharge apparatus. (18/6/21.)

APPLICATIONS FOR PATENTS.

January 29, 1923.

2 592 H. J. OSBORN. Incandescent lamps.
2 600 F. J. YOUNG. Wireless receivers.
2 605 W. C. FOX. Electric furnace covers.
2 606 J. H. DEAS. Trolly head guide for electric railways, etc.
2 609 H. T. BOOTHROYD. Electro-magnetically operated brakes.
2 610 A. B. GREGSON. Switches for intermittent electric signs.
2 614 E. G. CRAVEN. High-frequency transformer for wireless telegraphy, etc.
2 623 M. L. MAGNETO SYND. and A. P. MCGOWRAN. Terminals for conductors.
2 631 METROPOLITAN-VICKERS ELECTRICAL Co. and A. E. L. SEANES. Amplifying apparatus.
2 645 DAGNO, LTD., and J. H. NOBLE. Storage batteries.
2 652 BRITISH THOMSON-HOUSTON Co. and A. P. YOUNG. Telephone receivers.
2 657 WESTERN ELECTRIC Co. (DEAKIN). Telephone systems.
2 664 E. W. MARCHANT. Current distributing systems.
2 668 B. RAETTIG. Plug and socket contacts.

January 30, 1923.

2 691 and 2 692 J. W. RECORD. Electric measuring instruments.
2 703 J. J. E. SLOAN. Electric head lamps.
2 704 J. J. E. SLOAN. Electric lamp globes.
2 709 F. W. DODD. Adjustable brackets for electric lamps, etc.
2 727 M. J. ARSKER. Electric lamp fittings.
2 728 H. W. SYMONS and F. E. WILSON. Telephone receivers, transmitters, etc.
2 746 RADIO COMMUNICATION Co., N. LEA and J. SCOTT-TAGGART. Telephone receivers, etc.
2 757 GENERAL ELECTRIC Co., LTD. Evacuation of incandescent lamps etc. (1/2/22 Germany.)
2 761 BRITISH THOMSON-HOUSTON Co. Arc welding. (16/2/22 U.S.)
2 762 WESTERN ELECTRIC Co. Carrier current signalling systems. (4/2/24 U.S.)
2 773 E. W. B. GILL. Thermionic valves.
2 774 GES FUR DRAHTLOSE TELEGRAPHIE. Thermionic generators. (14/2/22 Germany.)
2 783 H. WADE (GAINSFORD AND BROWN). Means for pulling down trolley poles.
2 791 AUTOMATIC TELEPHONE MFG. Co. and C. GILLINGS. Telephone systems.
2 792 AUTOMATIC TELEPHONE MFG. Co. and C. GILLINGS. Telephone systems. (10/5/22 U.S.)
2 803 E. C. R. MARKS (AMERICAN FLYER MFG. Co.). Toy electric railway switches.
2 805 M. L. MAGNETO SYND. and H. S. POTTER. Electric lamps for mines, etc.
2 807 E. GRANAT. Electric distant control system. (8/2/22 France.)

January 31, 1923.

2 822 H. C. CHAMBERS. Electrical devices for internal combustion engines.
2 827 J. POWNALL. Ceiling rose for electric lighting.
2 828 J. POWNALL. Switch.
2 836 P. M. MACINTYRE. Telegraphically transmitting writing, etc.
2 837 W. L. TURNER and W. J. S. CLEMMEY and E. G. PULFORD. Valve holders for wireless telegraphy.
2 840 R. JENKINS. Electric appliances liable to overheating.
2 847 J. H. TAYLOR and W. E. TAYLOR. Accumulator plates.
2 876 C. A. VANDERVELL AND Co. and W. H. GLASER. Magnets for magnetos, etc.
2 895 G. F. SHOTTER and F. C. KNOWLES. Protection of a.c. distributing systems.
2 906 D. J. OWEN. Testing electric insulation of motor cars, etc.
2 910 R. L. ASPDEN. Flywheel dynamo electric machines for internal combustion engines.
2 915 MATHER AND PLATT and S. F. BARCLAY. Bi-polar electrode electrolyzers.
2 919 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Motor control.
2 920 BRITISH THOMSON-HOUSTON Co. Automatic systems. (15/4/22 U.S.)
2 924 AUTOMATIC TELEPHONE MFG. Co. and P. H. ROSEBY. Resistance material.
2 925 AUTOMATIC TELEPHONE MFG. Co. and P. H. ROSEBY. Detectors for high frequency telephony, etc.
2 928 CONTINENTAL AUTOMATIC TELEPHONE and ELECTRIC Co. (TELEPHONE FABR. A. G. VORM J. BERLINER). Aerials for wireless signalling.
2 936 and 2 937 W. H. HITCHCOCK and A. E. KATZ. Thermionic valves, etc.
2 961 J. H. H. HAWKINS. Wireless receiving apparatus.

February 1, 1923.

2 965 H. F. SHANAHAN. Electric couplings.
2 989 H. R. WADDINGTON and I. H. PARSONS. High-frequency transformers and means for tuning same.
3 002 W. H. EDRIDGE. Galvanic cells.
3 026 X-RAYS, LTD., and M. A. CODD. X-ray tubes.
3 035 ENGLISH ELECTRIC Co. Rotors of electric fluid turbines.
3 046 L. M. ROBINSON. Travelling wireless transmitting and receiving station.
3 055 ELECTRICAL APPARATUS Co. and W. M. MORDEY. Electricity meters.
3 062 J. T. LEWIS. Means of carrying shades on electric lamp holders.
3 065 H. R. HARRIS. Leading-in bushes for electric cables.
3 073 F. RYMAN. Connections for flexible conductors.
3 074 T. BROWN and G. ELLISON. Switches.

February 2, 1923.

3 088 F. I. HOFFMAN. Driving of dynamos for motor cycles.
3 095 L. OTTORINO. Multiple electric signs.
3 100 H. G. WRIGHT. Microphones, etc.
3 106 BELDAM TYRE Co. (1920) and R. S. COLLIS. Valve holders for wireless telegraphy.
3 125 ELECTRIC CONTROL, LTD. Protective apparatus for high voltage systems.
3 132 A. REYROLLE AND Co. and H. F. SECRETAN. Wall plugs.
3 133 E. A. GORDON. Combined gramophone and wireless receiving system.
3 148 J. E. STEWART. Electric machines.
3 158 W. J. OLIVER. Wireless receiving apparatus.
3 166 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Welding.
3 182 C. H. LAUTH. Electrodes.
3 183 C. H. LAUTH. Insulated conductors.
3 184 C. H. LAUTH. Electric cooking ovens.
3 208 H. E. DONNITHORNE. Production of h.t. unidirectional currents.
3 214 T. F. GAYNOR. Crystal detector for wireless instruments.
3 264 A. H. DARKER. Train lighting dynamos.
3 267 A. E. WHITE (OSTERREISHISCHE DYNAMO-WERKE). Devices for connecting and disconnecting circuits.

February 3, 1923.

3 230 WILKINS AND WRIGHT and J. H. HEWITT. Electric condensers.
3 234 H. W. HEADLAND. Wireless sets.
3 242 H. R. WADDINGTON and I. H. PARSONS. Tuning coils or inductances.
3 254 C. B. BATHGATE and C. LEVER. Wireless mast.
3 260 F. W. YEO. Electric lights for buoys.
3 262 M. G. ANDERSEN. Sound transmitting devices for telephones. (8/8/22 Denmark.)
3 264 J. STONE AND Co. and J. T. PRESTIGE. Train lighting dynamos, etc.
3 274 D. G. TANNER. Supports for wireless aerials.
3 288 MYCROMET MFG. Co. and A. W. BUTTERFIELD. Tumbler switches.
3 293 ENGLISH ELECTRIC Co. and R. A. R. BOLTON. Switches.
3 298 H. S. CONRAD. Telephone systems.

Arrangements for the Week.

FRIDAY, FEBRUARY 16th (To-day).

INSTITUTION OF ELECTRICAL ENGINEERS. (SOUTH MIDLAND CENTRE). (STUDENTS' SECTION).
Lecture entitled "Protection . . ." by Mr. F. R. Coombes.

INSTITUTION OF MECHANICAL ENGINEERS.
6 *p.m.* At the Institution, Storey's Gate, London, S.W.1. Annual General Meeting.

BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION.
7.30 *p.m.* At Caxton Hall, Caxton Street, London, S.W.1. Salesmanship Conferences. Lecture on "Electric Power in the Home—Motor-Driven Appliances," by Mr. L. J. E. Genner.

JUNIOR INSTITUTION OF ENGINEERS.
7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette entitled "Notes on Some Insulating Materials," by Mr. T. L. Allison.

INSTITUTION OF ELECTRICAL ENGINEERS. (SCOTTISH CENTRE). (STUDENTS' SECTION).
7.30 *p.m.* In Room 149, Royal Technical College, Glasgow. Lecture entitled "Light and Illumination," by Mr. G. Lennie.

SATURDAY, FEBRUARY 17th.

WEST YORKSHIRE METALLURGICAL SOCIETY.
2 *p.m.* At Technical College, Bradford. Lecture on "Cast Iron," by Mr. E. Adamson.

JUNIOR INSTITUTION OF ENGINEERS.
2 *p.m.* Visit to Buildings in course of construction at Wembley for the British Empire Exhibition.

PAISLEY ASSOCIATION OF ELECTRICAL ENGINEERS.
3 *p.m.* Visit to the Fairfield Shipbuilding and Engineering Co., Govan.

MONDAY, FEBRUARY 19th.

INSTITUTION OF ELECTRICAL ENGINEERS.
7 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London. Informal Meeting. Discussion on "Esprit de Corps" (Opened by Mr. F. Peake Sexton).

INSTITUTION OF ELECTRICAL ENGINEERS. (NORTH-WESTERN CENTRE.) (LIVERPOOL SUB-CENTRE.)
7 *p.m.* At the Laboratories of Applied Electricity, The University, Brownlow Street, Liverpool. Paper on "The Maintenance of Voltage on a D.C. Distribution System by means of a Fully Automatic Sub-station," by Mr. P. J. Robinson.

TUESDAY, FEBRUARY 20th.

INSTITUTE OF TRANSPORT.
5.30 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Lecture entitled "Modernisation of Passenger Railway Stations," by Mr. F. Bushrod and Mr. J. F. S. Tyler.

INSTITUTION OF ELECTRICAL ENGINEERS. (EAST MIDLAND SUB-CENTRE.)
6.45 *p.m.* At The College, Loughborough. Short Papers.

INSTITUTION OF ELECTRICAL ENGINEERS. (NORTH WESTERN CENTRE.)
7 *p.m.* At the Engineers' Club, Albert Square, Manchester. Lecture on "Maintenance of Voltage on a D.C. Distribution System by means of a Fully Automatic Sub-station," by Mr. P. J. Robinson.

INSTITUTION OF ELECTRICAL ENGINEERS. (NORTH MIDLAND CENTRE.)
7 *p.m.* At the Metropole, King Street, Leeds. Paper on "Some Problems in High Speed Alternators and their Solution," by Mr. J. Rosen.

ILLUMINATING ENGINEERING SOCIETY.
8 *p.m.* At the Royal Society of Arts, John Street, Adelphi, London. Discussion on "The Projection of Light."

WEDNESDAY, FEBRUARY 21st.

UNIVERSITY OF LONDON.
5.15 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. First of series of four Lectures on "The Control of the Speed and Power Factor of Induction Motors," by Prof. Miles Walker.

INSTITUTION OF ELECTRICAL ENGINEERS. (SHEFFIELD SUB-CENTRE.)
7.30 *p.m.* At the Royal Victoria Hotel, Sheffield. Paper on "Cement Manufacture and the Application of Electric Drive thereto," by W. J. Coles.

ST. BRIDE RADIO AND EXPERIMENTAL SOCIETY.
7.30 *p.m.* At St. Bride Institute, Bride Lane, Fleet Street, London. Inaugural meeting.

INDUSTRIAL LEAGUE AND COUNCIL.
7.30 p.m. At Caxton Hall, Caxton Street, London, S.W.1. Lecture entitled "Economics of War and Peace," by Mr. W. A. Appleton.

FRIDAY, FEBRUARY 23rd.

JUNIOR INSTITUTION OF ENGINEERS.
7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette entitled "Characteristics, Operation and Maintenance of Underground Cables," by Mr. A. J. Tracey.

EDINBURGH ELECTRICAL SOCIETY.
8 *p.m.* At Philosophical Institute, 4, Queen Street, Edinburgh. Lecture entitled "Faults on A.C. and D.C. Plants," by Mr. J. Thomson.

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THE ELECTRICIAN

ESTABLISHED 1861.

THE OLDEST WEEKLY ILLUSTRATED JOURNAL OF

Electrical Engineering, Industry, Science and Finance.

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CONTENTS.

Notes of the Week	185	Books Received	20
Turbo-Alternator Design	187	Legal Intelligence	205
Electrical Operation and Control of Textile Machinery and Processes. By Frank Nasmith	188	£100 000 for Research	205
The Conversion of Spinning and Weaving Mills from Steam to Electric Drive. By V. Mallalieu. Illustrated	189	Mid-Lancs Electricity District	205
The War and the Textile Industry	191	Industrial Administration	205
An All-Electric Textile Mill. Illustrated	192	Imperial Notes	206
Electricity and the Textile Industry. Illustrated	194	Foreign Notes	206
Group Driving in a Lancashire Mill. Illustrated	196	Obituary	206
Textile Drives and Motor Design. Illustrated	197	Personal Items	206
Some Problems in High Speed Alternators and Their Solution. By J. Rosen. Illustrated	198	Electricity Supply	207
Institution of Electrical Engineers	200	New Editor of the "Blue Book"	207
Selling Domestic Power-driven Appliances	201	Tenders Invited and Accepted	208
Correspondence	202	Institution Notes	208
British Industries Fair	203	Electric Traction	209
Halifax Electricity Works Dispute	203	Wireless News	209
Watford Decides on German Meters	204	Business Irems	209
Forty Years Ago	204	Companies Meetings, Reports, etc.	210
Workshop Heating and Ventilation	204	New Companies	210
N.A.S.E. Dinner	204	Commercial Intelligence	211
Standard Plugs—G.E.C. Enterprise	204	Prices of Metals, Chemicals, etc.	211
		Patent Record	212
		Arrangements for the Week	212

Notes of the Week.

Textile Progress.

This issue is our fifth Annual Textile Issue. Conditions in that industry, we know from personal experience, are still bad, and it may be said that they might easily be worse but for the electric drive. During the boom period of a few years ago, to obtain an increase in output was the greatest desire of the textile manufacturer. To instal electric driving was the easiest and best means of achieving that end, and now that a slump is in being he finds that the flexibility, convenience and freedom of responsibility from power-production problems which this form of drive gives are advantages which are well worth realising. We are not, therefore, surprised to hear from a journal published in the textile area that "The prejudice that existed some years ago against the use of electricity has largely disappeared, and it is generally conceded that better spinning and weaving with increased output can be obtained by electricity owing to the more uniform drive and to the closer application of the motor to its work." We could not have put it better ourselves.

An Interesting Heating Installation.

Conditions being what they are, it is not astonishing to learn that few technical advances have been made. Probably the most important is that which we chronicle on another page of this issue in our description of the Egyptian Mill at Bolton. It has always been an argument against the use of electricity in the textile industry that moist heat is required. The installation at the Egyptian Mill shows how this can be provided electrically, and it is therefore a great advance. We hope the example will be followed elsewhere. It is sure to be successful. The relative merits of individual and group drive still continue to be a subject for discussion. The Oerlikon Co. have attempted to solve the question once and for all by designing a drive which shall combine the advantages of both systems. There are, of course, applications for which one or other of the arrangements is manifestly the better, but this new design might satisfactorily be tried where some compromise is possible. Mr. Nasmith, in his article, suggests that even with the solution of this matter electrical engineers have not finished their task. There are plenty of other things to be discovered and improvements made. Two of the most interesting of these are in the domains of colour matching and the graduated control of printing machines.

The Dangers of Electricity.

One of the disadvantages of propaganda in favour of any particular cause is that it inevitably begets propaganda to benefit the opposite cause. The electrical industry was for long free from this disadvantage, for it had no propaganda. But when the British Electrical Development Association and other bodies got to work we expected to find what has actually happened—inspired paragraphs and notices calling attention, not to the advantages but, to the dangers of electricity. We recently mentioned one not particularly clever effort in this direction. In our Correspondence columns to-day Mr. Justus Eck gives us a much more subtle example, while evidently the "begetter" of whom he complains is also responsible for an article in "The Westminster Gazette," which boldly begins: "There can be no doubt that a considerable case can be made for the abolition of electric light," and for a familiarly hysterical effort in "The Daily Express." In truth a considerable case can be made out in favour of anything—of the hypothesis that the earth is flat and that a diet of cold water is the best for the human system. A considerable case is not always a tenable case, and that is true in this instance.

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Electric Light and Eyesight.

Now what are the facts and what is the fiction? The modern electric lamp, according to Mr. BAWTREE, is perilous on account of its large volume of light, intrinsic brilliancy and ultra-violet radiation. Mr. BAWTREE has even visualised strange new and unsuspected dangers arising from X-rays, electronic emanations and induced currents from alternating supply. If some representative of the daily papers which have given publicity to this discourse had been present at the discussion they would have found that the experience of the speakers was entirely opposed to the author's views. No evidence worth the name was adduced in support of his contentions. It is, of course, understood that electric light, like other modern illuminants, should be used with discretion. Several members of the Illuminating Engineering Society who were present emphasised the need of suitable shading. But they could go no further with Mr. BAWTREE and emphatically rejected his advice that we should return to carbon filament lamps on the ground of their higher hygienic qualities. Photographers are naturally familiar with the actinic qualities of ultra-violet light and expressed themselves as quite content to incur the dangers of the minute quantities of this radiation emitted by incandescent lamps. The other "dangers," such as X-rays and so forth, are too absurd for discussion. We only wish that daily papers would exercise a little more discretion and avoid giving publicity to such alarmist statements. In these days when expert advice is readily available it is strange that they seem to have no machinery for detecting absurdities. In the meantime we suggest they study a sensible article in the "Manchester Guardian," if they fear that our own views are tainted.

Coal Costs and Psychology.

WE have received an interesting letter commenting on the Leading Article which appeared in last week's issue. In it, it will be remembered, we pointed out the great discrepancies that existed in the coal costs at various stations, and suggested that this matter should be given more attention. Our correspondent points out that comparison would be fairer to the stations in the south of England if pounds of coal per unit generated had been taken as a basis of comparison owing to the effect of increased railway charges; we agree. But his principal point is that working conditions and the contentment of the human element are factors whose effect upon costs are as important as they are invisible. Again we agree. As we have more than once chronicled, a determined effort is being made to reduce the salaries and wages of those employed by electricity supply undertakings on the plea that costs must be cut down. That effort will be met by counter attack, and the spirit of animosity thus generated may easily counterbalance the effect on the balance sheet of any saving so obtained. When a man is worrying how to make both ends meet and is suffering under a sense of injustice he cannot be expected to take the same close interest in his work as when he is free from anxiety. The matter is psychological rather than technical, but it will affect the coal costs just the same.

Transformer Problems.

A WEEK or two ago Mr. W. T. TAYLOR started a fine hare through our Correspondence columns. He wanted to know what British manufacturers made 110 000 V transformers, and he attracted quite a respectable pack of hounds. The chase for various reasons was exciting (we find it hard to keep up the metaphor), but after Mr. TAYLOR had doubled more than once we think we may say he was finally run to ground. His final contribution is that several British manufacturers have designed, built and have in successful operation power transformers on 110 000 V circuits, and that difficulty or uncertainty in the matter of design, manufacture or assembly of these units is a thing of the past. We never supposed otherwise. Equipment for such high pressures is not yet required in this country. But every engineer worthy of the name keeps in touch with what is going on elsewhere, and schemes and plans out his own ways of solving even problems with which he is not immediately connected. The demand is now arising and is being met. We have no doubt this will continue to be the case.

Watford's Dilemma.

WATFORD will have to join other municipalities on the black list. The Town Council, after much discussion, has decided to give an order for electricity meters to a German firm and so save themselves £1 300. We understand that the Council are not influenced by any tenderness for our late enemies and are certainly not indifferent to the state of the home labour market. But, of course, they don't make meters in Watford, and that may have something to do with it. We are, however, a little sorry for the Council. Mr. BARHAM found out that meters similar to those he required were being sold to Australia at 25s. 9d. each, as against the price of 40s. 9d. each offered him by the same firm. The Council, therefore, had to make the choice between feeling they had been done and laying themselves open to the charges which are usually levelled when municipalities buy abroad. Apparently they preferred the latter course. We should say they have made the wrong choice.

A Word to the Wise.

WE do not want to cast aspersions at those who are going to provide solutions of the interesting problem of wiring the "All-Electric House." But really some of the intending competitors are running things a little close. Applications for plans and conditions are still coming in, although it is only about five weeks to the closing date. To ensure a prize-winning design a large amount of thought and detail work will be necessary. We therefore suggest that those who intend to take part in our competition, and have not already been in touch with us, should lose not another moment. For ourselves, we are beginning eagerly to look forward to receiving the first efforts. Those who started to think about the matter in early January must, with the succession of wet week-ends that we have enjoyed, by now have decided how they are going to tackle the various problems. To them we suggest that they might let us have their results as soon as they conveniently can—at least before the judges become jaded.

"Science Abstracts."

IN a recent issue of the "Electrical World," Prof. KARAPETOFF makes an appeal to electrical students to keep in close touch with the progress of their profession by a constant study of the numerous scientific technical and trade journals. He gives a list of the journals which he himself regularly studies, and we are glad to see that THE ELECTRICIAN is among them. He details some useful methods of making notes on what is read, and remarks that it will pay the young engineer to obtain published information on electrical topics in a scientific way so as to have at hand information when required in as short a time as possible. With this advice all will agree in theory, but the practical task of collection and collation is enough to make the bravest tremble. Fortunately, this task is enormously lightened by the publication in more than one language of journals whose principal object is to record what has been dealt with elsewhere. Of these the best known to our readers, and it ought to be better known, is "Science Abstracts." Prof. KARAPETOFF pays a tribute to its worth, and seeing the vast amount of expert work that goes to its compilation what he says is not exaggeration. "Science Abstracts" allows the engineer quickly to satisfy himself of the general idea and perspective of any subject in which he is interested. It should be widely studied and supported.

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The British Industries Fair.

It is to be hoped that the numerous buyers from overseas, who are presumably visiting the British Industries Fair, will not regard the electrical exhibits as representative. Very little electrical machinery is being shown, and the display of electric lighting, cooking and heating apparatus can politely only be described as inadequate. In one or two cases, in fact, it looks as though exhibitors had included one or two electric fires on their stands as an afterthought, in order to fill up odd corners. In another case, an electrical firm whose name is a household word has a stand so small as to make a proper display of its productions impossible. The visitor cannot help noting the absence of nearly all the larger firms in the industry. It is, in fact, evident that the British electrical industry does not, as a whole, regard the British Industries Fair as a very potent means of influencing oreign trade. There it is mistaken.

A Cheerful Prospect!

It occasionally happens that proceedings at a technical discussion are lightened by a remark which gives rise to purely philosophical speculation. Such was Prof. THORNTON'S hint at the Institution of Electrical Engineers last week that an exciter switch he describes might be used to shut down all the stations in London from Gwydyr House. Remote control is as favourite a theme with novelists as with engineers. We have all of us read of the foreign spy who, by pressing a button in a cellar in Hackney, can blow up the House of Lords, but this combination of romance and engineering is new. It takes a little effort to imagine Sir JOHN SNELL shutting down the London companies' stations one by one because they refuse to agree to proposals for a Joint Authority; it takes less to imagine what would happen in the streets as the result of his action, and still less to imagine what the Papers would say about it next morning. And if the Commissioners, why not the E.P.E.A. and the E.T.U.? We think we had better leave this subject with the remark that if it ever happens may we be there to see or rather not to.

Dish Washing and the Ordinaries.

SOME hard things were said about the electric dish-washer at the Salesmanship Conference on Friday. But there need be no pessimism about this, for the electrical part of the apparatus (a small part only) is sound enough, and the difficulty arises at the point where the water comes in contact with the plates and saucepans. The dish-washer as at present designed undoubtedly has a place in restaurants, hotels and other similar establishments. Its place in the ordinary house is less certain, owing to its high cost and infrequent use. But it is in the ordinary house that dish-washing shows its most distasteful side. We suggest, therefore, that the problem has got to be tackled afresh from first principles, so that Mrs. Ordinaire and her like may receive some very necessary relief.

Turbo-Alternator Design.

It is appropriate that the Faraday medal of the Institution of Electrical Engineers should have been awarded to Sir CHARLES PARSONS on the day on which a Paper on the machine to which he has devoted his life's work was down for discussion. The evolution of the steam turbine from the experimental to the commercial stage was beset by more than ordinary difficulties, difficulties which required much patience, knowledge, money and time to overcome. It was doubly appropriate therefore that Mr. ROSEN'S Paper should consider the history and failure of turbo-alternators and lay bare the troubles that have been encountered in the design and construction of the various parts. In honouring Sir CHARLES PARSONS, the Institution has, as Mr. GILL well said, honoured itself, and in discussing a Paper of this kind it has enabled the advance, which Sir CHARLES started, to be further continued.

The Speed Difficulty.

One of the fundamental difficulties of turbo-alternator design is connected with the question of speed. High speeds of rotation are essential to the economical operation of the steam turbine, and the standard frequency of 50 in this country limits the alternator speed to 3 000 revs. per min. Either, therefore, the turbine must be constructed to run at this speed, or gearing between the turbine and the alternator must be employed. The latter course enables ordinary material and low speed construction to be used on the alternator, and though it introduces certain complications, it would be interesting to know why in this country this particular arrangement has not been much adopted. Mr. ROSEN avoided this point, and it was not mentioned in the discussion.

Size and Ventilation.

Taking the 3 000 revs. per min. machine as standard, it is interesting to see how rapidly the size of the machines constructed since the war has increased, until to-day alternators with a continuous maximum rating of 20 000 kVA have been manufactured in this country, as against 9 375 kVA for the same speed in the United States. The reason for this appears to lie in ventilation difficulties, a matter to which Mr. ROSEN gave a good deal of consideration. It is interesting to find that he is in favour of water cooling, an arrangement which only a few years ago would have been considered far outside the range of practical politics. Incidentally, the use of water cooling enables the heat losses to be accurately measured, and so forms a useful check on design and operation.

Mechanical Construction.

The most important part of the Paper, if the remarks in the discussion may be taken as a criterion, is that which deals with the mechanical construction of the rotor. Mr. ROSEN prefers the solid forging with a long body. On the 14 700 kVA machines, which represent standard practice, the length was 105 in., with a diameter of 29 in., giving a ratio of pole length to pole diameter of 3·62. He also described in some detail the improvements that have been made in the windings so as to reduce cost and to increase reliability. These desiderata in the Parsons machines are, of course, obtained by the use of stranded cable, which can be made to any shape on a special machine and is then placed in the slot. Similar care has been expended on the design and manufacture of the end connections and on the discovery of a flexible mica insulation, which prevents unequal expansion and reduces eddy currents in the joints.

A Delight to the Designer.

The example set by the author of laying bare secrets was followed in the discussion, with the result that a mass of information was collected both from other designers and from users which will form a useful record and a starting point for fresh progress. As Dr. S. P. SMITH said, it was a delight to the designer and an encouragement to consulting engineers not to demand too standardised a product.

The Right Way to Work.

The proceedings generally bore out the view that the right way to set out in these matters is to work for the utmost limitation of losses and to use the best materials at the lowest stresses possible. This may seem to be both idealistic and expensive. But really it need not be so. The best materials must be the cheapest in the end and low stress means reliable operation. At the same time this must not be turned into an argument for large factors of safety. The more that is discovered about the materials employed the more will the uses to which they can be put be more accurately known and the more will it be possible to reduce the weights used to a minimum.

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Electrical Operation and Control of Textile Machinery and Processes.

By FRANK NASMITH.

It would be difficult to define clearly the trend of textile machinery improvement at the present time, or even to enumerate any invention or series of inventions involving new principles. Such improvements as have been forthcoming are of a minor character, and it may safely be stated that invention of the character which gave us the self-acting mule, or the combing machine, has not been met with for a number of years. A number of useful improvements have, however, been made, which have refined the machinery to which they have been applied.

The Work of the Cotton Industry Research Association.

The work of the British Cotton Industry Research Association will undoubtedly be closely watched. Already the result of certain investigations have been published, and from the exact knowledge of the behaviour of fibres and material when undergoing certain processes new mechanism may be evolved. If there is any distinct trend in invention to-day it is towards the provision of machinery which will more gently treat fibres in their initial stages of preparation for spinning, and, at a later stage, by increasing the draft or attenuating process in a single machine to eradicate one of the machines at present forming a unit in the ordinary mill complement.

A possible scarcity of labour, particularly younger labour, may necessitate the introduction of machines and appliances which do not depend upon the human element so completely as is at present the case.

Electric Drive Making Headway.

Mill owners have become accustomed to the employment of the electric drive, which, if it is not progressing as speedily as was originally foreshadowed, is, nevertheless, making headway in the textile factories of this country. The familiarity with the medium may result in its further application, not merely as a means of transmitting power but also in the operation and control of parts, and the selection of mechanisms in order to form pattern.

Increasing knowledge of the scientific possibilities of electricity may enable textile machinists to solve problems which to-day are performed by mechanism in an inadequate and non-positive manner. Take, as an example, the problem of picking or projecting the shuttle from box to box in a loom in order to carry the length of weft or filling and lay it between the warp threads. The operation is at present performed by subjecting the shuttle to a hard sharp blow, first in order to effect its release from springs which bring it to rest and hold it in the box, and, secondly, in order to impart to it that high velocity which will enable it to pass through the warp threads in the small amount of time allowed. Noise, comparatively heavy consumption of power, considerable wear and tear of parts are defects of this method. Further, from the time the shuttle leaves the opening of the box from which it is ejected it is uncontrolled. It is suggested that electric control of the shuttle is a possibility. Whether at present such a method is commercially sound it is for electricians to say. Polyphase currents or magnetic devices might be employed, and the stud system of electric traction naturally presents itself as the means possible of adoption. Some years ago experiments of this character were made in relation to swivel loom shuttles, in which the shuttles move only a short distance, but these experiments were unfortunately never completed.

Possible Developments.

Another principal weaving operation is the shedding or division of the warp threads to form a rectangular opening or "shed." In pattern weaving the threads are raised or lowered in a predetermined manner to form a pattern. We are all familiar with the electric advertising signs which are so largely used in America, and in this country. There is no reason why a rotary drum provided with contact and non-contact spaces might not be utilised to actuate electrically the pattern controlling mechanism of a loom. By the use of removable studs in combination with this rotary drum, within certain limits, a large variety of designs could be produced with very little trouble. It would, undoubtedly, be possible to dispense with many mechanical parts which, at present, generate friction and eat up power.

An Electrical Jacquard.

Some years ago Sizepanik, an Austrian, invented a system of producing jacquard designs in a remarkably short space of time. By the agency of photography, insulated and non-insulated surfaces, and electrical card-cutting devices he cut down the time occupied in the production of an intricate design from days to a few hours. His method was, however, costly. Since that time, however, Dr. Carver has developed an electrical jacquard, and this, to-day, is working commercially in the production of linen damasks.

Quite a number of looms employ what are termed drop boxes or circular boxes. The boxes contain shuttles carrying differently coloured wefts, and when required by the peculiar colouring of the pattern the requisite shuttle box is brought into position so that the shuttle may be projected across the loom. There is no reason why such control should not be effected by electrical means.

Progress in Control Devices.

There are, to-day, in existence a number of control devices applied to textile machinery which are electrical. The best known examples are the stop motions applied to the drawing frame and the loom. In both cases the breakage of material—a sliver in the first case and a thread in the second—causes an electric circuit to be closed, and brings about the stoppage of the machine. But there are other textile operations that could be controlled electrically. For example, cloth in passing to certain finishing machines should be maintained at full width and guided correctly. At present various devices are employed, one of which relies on air under pressure to effect the movement of guiding rollers. The movement sideways of the fabric affects valves which, permitting a flow of air, actuates rollers to secure the desired guiding effect. There is no reason to believe that electricity could not be employed for this purpose.

Positive control of the let-off motion of looms, which is largely non-positive to-day, might be effected by the use of a small motor—the speed of which could be controlled directly from the decreasing diameter of the warp on the beam, or from the cloth roller which is taking or winding up the woven fabric. In operating ring frames it is stated that 80 per cent. of the power consumed is taken by the spindles. Many attempts have been made to control the speed of spindles, and much progress has been made electrically. There is, however, quite a useful field of investigation awaiting the explorer.

Electricity as an Aid to Matching.

There has been quite a remarkable addition to the number of colour matching lamps on the market. In a very similar field the "Fadeometer" is most interesting. Much has been written lately about fadeless dyes, and numerous inquiries have been made regarding the suitability of certain dyes for certain fabrics. The "Fadeometer" is an electric lamp which is employed to test dyed patterns. It gives a standardised sunlight for any length of time, and the records secured from its use should prove extremely useful. The "Fadeometer" utilises the

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violet carbon arc, which is controlled and maintained absolutely constant by automatic mechanism contained within the instrument cabinet. The arc stream plays between special electrodes and develops a spectrum containing the ultra-violet and other rays found in the spectrum of sunlight. Being of the same actinic properties as sunlight, this arc affects all colours and produces chemical reactions as in sunlight. These light characteristics, however, never vary; they are identically reproducible; hence the possibility of an absolute standard. One interesting feature in connection with the apparatus is that underneath the light is a humidifier, which is kept filled with water. The radiant heat from the light evaporates the water and carries the vapour upward, thus maintaining the proper humidity in the region of the samples.

Nothing has recently been heard of an attempt made some years ago to singe or "gas" threads by means of electricity. At the time the writer proved how uneconomical was the method when compared with that usually adopted, namely, passing the thread through a bunsen flame. The objections were primarily cost, and, secondly, the difficulty of insulating the singeing units.

Electrolytic bleaching, although not widely employed, except in connection with laundries and linen bleach crofts, has proved quite successful for cotton goods and might, with advantage, be developed.

Use of Graduated Control Should Increase.

There is one well established feature of electrical practice which might have a considerably wider application. Originally devised in Germany, the writer noted its wide application in the United States. Reference is made to the easy graduated control of calico-printing machines. In this country it was the practice to employ small steam engines and gearing for driving those machines. By the use of electricity the exact speed desired can be secured, with the result that better printing, better registration of the design, and other advantages accrue. Reference has been made to the spindles of ring frames, the speed of which can readily be accelerated or retarded by either mechanical or electrical means, although the latter is essentially finer in the gradations that can be secured. There is no reason why similar control should not be exercised over the rollers used for drafting in ring frames and mules. In the production of some kinds of fancy yarns this is essential, and to-day for such yarns there is a growing demand from the hosiery industry.

As previously suggested by the writer, the combination of electrical and pneumatic means to produce fancy yarns might be adopted. The first would control the spindles, and the second provide the extra, or additional, material to the twisting yarn to form those "slubs" or knobs which are a feature of certain classes of yarn.

Electrical Heating Possibilities.

Improvement in electrical heating apparatus may have proceeded so far that the principles could be modified to apply to the many machines which, at present, employ steam as a heating medium. It may be stated that the comparatively rapid condensation of the steam within these machines is naturally uneconomical. The material in a wet state, and either in the form of yarn or cloth, passes over the outer face of a cylinder into which live steam is admitted. The object, of course, is to dry the material, and the suggestion is that some force of electrical heating apparatus might be utilised.

It would not be good policy to suggest that electricity can be utilised to operate each and every part of a textile machine. There are many mechanisms that are both satisfactory and economical. But others, some of which have been outlined, could be very materially improved by electrical control.

The Conversion of Spinning and Weaving Mills from Steam to Electric Drive.*

By V. MALLALIEU.

The mills to which the reader's attention is now drawn comprise a group of buildings which, up to about eighteen months ago, were driven by three steam engines, the largest of which, a beam engine of hoary age, groaned loudly under its load, and literally called for replacement. The boilers were also worn out, and the whole question of power supply was, therefore, brought under review. In considering the various possible schemes of driving, it was obviously desirable to centralise the power plant and, owing to the disposition of the buildings, this practically necessitated electrical transmission to, at least, some portion of the machinery. Complete electrification offered a simple solution to an otherwise complex and difficult millwrighting problem; moreover, it eliminated the necessity of installing any new steam power plant at all, as the Blackburn Corporation were just on the point of completing their new large power station, and offered to give the requisite supply on satisfactory terms. It was therefore decided to take the Corporation supply and drive electrically.

The Conversion Scheme.

The METROPOLITAN-VICKERS ELECTRICAL CO. worked out a scheme for driving the mills, and submitted a tender for the electrical equipment required; the contract for the whole of the work, both mechanical and electrical, was, however, placed with Ashton, Frost & Co., and the Metropolitan-Vickers Electrical Co. became their sub-contractors for the electrical plant. This comprises 38 motors, aggregating 1 635 H.P., together with control gear, main low-tension switchboard, and the complete cabling system, all for operation with 400 V, 50-period, three-phase power.

The driving is all on the group system, and in its design the following aims were kept in view:—

(1) Transmission from motor to machine through one shaft only, with the minimum of gearing and belting.

(2) Limitation of motor horse-power and speeds to a few standard ratings.

(3) Protection of the motor windings from the atmosphere of the factory.

The first of these aims was almost realised by using a considerable number of motors of moderate size in preference to a few large machines, and by speeding up lineshafts sufficiently to couple them direct to the motors wherever the character of the machinery permitted it. The general principle of putting a separate motor to each lineshaft was only departed from in the case of a few of the lighter shafts and minor drives, where such a departure became expedient in order to comply with the second aim to limit the number of motor sizes. The motor sizes actually installed were as follows:

3	160 H.P.	415 revs. per min.
6	60 H.P.	725 revs. per min.
1	60 H.P.	415 revs. per min.
19	30 H.P.	725 revs per min
8	20 H.P.	725 revs. per min.
1	5 H.P.	950 revs. per min.

The third condition aimed at was completely attained by accommodating the three 160 H.P. motors in a specially built motor tower, while all the smaller machines were provided with pipe ventilation arranged to take in air from outside and exhaust it into the rooms.

Fig. 1 is a plan of the mills showing the positions of the motors. Taking the large four-storeyed spinning mill first—the ground floor houses the carding department, and this is driven by a number of lineshafts which of necessity run at rather low speeds. These shafts are operated by three 60 H.P. and two 20 H.P. motors, all running at 725 revs. per min., fixed overhead and connected to their respective shafts by means of staggered tooth laminated steel gears. The motors are all of the squirrel-cage type, and to overcome the objection of the Corporation to the use of such large squirrel-cage machines,

* From "The Metropolitan-Vickers Gazette."

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the 60 H.P. motors are provided with automatic centrifugal clutches made by Thos. Broadbent and Sons, which enables the motor to start up light with a low starting current and automatically pick up the load as the motor approaches full speed. Fig. 2 shows one of these 60 H.P. motors with clutch and gearing; it should be noted that the whole, including two pedestal bearings carrying a short piece of the lineshaft with half-coupling, is mounted on a common bed-plate and constitutes a self-contained driving unit, which was accurately assembled in Ashton, Frost and Co.'s shops before being delivered to the mill. The same remark applies to all the gear drives in the installation except that the 30 H.P. and 20 H.P. motors are not provided with clutches and have overhung pinions. Each motor is controlled by an oil-immersed auto-starter having overload and no-voltage releases and an ammeter.

Spinning Mule Drives.

The upper three-storeys of the large mill are occupied by spinning mules, and each storey is driven by one line-shaft which originally ran at 200 revs. per min., but has now been speeded up to 415 revs. per min. and direct coupled to a 160 H.P. motor. Now the spinning mule is at least so far faithful to its name in that it is exceedingly difficult to drive, on account of the large cyclic variation in its power consumption. In this instance the requirements have been very accurately anticipated, the average load on the 160 H.P. motors proving to be about 120 H.P., while the momentary peaks occasionally reach 250 H.P., which is just about the limit of overload permissible in view of the importance of speed uniformity. Fig. 3 is an exterior view of the tower which was erected at one end of the mill to carry the three motors; Fig. 4 is an interior view showing one of the motors mounted on cast-iron girders in the tower, with its switch pillar and liquid starter on a floor below, level with and accessible from the floor of the spinning room which the motor drives. The switch, starter and motor brush-lifting gear are electrically interlocked in order to prevent incorrect sequence of operation.

Constructional Details of Tower.

The tower itself is probably unique in construction. Brickwork was ruled out, as it would probably have caused trouble due to settlement, and structural steelwork was thought to offer possibilities of vibration; the tower was therefore built of cast-iron columns and cross-beams, and the three exterior sides were completely glazed so that no light is cut off from the mill. Each floor is constructed with a hatchway, and a lifting girder is provided in the roof so that any motor can be easily lowered to the ground if necessary.

Cotton Spinning Mill.

The smaller four-storeyed mill contains the cotton-spinning machinery on the ground floor, and ring-spinning frames on the three upper floors. Each floor is driven by one 60 H.P. squirrel-cage motor direct coupled to the lineshaft through a Broadbent centrifugal clutch. The bottom room shaft with its motor runs at 415 revs. per min., but the three ring-room shafts have been speeded up to 725 revs. per min. with quite satisfactory results. The determination of line-shaft speeds is only too often a matter for compromise between the electrical engineer, who wants a high speed in order to instal a direct-coupled motor at a low cost and a high power factor, and the mill manager who is accustomed to the low shaft speeds which prevail in engine-driven mills. Now, ring frames are themselves high-speed machines, and can well be driven from a high-speed lineshaft as exemplified here.

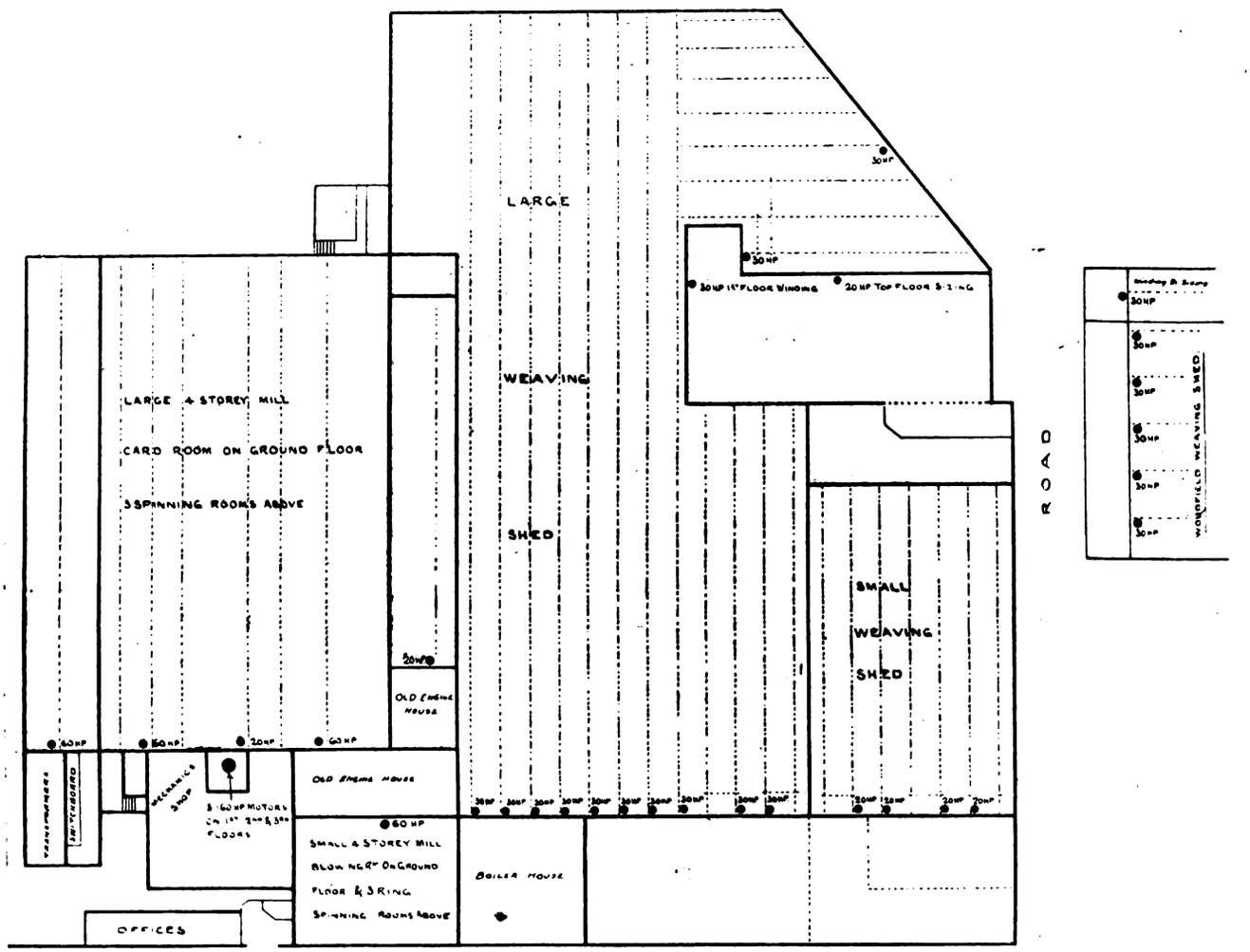

FIG. 1.—PLAN OF THE MILL HILL COTTON WORKS, BLACKBURN.

Weaving Shed Installation.

In the weaving sheds, of which there are three, containing a total of about 1 200 looms, the method of driving is in general the same throughout, and consists in the use of 20 H.P. and 30 H.P., 725 revs. per min. squirrel-cage motors, mounted on wall brackets and geared to the cross-shafts which run at 136 revs. per min. Laminated gears are used, and the assembly is on the same lines as described for the card-room motors. The old wall brackets which had supported the old lineshaft with its bevel gears were utilised, in conjunction with additional

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new brackets, to support the motor baseplates. As far as is practicable with the two sizes of motors adopted, the cross-shafts are individually driven; this principle has, however, been departed from to the extent of belting two shafts together in the two small weaving sheds, where the shafts are short and require only 10 to 15 H.P. each.

There are two 30 H.P. and one 20 H.P. motors in the winding, warping and sizing departments, all driving lineshafts

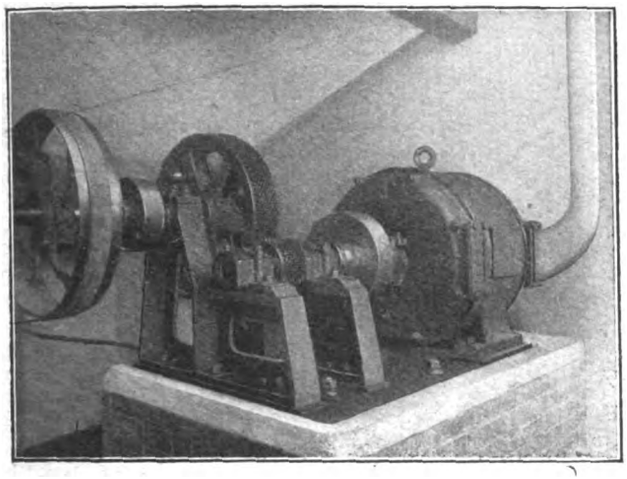

FIG. 2.—VIEW OF PIPE-VENTILATED MOTOR, WITH CLUTCH AND GEARING DRIVING CARD ROOM LINE SHAFT.

by means of belts and not exhibiting any features that call for special comment.

The whole plant is controlled by a ten-panel open-type, slate switchboard situated in a specially-built room adjoining the Corporation transformer substation. The main incoming panel has a capacity of 2 000 A, and there are eight-feeder panels for power and one for lighting. Each panel is equipped with an ammeter and a watt-meter, so that power costs can be accurately proportioned amongst the various departments.

Single-wire, armoured, lead-covered, paper-insulated, three-core cables of W. T. Glover and Co.'s manufacture constitute the main feeders, three of which run from the switchboard direct to the three 160 H.P. motors, while the remaining five run to ironclad distribution fuse boards in various departments. The smaller motors are connected up to these distribution boards

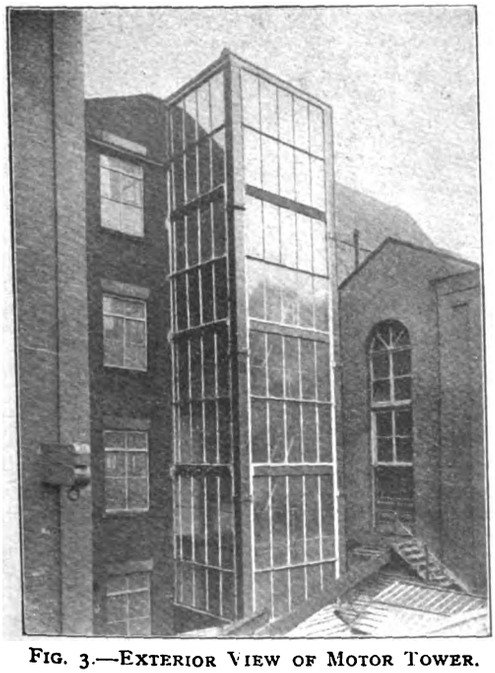

FIG. 3.—EXTERIOR VIEW OF MOTOR TOWER.

by means of single-wire-armoured V.I.R. three-core cables. Trifurcating boxes and armour clamps are provided on all the motors and control apparatus, so that the whole system from the switchboard onwards is completely armoured and continuously earthed.

The mill was formerly electrically lighted by means of a steam-driven 230 V d.c. generator. This has, of course, been discarded, and the lighting circuits have simply been connected through a distribution board and a four-core cable to the lighting panel on the main switchboard, where a 230 V supply is made available by a connection to the neutral point of the transformers.

Satisfactory Results Obtained.

The installation has been put into operation without a hitch, and is running eminently satisfactorily, the driving being now noticeably smoother than with the old engine. It is indeed not too much to say that in this instance electrical

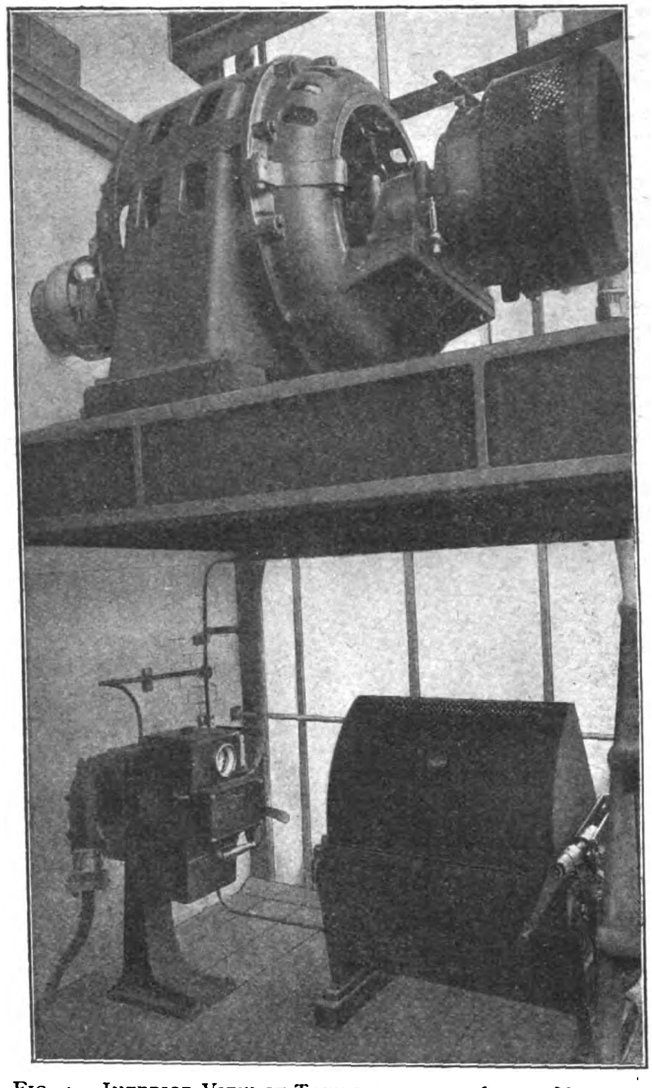

FIG. 4.—INTERIOR VIEW OF TOWER SHOWING 160 H.P. MOTOR AND CONTROL GEAR.

driving has been the means of converting an old mill, handicapped by a very irregular layout, into the equivalent of a modern mill.

The War and the Textile Industry.

It is pointed out by the author that electrical driving in Lancashire cotton spinning mills and weaving sheds was steadily growing prior to the war and, as a result of experience gained up to that time, it was becoming recognised that the use of power purchased from a large power station had much to recommend it, and was economically sound. The war, while completely arresting the work of electrically equipping cotton mills, did much to popularise the electric power station amongst industrial power users, and, as a consequence, when the post-war movement for industrial reconstruction set in, spinning and manufacturing companies who found themselves faced with the necessity of renewing power plant approached the subject with a more open mind than they would have done in 1914. Much progress has resulted. There is no doubt that these are the right lines upon which to work, and when trade in the textile industry revives the development may well be highly satisfactory.

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An All-Electric Textile Mill.

Power, Heating and Cooking from One Source at Bolton.

An argument which has often been advanced against the use of electricity in textile mills is that as moist heat is required for carrying out the various processes it is false economy to use the electric drive at all when steam operation will show a greater over-all efficiency. Alternatively, it is contended that if the electric drive is to be employed it is much better that each mill should generate its own power than take a supply from the public mains, for in this way the exhaust steam from the turbines can be put to efficient use. Long years of hard experience are now beginning to show the textile manufacturers of the country the fallacies of these

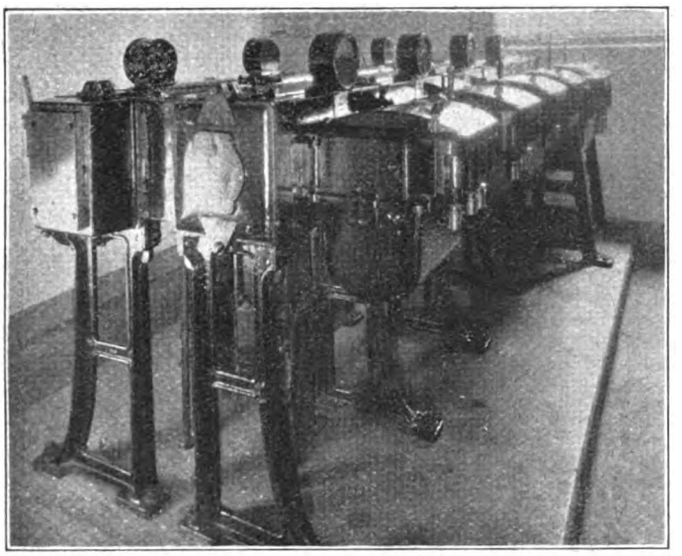

FIG. 1.—VIEW OF THE CONTROL BOARD IN THE SWITCH ROOM.

arguments and for some time now there has been a gradually increasing disposition to supersede even well designed and economically operated steam plant by the electric motor, a tendency that was accelerated by the war and war conditions.

There are many reasons for this, among the most obvious being that the textile manufacturer's principal duty is to ensure the economic production of certain material and that the less he is bothered with complicated questions of power generation the better for all concerned. Nevertheless it is only recently that the great step forward of using electricity for heating purposes in a textile factory has been made and Mr. W. J. H. Wood, Borough Electrical Engineer, of Bolton, and Mr. L. L. Haselden, of Knowles, Ltd., in whose Egyptian Mill in that town an interesting electric heating installation has been carried out, are therefore to be congratulated both on their enterprise and on the results they have obtained.

The Electric Drive as a Space Saver.

Like many other mills, the Egyptian Mill was partly shut down soon after hostilities commenced and was closed altogether in 1916. When reopening was considered after the war the existing boom in the textile industry made the consideration of extensions inevitable. It was found that by adopting the electric drive throughout and by employing electric heating for providing both the hot air and the necessary humidity the space originally occupied by the engine house and most of the reservoir could be absorbed and the area available for textile production greatly increased. In February, 1919, an order was therefore given for the entire electrification of the mill on the lines we describe below and the installation has now been in satisfactory operation for some months.

Supply Arrangements.

Energy is obtained from the 6 000 V mains of the Bolton Corporation through two 600 kVA transformers which are contained in a special transformer chamber on the ground floor of the mill. These transformers, which are controlled by the switchgear of the usual type, step down the high tension current to 400 V for use on the heaters and the motors, and to 230 V for use on the lighting circuits. The mill switch room, which adjoins the transformer chamber, is illustrated in Fig. 1. It contains ten ironclad switch panels of George Ellison's make, four of which control the spinning room motors and one the card room motor. Another panel controls a distribution board in one of the spinning room motor chambers whence are supplied the motors which drive the hoist, the bale breaker and blowing equipment. The heating installation is controlled from five similar panels, while other switches control the hot water boiler and hot cupboard in the canteen and the lighting installation of the mill generally.

The Hot Air and Humidity Installations.

The Egyptian mill is a five storey mill with a spinning room on each of four floors. Three of these spinning rooms contain two 40 kW heaters which work in conjunction with one 7½ H.P. fan motor. The card room is similarly equipped, while the fourth spinning room contains three 40 kW heaters which also work in conjunction with a 7½ H.P. motor. These heaters and motors comprise the hot air installation and have a total capacity of 440 kW. Each 40 kW heater is divided into eleven units and is sectionalised for control purposes into banks of 16 kW and 24 kW respectively, each of which is controlled by two triple pole star-delta switches.

In addition each spinning room and the card room contains an electrically heated hot water installation for providing the humidity necessary to satisfactory textile operation. Each of these humidity heaters consists of five sets of immersion heaters with an aggregate capacity of 64 kW making a total capacity under this heading of 320 kW. Each hot water heater is sectionalised and controlled by three triple pole air break switches, one of which controls a tank of 16 kW and two tanks of 24 kW each. In this way a certain range of heat adjustment is easily obtainable. A motor driven pump in the basement supplies water for humidifying purposes to all the spinning rooms and the card room. The general arrangement of the two sets of heating installations which have been supplied by Hall & Kay and Belling & Co. are shown in diagrammatic form in Fig. 2 and a photograph of one of the installations is given in Fig. 3. The operation of both the hot air and hot water installation is controlled by a triple pole oil

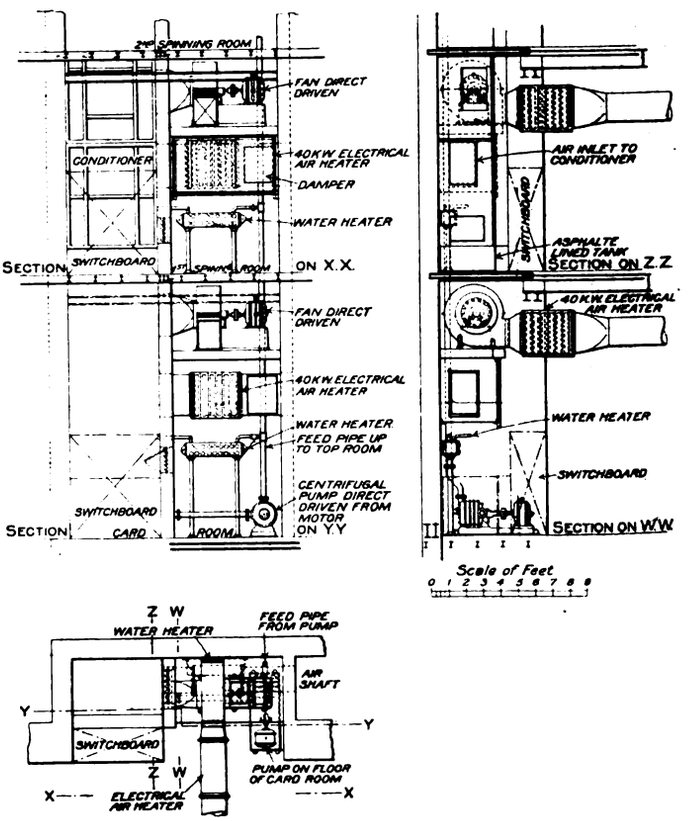

FIG. 2.—DIAGRAM OF ELECTRIC HEATING ARRANGEMENTS IN THE EGYPTIAN MILL.

break switch. This switch is fitted with a no-volt release device. And in order to ensure safety in working and to prevent over-heating this device is connected in the fan motor circuit. It consists of a small mercury break switch

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which is kept in the " on " position by a small bellows which is operated by air from the fan and which is so arranged that only when the fan is working can the no-volt circuit be closed. The motor itself is operated from a different circuit from the heaters.

It should be pointed out that the object of the hot air installation is to provide a sufficient temperature in the mill during non-running hours and it does not therefore increase the total kilowatt demand. This does not apply to the same extent to the hot water installation, as humidity is required during the working hours. But it is found in practice that the heat from the belt friction on the machines is sufficient to heat the mill except on very cold days when the boiler plant can be used as a standby. The hot water heating is transmitted through the spinning rooms and card rooms by means of pipes, while the air heating is effected through the trunks shown in the diagram which are fixed to the ceilings of the rooms. In the hot water installation the water is pumped over the immersion heaters, thence passes through humidifiers and is then sprayed into the room.

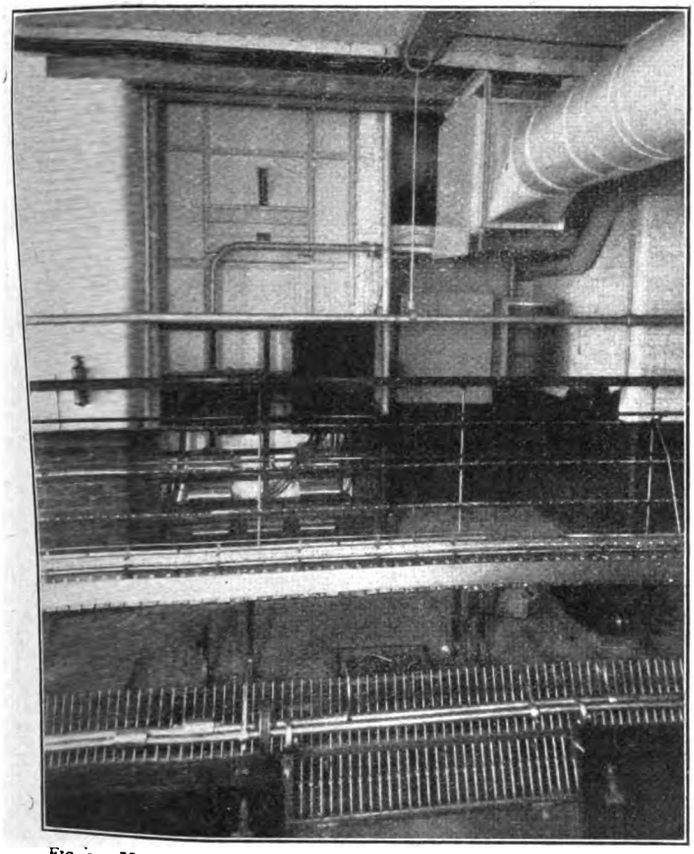

FIG. 3.—VIEW OF THE ELECTRICALLY OPERATED HOT AIR AND HUMIDIFIER INSTALLATION.

The Power Installation.

Turning to the power installation, the machines in the card room, which is on the ground floor, are divided into three groups, each of which is driven by a 85 H.P. slip ring motor running at 365 revs. per min. These motors, as in all other cases, are fixed in a special chamber outside the actual working rooms. Each spinning room is driven by a 225 H.P. slip ring motor running at 480 revs. per min. and direct coupled to the line shaft. Each spinning room contains seven pairs of mules or 15 400 spindles. The spinning room motors are also placed one above the other in a special motor chamber (see Fig. 4), the floors of which are covered with iron gratings which can be easily lifted and the motors moved out for repair or inspection by means of a hand worked hoist fixed to the roof. Each motor is controlled by its own set of ironclad switchgear and an oil immersed starter as shown in Fig. 4. A push button emergency switch in each spinning room enables the plant to be stopped quickly in case of need. Each of these floors is equipped with a small runway for bringing the motor under the hoist and with a special plug which enables a cleaning blower to be easily used on the motor while in position. In addition to these main motors there is a 40 H.P. motor in the blowing room. This is direct coupled to the line shaft and runs at 480 revs. per min., while a 5 H.P. squirrel cage motor which is geared direct through a raw hide pinion and spare wheel drives the bale breaker. A lift for finished goods is also electrically driven. All the above motors are of Crompton and Co.'s manufacture, the main switch and motor control gear having been supplied by George Ellison.

We understand that the cost per installed horse-power of

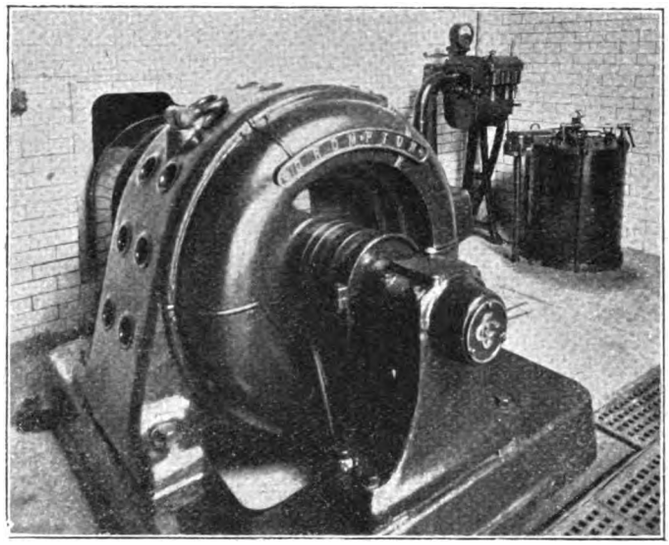

FIG. 4.—VIEW OF ONE OF THE SPINNING ROOM MOTORS SHOWING CONTROL GEAR.

the power installation including the main control panel, wiring, motors and starting gear, at prices ruling in February 1919, was £4 15s. per H.P. We have already referred to the warming cupboard which was supplied by the Carron Co. It is used for keeping the food of the workpeople warm, and a Jackson heater in the canteen provides hot water for washing and other domestic purposes. The use of electricity is carried as far as to employ an electrically driven yarn tester, by means of which the strength of the yarn for spinning can be simply determined.

The installation generally, therefore, provides an example of a mill in which all the operations necessary for the production of the material and the comfort of the workpeople are per-

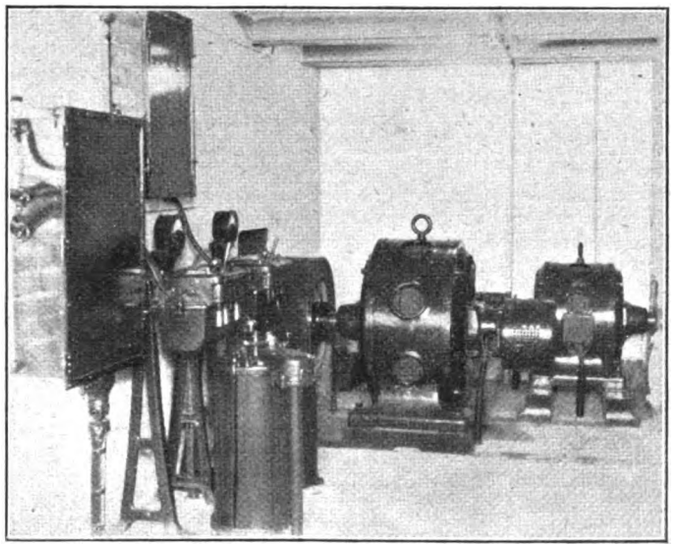

FIG. 5.—CARD ROOM AND BLOWING GEAR MOTORS.

formed by electrical means. We were told that this could not be done, but in fact it has been done, and we hope that the example will be widely followed by other textile manufacturers. In every respect but that of a humid atmosphere there is little to distinguish a textile mill from any other factory, and methods which have proved successful in numerous other trades can, therefore, be well adopted in this instance. In this way conveniences of all sorts will be obtained and the results are likely to justify the conversion.

We have to thank Mr. W. J. H. Wood and Mr. L. L. Haselden of Knowles, Ltd., for permission to describe and illustrate this interesting installation.

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Electricity and the Textile Industry.

Some Historical and Technical Points.

In the previous Textile issues of THE ELECTRICIAN articles have been published describing and criticising the engineering aspects of applying the electric drive to textile machinery and showing how the installation from the point where the supply enters the building to the point where the motor drives the machine can best be carried out. It is trite to say that the engineering problems in a textile factory are not wholly electrical, and we have, therefore, also, from time to time, included aspects of the design and manufacture of the textile machinery itself. These aspects are, of course, highly important from the electrical engineer's point of view, for in order to design and manufacture motors and other equipment which shall operate in the most efficient way it is essential that the tasks which they have to perform should be perfectly understood.

Taking the textile industry as a whole, it may well be said that it offers one of the finest examples of the commercial application of theoretical study and scientific research. Anyone who reads the records of the Textile Research Association will realise how true this is, and it may also be said that improvements in machinery and methods of manufacture have been continuous ever since the days of the spinning wheel and the hand loom, until now the textile industry has probably a better balanced group of machinery available for its purpose than any other in the industrial world. Competition demands that every means of reducing the cost of manufacture shall be adopted without sacrificing the quality of the production, with the results that methods and machines which appeared yesterday to fulfil all requirements are constantly being discarded in favour of those into which improvements have been introduced.

The Electric Drive from Three Aspects.

In this connection, from the electrical point of view, there are three points which may be considered—the question of supply, the question of drive, and the question of the equipment used. As regards supply, it is becoming more and more recognised by all concerned that the most economical results are obtained when the necessary electricity is purchased from a public undertaking. If the results of this course are not directly reflected in the balance sheet, as they usually are, at least the textile manufacturer is relieved from a large amount of responsibility for work in which his interest can only be secondary, and it is, therefore, not surprising to find in all the towns in the textile areas of Lancashire and Yorkshire a constant succession of mills, where either steam engines or private electrical plant were formerly used, being added to the mains.

An Alternating Preserve.

This tendency is likely to continue. To those interested in the perennial problem of direct current versus alternating current supply it may be noted that the textile mill is practically the preserve of the three-phase alternating current system, experience having proved that the great success attending the electric drive is due to the polyphase induction motor supplied from the turbo-alternator. The even torque of the latter ensures that the frequency of the current on which the speed depends is maintained with absolute steadiness. Alternating current has the further advantage that its installation cost is less than that of the equivalent direct current plant, that the efficiency, starting torque and speed regularity under varying conditions of load compare favourably with those of direct current motors, that induction motors are more fireproof, and can therefore be used with greater safety in places like textile mills where the atmosphere is laden with dust and fluff, an advantage which may be mentioned in spite of the increasing tendency to install the driving equipment in separate towers, and finally that the starting gear is simpler and more robust, so that rapid starting can be more easily effected. The use of alternating current in most cases, of course, eliminates the employment of rotary transforming plant and leads to further economies from this cause.

Group v. Individual Drive.

Burning as the problem of alternating versus direct drive is to most electrical engineers, still more burning to the textile specialist is the question of the group and individual drive. These terms explain themselves, and, putting the argument for both forward as judicially as possible, it may be said that the group drive is less costly to install owing to the smaller number of motors required, and that these motors can be erected out of the way of the workers on the ceilings of the mills or in special alleys or towers separate entirely from the working rooms. The disadvantage, of course, is that it may be necessary to run a large motor lightly loaded when only a small number of machines is required. This principally explains why the individual drive has been adopted by several mills in this country and is even more extensively used abroad than the group drive—in fact, it may be said that, from the purely engineering standpoint, it constitutes the most satisfactory method of applying electricity in the textile mill. But owing to the larger number of motors required necessitates an increased capital expenditure, and its best chances, therefore, are in an entirely new mill, where this is set off to some extent by the saving on the shafting, pulleys, etc. The advantages of the electric drive, apart from those of an economic character, are well known and correspond to those which are met with in other industrial applications. The chief exception to this rule is the permanent advantage to the textile manufacturer of obtaining at the pulleys of his machines a maximum steadiness and uniformity of speed. The result is an increased output of improved quality.

The Importance of Constant Speed.

These features are among the most important considerations affecting the commercial economy of a textile mill for the reason that if the speed of a given textile machine is exceeded, even momentarily, the safety of the yarn is endangered. On the other hand, if the speed is less than the critical value the capacity of the machine will not attain its maximum, and the tendency will be to damage the yarn or material undergoing manufacture. These requirements are all in favour of the use of the induction motor to which we have already referred. The synchronous speed of this motor, of course, depends solely on the speed of the prime mover, and its characteristics are such that even with a very variable load the regularity of speed is only slightly affected. In the case of the mechanical drive, a perfectly even torque may be obtained at the driving shaft of the mill engine, but before this can be transmitted to the machines modifications are introduced, due either to load variation or other extraneous causes. By using the induction motor the speed regularity of the steam turbine is brought nearer to the textile machines than by any other method of transmission at present in use; the result is better and increased production, and consequently greater commercial economy. To those who are further interested in this important question we may refer to a paper which was read recently by Dr. J. F. Crowley before the Royal Society of Arts, an abstract of which appeared in THE ELECTRICIAN of September 15th, 1922.*

Good Lighting and Production.

An important subsidiary problem in textile mills, as in all places where there is moving machinery, is the provision of proper lighting. Good lighting in a textile mill results not only in larger and better production, but is also conducive to the comfort and safety of the mill operatives. These desiderata, it is hardly necessary to say, can only be obtained by electrical means and the employment of the gasfilled lamp in conjunction with parabolic reflectors and other special fittings have done much, not only to attain the ends which we have just mentioned, but to emphasise the flexibility, cleanliness and coolness of the electric light.

Some Illustrations.

In these days it is becoming increasingly more usual to spread information by means of illustrations, and to emphasise what we have just said we therefore publish on the opposite page some photographs of typical methods of applying the electric drive to textile installations. These illustrations show what the BRITISH THOMSON-HOUSTON CO. have done in this direction, and it is not inappropriate that they should be chosen for the purpose, as they were responsible for the first electrically equipped textile mill in this country nearly twenty years ago, and have since designed and installed more than 4 000 motors, aggregating approximately 130 000 B.H.P. in all classes of textile factories.

* "Electric Power in the Jute Industry."

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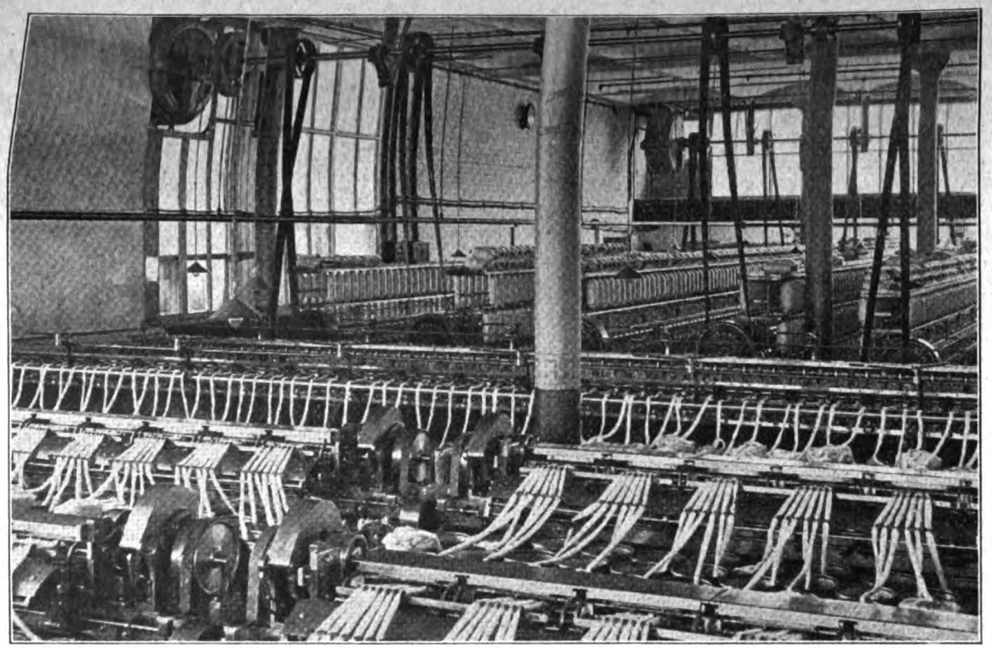
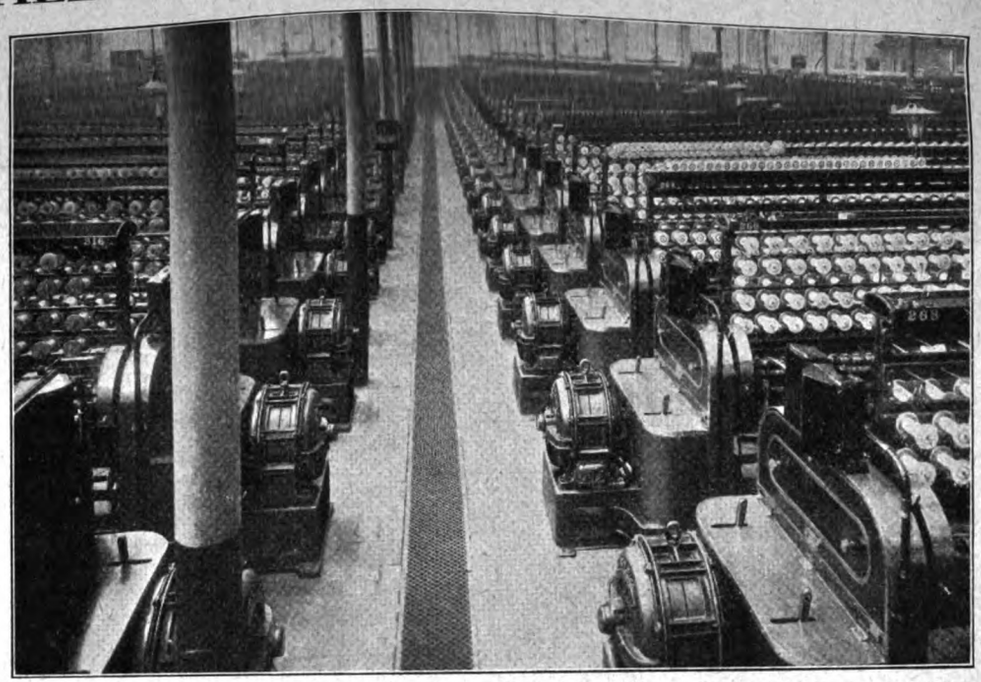
SOME TYPICAL TEXTILE MILL DRIVES.





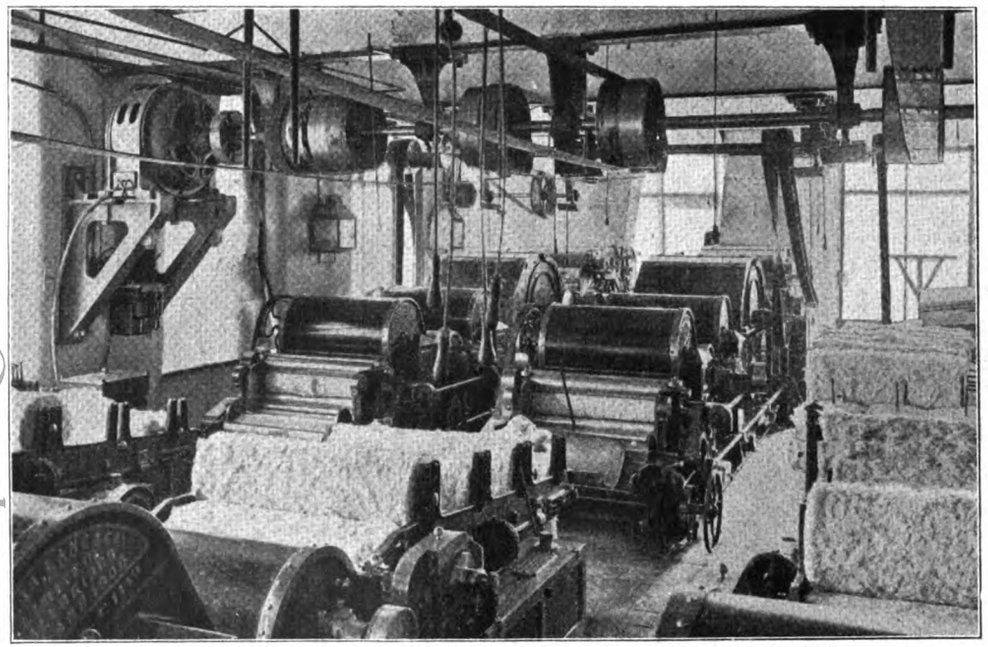


FIG. 1. VIEW OF CARD AND FRAME ROOM IN A LANCASHIRE TEXTILE MILL.

The Drawing, Stubbing and Intermediate Frames are driven by a 90 H.P. Slip-ring Induction Motor running at 360 revs. per min. This is shown in the foreground. The Roving Frames are driven by a 75 H.P. Squirrel-cage Induction Motor running at 360 revs. per min. Both motors are fixed to the ceiling in an inverted position and are direct coupled to their respective line shafts.

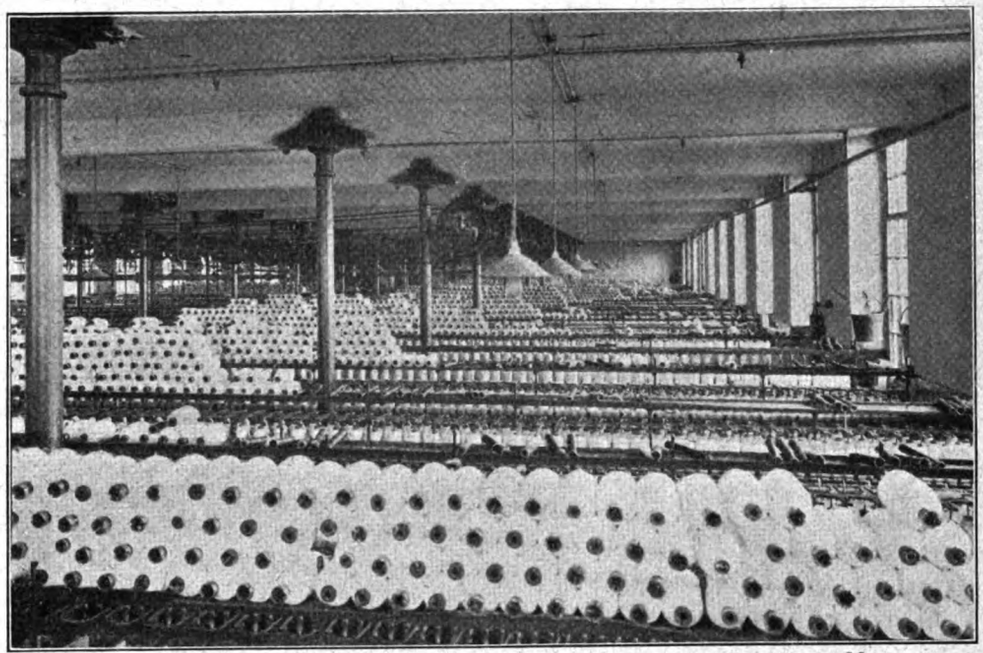


FIG. 2. DOUBLING ROOM SHOWING FRAMES DRIVEN BY INDIVIDUAL INDUCTION MOTORS.

FIG. 3. A 50 H.P. ENCLOSED VENTILATED INDUCTION MOTOR RUNNING AT 585 REVS. PER MIN. AND DRIVING BLOWING ROOM MACHINERY IN A YORKSHIRE COTTON MILL.

FIG. 4. GENERAL VIEW OF A SPINNING ROOM DRIVEN BY MOTOR IN SEPARATE CHAMBER AT THE FAR END OF THE ROOM.

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Group Driving in a Lancashire Mill.

When the electric drive in a textile mill was under consideration in past years, much discussion prevailed as to whether group or individual drive was most suitable. To-day practice is more clearly defined, and, with the exception of the individually driven loom, group driving is generally installed. But it is by no means certain that the present practice may not be modified in the near future, as more attention is being paid to a combination of these methods, thus leading to other subdividing groups of machinery.

A Combined System.

An interesting installation was recently carried out, partly on these lines, in the worsted spinning mill of the Bolton Eagle Spinning Co., where the arrangements for driving the preparation machinery and also the worsted mules were in accordance with the latest ideas on small group drive. After careful experiments, it was decided to drive the preparation and French drawing in groups of one line shaft each. For the mule spinning individual drive was selected. The shafts driving the preparation and French drawing were speeded up to run at 480 revs. per min., each being directly coupled to motors through flexible couplings. The motors were mounted on cross girders carried between cast iron wall brackets firmly fixed on the end wall.

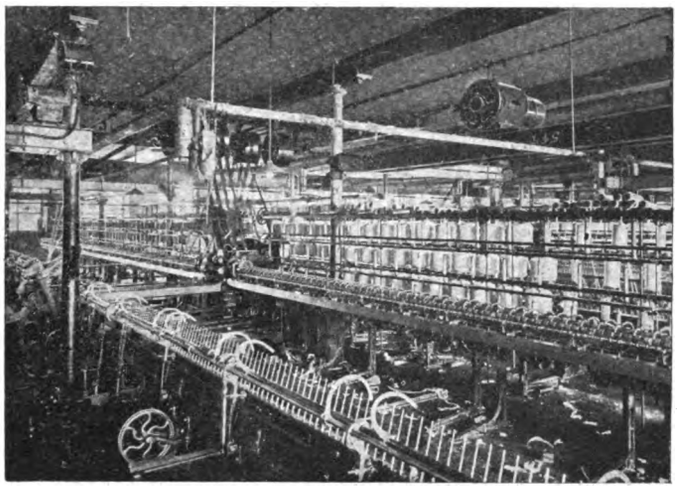

FIG. 1.—A VIEW OF THE MULE MOTOR DRIVE IN SPINNING SECTION.

The starting gear for the above motors is fully automatic, and consists in each case of oil immersed auto transformer starters. The size of the motors is standardised, those for the preparation machiners being 15 H.P. squirrel cage machines running at 480 revs. per min., while for the French drawing, 35 H.P. squirrel cage motors running at 480 revs. per min. were employed.

It is interesting to note that, although the shafts are of considerable length, no difficulty has at any time been experienced in starting up. The various illustrations show the neat method of mounting the motors and the absence of clumsy overhead gearing.

The Spinning Section.

For the spinning section (Fig. 1), where individual drive was decided upon, each of the 54 mules is driven by a 15 H.P. squirrel cage mule motor, which machine has been specially designed by the General Electric Co. for this class of drive. These mule motors have, we understand, been found to be fully capable of standing the large and frequent peak loads which invariably occur in mule spinning. In the installation under review, the number of draws is approximately four per minute, and the peak load, at the commencement of the outward travel of the carriage, approximately 30 H.P. At the same time, special attention has been given to slip which has been reduced to a minimum the light load speed of the motors being approximately 990 revs. per min., whereas during the peak period this speed only drops to about 950 revs. per min.

The arrangements of the mule drive is shown in Fig. 1. It will be seen that the mule head stock countershaft is retained, and that the drive from the motor is over a 14 in diameter double width balanced pulley (specially keyed on to the motor shaft) through a 6 in. belt on to the fast and loose pulleys of the countershaft. The centre distance from motor-shaft to countershaft is about 14 ft. The motors, as will be seen, are well out of the way, but yet are extremely accessible and easy to handle in the case of adjustment or breakdown.

The mule motor starters are mounted close up to the ceiling and are arranged for rope operation, so that they can be easily controlled at any time whilst the mule is in motion. The method of starting is to switch the belt over on to the loose pulley of the countershaft, this allowing the motor to run up to full speed before any load is applied.

The advantages which have been noted in this drive, as compared with the group drive, are many and, it is claimed, amply repay the slight extra cost of running. The more important of these advantages may be summarised as follows :—

(1) The risk of breakdown is reduced to a minimum and complete stoppage is only likely to occur on account of failure of supply.

(2) In the spinning section, each mule, and in the preparation each small group, becomes an independent unit; consequently small orders can be executed and isolated machines or small groups of machines can be run without having to work long lines of idle shafting. The transmission losses which occur on the shafting (also the losses in a large motor running practically light) are done away with. This ability to use individual machines has proved its advantage in a very marked degree during the slump in the textile trade.

(3) All the motors and starters in each section of the mill are standardised and interchangeable, it being only necessary to carry one spare of each size.

(4) The steady running of the machines is very noticeable, the travel of the mule carriage being smooth and the acceleration good, whilst the spindle speed remains almost constant. It is obvious that the above points will make for a better quality of yarn, increased production and a minimum of attention due to broken ends, as the latter are very much fewer than is ordinarily the case with group drive.

(5) As each mule is an independent unit, the starting and stopping of individual machines does not in any way affect the running and speed of the rest of the mill or the remaining machines on the same floor. This is an advantage over group drive, where it has often been found that the starting and stopping of one or two mules has detrimentally affected the running of the remainder of the mules in the same group.

(6) The risk of accidents to operators is reduced to a minimum, as the machines are always under immediate control; the time lost in replacing belts is also reduced, as it is only necessary to stop one machine instead of having to stop the whole section.

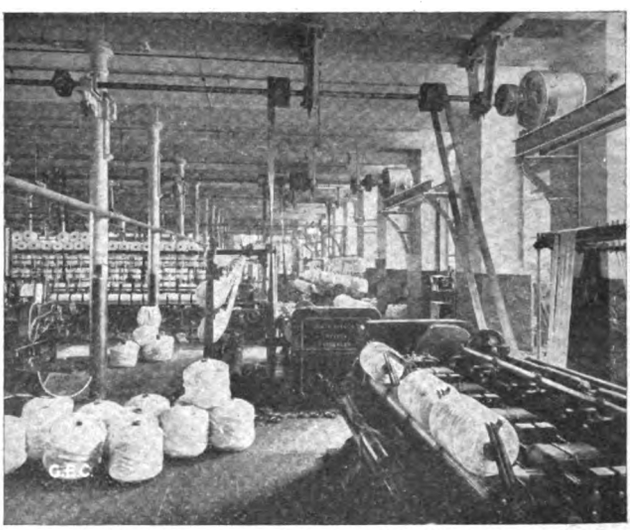

FIG. 2.—A SECTION OF THE PREPARATION MACHINERY, SHOWING THE LINE OF MOTORS.

The supply to the above mill, which is three-phase at 400 V and 50 cycles, is taken from the Bolton Corporation, and the scheme described was carried out by the GENERAL ELECTRIC Co., through their Manchester branch. The motors and control gear were manufactured at the company's Witton works. The wiring, etc., was supplied and carried out by the Bolton Corporation Fittings Department and S. H. Heywood and Co.

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Textile Drives and Motor Design.

Factors Governing Design.

There are few fields of application for the electric drive where the conditions of operation are as varied as in the textile industries. While in the case of looms, for instance, a constant speed is essential for ring-spinning frames, a variation in speed of spindles at top and bottom of cop is necessary if maximum production is to be ensured. On the other hand, the load of motor may be fairly constant, as with ring-spinning and doubling frames, or vary within wide limits, as with self-acting mules. There is, further, the case where several speeds are required, as for calico printing machines. Another consideration which cannot be overlooked is the necessity of avoiding important structural alterations in sheds, such as the provision of air-ducts in floor for the cooling of motors, when electrifying existing mills.

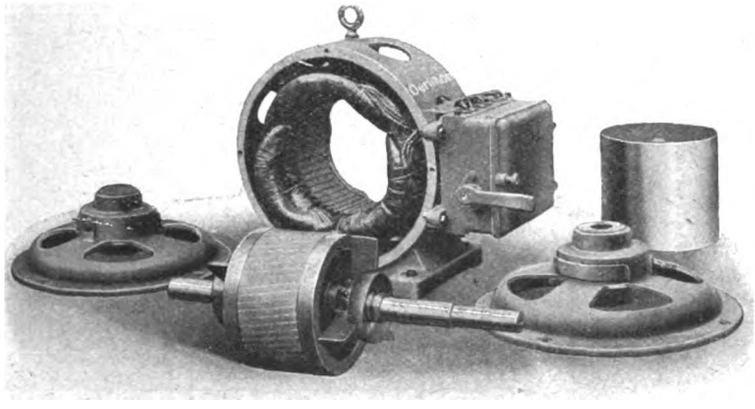

FIG. 1.—THE OERLIKON LOOM MOTOR.

The task has, therefore, been in the first place, to develop motor designs suitable for each particular class of machinery, while bearing in mind the necessity of limiting as far as possible the number of types, for manufacturing reasons. The Oerlikon Company has, for many years, devoted special attention to this matter, and it is proposed to give below a few particulars regarding the various types of motors used in connection with the many textile drives they have evolved.

Individual Loom Drives.

In our last Textile issue we referred to the new Oerlikon-geared individual drive and to the advantages secured through its installation. In order to have a single type of motor for this new geared drive, as well as for the ordinary belt-drive, it has been necessary to adopt a motor design satisfying the requirements of either drive.

In the case of the new geared drive, the motor is carried by two sleeves on vertical pillars, being hinged on the one and firmly secured to the other, while with belt drive pin suspension on a fixed support is used. With a view to meeting both cases, the Oerlikon loom motor, which is a totally-enclosed dust-proof squirrel-cage machine, is provided with two substantial lugs cast on frame, suitable for either mode of suspension.

Characteristics of the Loom Motor.

The Oerlikon loom motor has a high efficiency and a very large starting torque; it is fitted with ball-bearings, which ensure very smooth running, and necessitate the use of only little lubricant. In order to simplify the lubrication of motor, the cover of oil inlet is made in the form of a tube, which is designed to hold exactly the amount of oil required for filling bearing; once the used-up oil has been drained off it is only necessary to fill the tube in question with fresh oil and to pour its contents into bearing; the bearings then have enough oil for another four to six months; the possibility of oil reaching the inner part of machine or winding owing to over-filling of bearings is thus eliminated. Apart from the lubrication of bearings, the motor requires no further attention.

Special care has been taken in the design of rotor. The conductors and short-circuiting rings at either end of the winding are not soldered together, but are cast by a special process, thus removing the danger of the winding getting loose as a result of high temperatures.

The full load speed of the motor at 50 cycles is about 950 revs. per min.; this speed depends only to a very small degree upon pressure and variation in load. It is, therefore, nearly constant during operation. The motor is thrown direct on to the system by means of a special switch. This switch is connected to the starting handle of loom by means of a simple rod. The process of starting up and stopping the loom is, therefore the same as for mechanically-driven looms. In view of the fact that the switch is mechanically connected to the starting handle of the loom, the motor circuit is opened whenever the loom stops automatically. There is, therefore, no waste of energy when the loom is at rest.

Individual Drives—Two Applications.

After using, at the outset, commutator motors, for ring-spinning and doubling frames, the Oerlikon Co. has now entirely abandoned this type of motor in favour of the squirrel-cage induction motor; the latter motor can, in fact, be regarded as the ideal motor for textile work owing to the absence of commutator and to its robustness and simple design; the necessary variation in speed is obtained by means of the Oerlikon spinning regulator, which modifies automatically the speed, by acting on a jockey pulley regulating slip of belt.

The motor is started up by means of star-delta starter in order to reduce starting current, and operates in conjunction with loose and fast pulley. The tension of belt is maintained automatically by means of the jockey pulley referred to above. Fig. 1 shows the construction of motor, while Fig. 2 illustrates a ring-spinning shed fitted with Oerlikon individual drive.

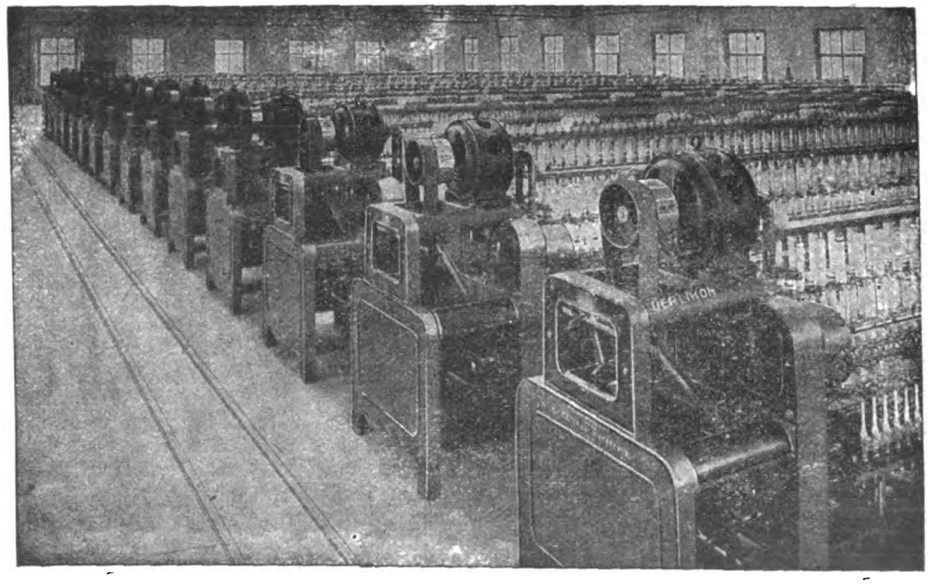

FIG. 2.—AN APPLICATION OF THEMOTOR.

Group Drives for Self-acting Mules.

Though individual driving is specially adapted for looms, ring-spinning and doubling frames, group driving is the more rational solution in the case of self-acting mules, owing to the peak loads when accelerating the carriage, which amount to about four times the normal load. Squirrel cage machines are therefore used, and the best results are obtained by grouping eight to twelve mules per motor.

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Some Problems in High Speed Alternators and Their Solution.*

By J. ROSEN.

Experience with large high speed alternators during the past ten years has revealed many problems of design, construction and operation. Peripheral speed must be comparable with the jet speed of a turbine and must be high enough to obtain good steam economy. In practice this means high speeds for alternators when direct coupled to the turbine speed. However the usual frequency of 50 limits the alternator speed to about 3 000 revs. per min. This speed is suitable for moderate outputs but it is too low to enable the best economy to be realised in small commercial turbines of 1 000 kW and under; hence the development of geared turbines. In 1887 de Laval showed that with his helical reduction gearing a ratio of 10 : 1 could be obtained for small powers, and in 1912 Sir Charles Parsons applied this form of gearing to turbines of much greater output coupled to electrical machinery. By the aid of modern single-reduction gears a turbine can be run at 5 000 to 6 000 revs. per min., the speed of the alternator being conveniently low (500 to 750 revs. per min.).

Analysis of Faults.

Fig. 1 shows the sizes of Parsons units constructed in the period 1909–1922, and in the original paper a similar diagram

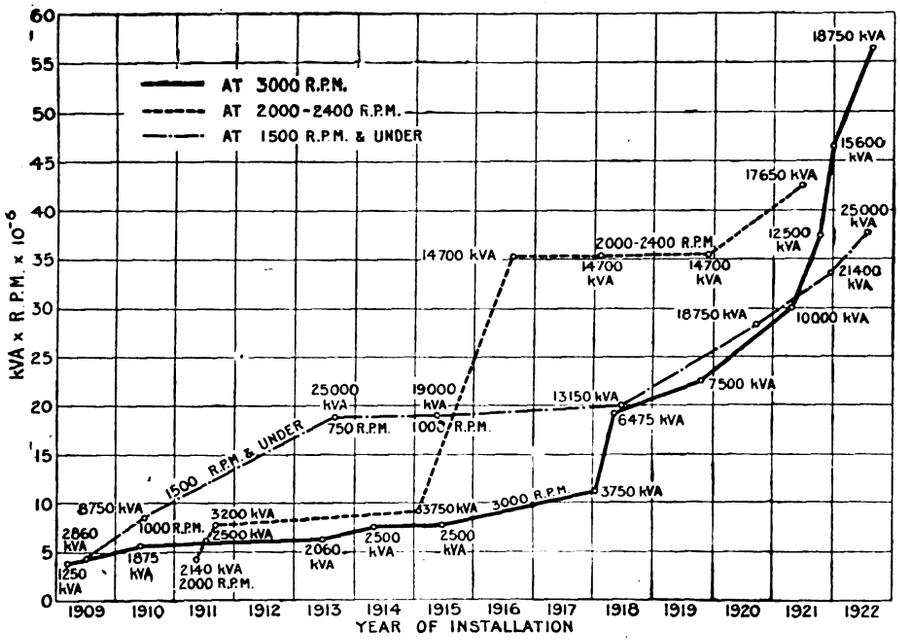

FIG. 1.—KVA × REVS. PER MIN. OF LARGEST PARSONS ALTERNATORS MANUFACTURED EACH YEAR.

is given for Metropolitan-Vickers turbo-alternators. With improved materials and methods of ventilation large alternators at high speeds are now no less reliable than the smaller machines. In the original paper this is illustrated by a diagram comparing number of alternators installed and breakdowns from 1912 to 1922. During 1916–17 there were several failures, due to reasons which are now quite clear, the faults occurring at terminals and end windings, owing to overheating, insufficient support against sudden short-circuits and local prejudicial conditions such as moisture in air-ducts. Since that period there has been a progressive improvement. Another fault mentioned is the erosion of conductor insulating tubes owing to grit drawn in during ground excavations. Protection by teak-wood packing is now afforded.

Chief Mechanical Problems.

The chief mechanical problems are concerned with rotor-construction. The barrel form, with exciting windings embedded in radial slots between the poles, has proved very suitable for high speed design. Experience has shown that a simple solid forging is the best construction. The conservative and a safe peripheral speed of 300 ft. per sec. has been adopted. Parsons alternators have run for many years at this speed corresponding with 1 000 to 3 000 revs. per min. The length of rotor body was 105 in., the diam. 29 in., and the ratio of pole length to diam. 3·62. It appeared from these earlier machines that the critical speed might be 1 600 revs. per min. Caps for supporting rotor and windings are one of the limiting factors in design. The material has now an ultimate strength of 65 tons per sq. in. with a yield point of 48 tons per sq. in. and is suitably ductile. With a relatively low peripheral speed the stress is below 12 tons per sq. in. Rotor end windings are not uniformly distributed under the caps which may tend to become oval in service. Methods of obtaining the eccentricity are described of which photographing the length of an electric spark jumping the gap between a fixed contact and the cap proved best. Particulars of distortion are given in the original paper and an extension of 0·01 in. between poles and 0·025 in. at centre of poles was observed. The caps were thus only lightly distorted.

Points in Alternator Design.

Early alternators were hand-wound with a continuous length of cable but this construction proved laborious and expensive, especially with increasing size of alternators. Accordingly conductors are now made separate from end connectors, which are of copper straps, and the cable is made on a special machine and is built up of copper strands, separately insulated. It can be made in any special shape and does not need to be deformed after leaving the machine, a condition favourable to the elimination of possible causes of short-circuit. Later, multiple joints were adopted for connecting cables forming core-conductors to end connectors, which served to eliminate eddy currents induced in joints. Mica is still the chief component in insulating tubes. The slot insulation is now moulded round the conductors, forming a bar ready for placing in slot. End connectors are also separately insulated before assembly.

During 1913, on drying out the stator windings of a 2 500 kVA 6 600 V alternator cracks developed in the hard insulating tubes which broke down to earth under the insulation test. It was found that when the machine gets hot such tubes tend to expand and lengthen. The copper conductor has a higher coefficient of expansion than the tube and the tube gives way. This difficulty has been overcome by using an insulating medium with suitable elastic properties. A flexible mica insulation was developed. When the spirit is evaporated from the varnish binding the mica flakes together the remaining oils ensure a sufficiently elastic insulation. Whatever method is employed the insulation must not be brittle; in this case cracks will develop. In addition the insulation must not pulverise. Movement of end windings as a whole cannot be entirely prevented. A case of breakdown arising from the stator end windings moving ½ in. and afterwards springing back to normal position is recorded.

Advantages of Tunnel Slots.

In the author's opinion a tunnel formation of slots for receiving stator conductor-bars has many advantages over open slot formation. The former method may be somewhat expensive but the windings are more accessible than former-wound coils in completely open slots. In addition flux-pulsations are minimised and the closed slot, leading to leakage of flux across the iron bridge, enables a high inherent reactance to be obtained. Moreover, it is possible to obtain a wave-form entirely free from ripples, a condition difficult to ensure with open slots. Tooth-ripples are objectionable as a possible source of resonance such as may cause breakdown of insulation; errors of instruments have been caused by

* Abstract of a paper read before the Institution of Electrical Engineers.

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high frequency circulating currents. Supports to teeth between slots in stators have in the past been a difficulty. The H-section spacer has proved most suitable as the U-type had insufficient bearing surface.

Cooling Difficulties.

With larger sizes and longer lengths of alternators it becomes more difficult to ensure uniform cooling. As a rule air is drawn or forced in from the ends only, but the available area for the passage of air is limited and the air becomes heated before reaching the central region. A more recent scheme for promoting uniform cooling involves the division of the alternator into separate air circuits in parallel. The air is forced into separate pressure belts or compartments cast into the stator casing, alternating with exhaust compartments throughout the length of the alternator. From each pressure compartment the air passes into radial ducts into the body of the core. A portion then passes between the stator teeth round the conductors into the air-gap where it divides and passes axially in both directions and radially into the adjacent exhaust compartments. The remainder of the air is short-circuited through a series of axial holes formed in the core immediately behind the conductor slots; this air joins the stream passing from the air-gap back into the exhaust compartments. Stator end windings are ventilated from end pressure compartments from which air is forced through suitably designed holes in the end walls of the casing on to the end windings. With this scheme of ventilation a separately-driven fan is recommended. The motor-driven fan can be designed for maximum efficiency and a consequent gain in the efficiency of the alternator of as much as 1 per cent. is possible. It is essential, in view of the large volume of air passed through the alternator, that it should be clean. A 10 000 kW turbine will pass 1 670 lb. of steam per minute, whereas the weight of the ventilating air passed through in the same period may be 2 740 lb., i.e., 45 per cent. more.

Filtering and Cooling Problems.

In early days cleaning apparatus consisted of filter cloths, but they have drawbacks, such as the large space occupied, the need for periodic removal of accumulated dust, the danger of fire due to the inflammable nature of the cloth and the length of external ducts for conveying air. The wet air filter helps to overcome the first three difficulties and also aids in lowering the temperature of the air. But there is a danger of free moisture being carried into the alternator windings. This has been revealed by tests made by C. A. Parsons and Co. and a new form of apparatus has been devised in which the air does not come into contact with water but circulates round a closed system of ducts. The air is thus both cleaned and cooled. The apparatus may be likened to a reverse-action motor-car radiator and appears to be a commercial proposition. The Battersea Corporation Electricity Works in 1912 took out a patent for a cooler using water from the condensate and proved the advantages of the enclosed system. A cooler on these lines was installed by C. A. Parsons and Co. on a 3 000 kW plant in the power station at Newcastle-on-Tyne in 1919 and has run since its installation without any fault developing. Several advantages are attached to closed circuit systems of ventilation. The cooler can usually be installed inside the alternator foundation block, the only external plant being the fan with its short connecting air ducts. The system is therefore very compact. Little or no dirt can collect in the alternator as the same air is circulated continuously. Fire risk is also reduced as the actual weight of air (for a 10 000 kW machine only 80 lb.) available to feed an internal fire is small. At Gennevilliers power station a system of increasing the nitrogen content in the air, so that it will not support combustion, has also been planned.

Liquid Cooling Agents.

The use of a liquid cooling agent has always appealed to designers of dynamo-electric machinery. It was applied by Sir Charles Parsons in the period 1884–1889, cool oil being continuously pumped through hollow armature shafts, but the innovation was subsequently discarded as unnecessary. In 1904 or 1905 an alternator was built with water-pipes fitted in the radial ducts of the stator core. In the most modern scheme the rotor is cooled by water which enters and leaves at the same end giving uniform cooling throughout and avoiding the complexities of water connections at the coupling end of the face. As it is found necessary to add chemicals to prevent corrosion, the same water is used continuously and is cooled in a separate surface cooler. In the original paper the author gives some particulars of a water-cooled 18 000 kVA 3 H.P. alternator. The use of water makes it possible to get an indication of the losses in the rotor, excluding excitation losses. In the 18 000 kVA machine the actual power absorbed was only 35 kW at full output, and the excitation loss only 42 kW.

Exciter Questions.

Instability of exciters, a frequent cause of trouble, shows itself in two ways:—

(1) The exciter voltage tends to creep when the alternator is running at no load and it is difficult to keep the voltage steady for synchronising. This is due to absence of saturation in the exciter magnetic circuit at low voltage.

(2) Reversal of the exciter shunt-field current and exciter polarity. If this occurs when the alternator is running in parallel with other machines, the rotor drops back a pole-pitch and continues to give its load.

As a rule the effects of instability may be overcome by the provision of a main field regulator, which enables the exciter to work well up on the saturation curve. However, regulation may also be by means of a well-designed exciter field rheostat, with an exciter designed suitably for the lower voltages required when synchronising the alternator. The difficulty first mentioned, creepage of voltage, has been overcome by introducing saturation gaps in the exciter magnetic circuit, by suitable designs of magnet frame and by working the armature teeth at a high magnetic density. The second effect, the reversal of the alternator excitation, is explained in the original paper. and the author shows that it can be avoided by two methods, rocking the brushes to a position behind the neutral or putting compounder turns on the exciter field. There is no objection to the latter course, but rocking the brushes backward is undesirable as it is liable to cause sparking when the exciter is heavily loaded. Reversals may also be caused by careless manipulation of the exciter field rheostat in power station operation, or by sudden changes in load and sudden short-circuits.

Electrical Problems.

In three-phase turbo-alternators eddy currents are induced in the rotor and result in currents circulating in the rotor windings and body. Such eddy currents are due to flux pulsations and lower the efficiency. They may also attain such dimensions as to cause serious overheating, and the author mentions a case in which this occurred. It has also been found comparatively recently that induced voltages may reach such a value as to set up arcing. In one case arcing occurred between adjacent sections of keys securing the winding coils in the slots and between spacer pieces in the radial ventilating ducts on the plate of rotor. It was eliminated by using metal bonding strips fitted under the keys. In another case it was proved that arcing had taken place between the caps and the rotor body. It appeared that comparatively high voltages might be induced by variations in the main alternator flux due to (*a*) variations in the stator currents when the windings were short-circuited, and (*b*) the interruption of the field current effected by a quick break switch without a discharge resistance. Remedies suggested are: (*a*) bonding the caps into contact with the rotor body or providing short-circuiting rings at the end of the body, or (*b*) insulating the cap from the body so that currents will not stray into them. The latter remedy is the less satisfactory and more difficult to accomplish. The first method was applied, special bonding strips being designed, and proved satisfactory.

In conclusion, the author referred to the use of quick-break field switches without discharge resistance in the main field circuit. Tests have shown that in spite of every precaution in the design of the alternator heavy currents will circulate if the field circuit is broken in this way. It is inadvisable to subject the rotor repeatedly to such currents, and he suggests that the quick-break switch should be installed as a necessary device, but only used in cases of emergency.

The Postmaster-General of the IRISH FREE STATE, interviewed by the "Freeman's Journal," stated that efforts would be made to bring the telephone into more general use. The automatic system would be introduced as soon as possible. He did not see any prospect of the sixpenny telegram being restored. A larger extent of underground telephone cables had been laid last year than in the ten preceding years. Wireless telephony and broadcasting, on a plan which was evolved from the continued experiences of other countries, would be introduced by the Government. There would be one broadcasting station to the whole of Ireland.

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Institution of Electrical Engineers.

Faraday Medal Awarded to Sir Charles Parsons—Appropriate Discussion on Turbo-Alternator Design.

At the meeting of the INSTITUTION OF ELECTRICAL ENGINEERS on Thursday, February 15th, the PRESIDENT announced that the Council had decided to award the Faraday medal to Sir Charles Parsons, F.R.S. He recalled that this medal was established last year to commemorate the fiftieth anniversary of the Institution, and that the intention was that it should be the highest honour the Institution could confer. In conferring it upon Sir Charles Parsons he doubted whether the Institution was honouring him more than they were honouring themselves. The work that Sir Charles Parsons had done was so well known that he hesitated to say anything about it, but it had had an enormous influence upon the supply of electricity all over the world. The proper time for saying more would arise on the presentation of the medal which, it was hoped, would take place on May 10th, the occasion of the Kelvin lecture. It was, however, peculiarly appropriate that the announcement should be made that evening as it happened, by pure coincidence, that a turbine paper was to be read, and that Sir Charles Parsons was present.

Sir Charles Parsons Thanks the Institution.

Sir CHARLES PARSONS, who was given a most hearty reception, said he had come to listen to the paper, without the slightest idea that the Council had intended to award him the Faraday medal. The President had broken the news to him just before the meeting, and it came as a complete surprise. He could not express how deeply he appreciated the honour the Council had done him.

Mr. ROSEN then read his paper on "Some Problems in High Speed Alternators and their Solution," an abstract of which appears on page 198 of this issue.

DISCUSSION.

In opening the discussion, Dr. S. P. SMITH said the paper was a marvellous record of the way in which the author and his colleagues had overcome great difficulties. The consulting engineers of the Newcastle Electric Supply Co. had put into use a new type of plant, and there was certainly nothing more helpful to designers than to have such encouragement. When a consulting engineer said that no tender would be considered unless the tenderer could show similar or larger plants in operation, the designer's heart failed him completely; and it was an immoral practice. It was essential that the consulting engineer should work with the designer, who could then show what he could do. Turning to the question of ventilation, it was only possible to get through the amount of cooling air permitted by the size of the air channels. That being so, success in these large machines would be obtained by limiting the losses, and the paper showed many ways in which that could be done. A useful method was given for reducing the stator copper losses, and he would like to know how much less per cent. the losses were with an alternating current machine at 50 cycles than with a direct current machine, using the special type of cable described. The weakness in large turbo-alternators lay more in the stator than in the rotor, and greater attention should be paid to the elimination of the hot spots. More breakdowns might be avoided by greater attention to the design of the stator core. Laminations could not be handled too carefully, and if proper care was taken in designing the stator core, and the shops took equal care in constructing it, the iron losses in turbo-alternators could be kept within 1 per cent. of the output. He differed from the author in preferring as large a rotor diameter as mechanical considerations allowed, because it was much easier to cool a short core than a long one. A machine described in a Swiss engineering journal had a hole through the centre of the rotor. This not only enabled designers to see what the inside of the hole was like, but it also enabled test pieces to be examined for mechanical properties, although the stresses might be doubled. The use of aluminium instead of copper for the rotor winding had been suggested by an American designer, and no doubt with a small diameter rotor this would be satisfactory.

Need of a Flexible Mica Insulation.

Mr. W. M. SELVEY said the development of a flexible mica insulation deserved much greater notice than had been given to it in the paper. Experiments were now being carried out with new insulators, the best name for which was "solidified colloids." From experiments he had made with them it appeared that some would entirely replace mica. The dielectric strength was as good and the mechanical strength was better. Increasing the generating pressure would bring the copper down considerably. Air could not be properly cleaned when it was drawn from the engine room, and it was also impossible to humidify air without using steam, which added a little to the troubles. During recent years the air pressure necessary for dealing with ventilation had gradually increased, so that attention would have to be paid to the efficient pumping.

Some Practical Hints to Designers.

Mr. G. W. PARTRIDGE said that some of the troubles dealt with in the paper had been overcome by other people. The machines which had been supplying the Brighton railway with single-phase current for fourteen or fifteen years had stood up satisfactorily to the severe conditions, including a great number of direct short circuits. It was essential that the coils should be supported when they left the slot. The method described in the paper would give excessive overheating. The tunnel slot was old, but it had disadvantages. There was the extra number of joints, and in the author's design there was a danger of brush discharge owing to the length of the machine and the difficulty of getting rid of the air space round the coils. It would be impossible to examine the coils without dismantling the whole stator. It was necessary to have stator through bolts in order to obtain rigidity. The separate fan motor plant introduced another weak link, and there were enough already.

Field Current Problems.

Dr. H. M. THORNTON said the problem most prominent at the present time was how best to kill the rotor field after a short circuit? The best method was to compound the exciter, but there was a further method of using a buffer resistance between the rotor fields and exciter. The object of this was to prevent the volts induced in the rotor circuit by the stator ampere turns from reaching the exciter terminals and so reversing its field. There was no need to break the exciter field. If it were connected, not to the terminals directly, but to a change-over switch, all that was necessary to kill the rotor field was to short circuit the exciter field by throwing over the switch. Great improvement had been made in recent years in the mode of bringing out the end connections on the stator, so that a machine of the largest size could be short-circuited without any ill-effects. Experiments on a 6 000 kVA Parsons generator showed that 100 dead short circuits could be made with no more effect than that of cleaning the machine of dust. He suggested this as the best means of freeing generators from dust in the ventilation ducts!

Parallel and Divergent Practice.

Mr. W. T. TAYLOR said that in some respects the practice of his firm had been along parallel lines with those of the author, and in others it had been divergent. He called special attention to differences in the form of stator winding used. In the basket winding no appreciable stresses came on the winding during a short circuit, and there was the minimum amount of supports and bolts and brackets. There was no difficulty in dealing with stresses in the rotor body; the greatest stresses were in the dome and in the bottom.

It was by this time, 7.40, and there were still a few names of those wishing to speak in the hands of the President. Mr. GILL therefore asked whether it would be desirable to adjourn the discussion, but there seemed no general disposition to do this, and the author was called upon to reply, which he did quite shortly.

Heavy Deficit on Municipal Gas Undertakings.

A return issued by the Board of Trade relating to all authorised gas undertakings in Great Britain for 1921 shows that the profits on the companies' undertakings were £4 281 882, as compared with £4 148 233 in the previous year. There was a deficit during 1921-22 of £1 102 815 on local authorities' undertakings, as compared with a profit of £349 312 in the preceding twelve months.

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Selling Domestic Power-driven Appliances.

There was a slight alteration to the programme of the SALESMANSHIP CONFERENCE of the Electrical Development Association, on Friday, owing to Mr. L. J. E. Genner, who was to have read a paper on "Electric Power in the Home: Motor-driven Appliances," being unable to be present. Mr. J. W. BEAUCHAMP gallantly stepped into the breach and read a paper on the same subject, prepared at very short notice. The chair was occupied by Mr. A. C. CRAMB (Borough Electrical Engineer, Croydon, and hon. secretary of the I.M.E.A.).

Advantages of Power Appliances.

The paper pointed out the advantages peculiar to this line of work. There was no competition with gas, because the appliances offered facilities which could be obtained in no other way than by electricity. They saved a tremendous amount of labour, dirt and time, and consumed a small amount of energy per annum, so that the price of electricity was not so vital a factor as with heating and cooking. It had been argued that this small motor load did not bring sufficient revenue to the supply undertaking to justify its encouragement, but this argument was unsound. If, as was often the case, a moderate load was built up on lighting rates, it was very profitable and seldom produced any mains problems. If the supply authority was not able to put up a rate low enough for heating and cooking, it might yet secure much additional business with these appliances at fairly high figures, say, up to 3d. or 4d. per unit. In any case, electricity got the credit for the conveniences and economies arising from the use of these machines, and they served to popularise electricity.

The Principal Appliances Available.

The author then dealt with the principal domestic motor-driven appliances, pointing out the advantages of their use. They included the fan, the sewing-machine motor, the suction cleaner, the clothes washing machine, the plate-washer, the polisher, whisks, mincers, etc. It was pointed out that the fan was not merely a summer-time appliance, but could be used for many purposes during the winter, such as the drying of clothes, or, as was done in America, distributing the warmth from hot-water radiators, keeping vapour off windows, etc. Another point of some interest in connection with fans was that in this country we were always late with our orders, stock and advertising, and we should do well to commence campaigns a little earlier in the year. In addition to the advantages of the suction cleaner over carpet sweepers in respect of less wear of the carpets cleaned, there was the necessity of clean floors from the health point of view, especially where there were small children, and Mr. Beauchamp suggested that suction cleaner advertisers should use the baby as a salesman in connection with their posters. The possibilities of suction cleaning from a central plant should not be overlooked.

Saving Laundry Charges.

The salesman's story in connection with clothes washing machines should centre around the saving effected as against outside laundry costs and health. It had been stated that each penny expended on current and cleaning material in the electric washer would cover one shilling's worth of work at ordinary laundry rates. There was also the argument that risk of infection could be avoided by cleaning clothes at home, and yet escaping most of the heavy work of rubbing and scrubbing. It was well to take advantage of the comparative novelty of some of these appliances; plenty of people were not even aware that such things as electric washing machines existed, so that a salesman should not be in a hurry to explain that his pet machine was the best. The lady to whom he was trying to sell might be ready to assume that his was not only perfect, but the only one in existence, and it would be a pity to make her curious about his competitor's.

The fact that these appliances took much of the drudgery out of housework enabled housewives themselves to extend the scope of their personal work, if desired, without losing caste, which might be considered to attach to dirty jobs with hand appliances. Among other selling points, Mr. Beauchamp advised salesmen not to concentrate too much upon first cost, and also pointed to the usefulness of the argument that, whereas a man would often be willing to spend large sums on improving the efficiency of his office he was not so willing to spend a comparatively small sum on improving the efficiency of his home and reducing labour.

A Difficulty.

One difficulty in selling domestic appliances was the lack of outlets, and Mr. Beauchamp urged his hearers to sell as many outlets in wiring installations as possible. They should also try to push the B.E.S.A. standard plugs and fittings, which made it easier for a consumer to add equipment piece by piece, and less likely for him to be strangled in a maze of flexibles. Considering the cost of using some of these appliances in terms of the user's electric light bill, he quoted the following figures relating to a middle-class house:—

Lighting, 300 kWh per annum, at 8d.	£10 0 0
Other purposes, 300 kWh per annum, at 2d. ..	£2 10 0

Thus there was an extra six kWh per week available for a 25 per cent. increase in the bill, and these would probably cover the full use of suction cleaner, washing machine, flat-iron, fan and sewing machine.

DISCUSSION.

The CHAIRMAN said it was the feeling of supply authorities that the man selling the apparatus ought to do the main part of the work in developing this side of the industry, because the cost of some of these machines was heavy compared with the number of units consumed. In a plea for co-operation between supply authorities and contractors, he expressed the opinion that they were not working together to the extent that they should. If they did not make up their minds to develop this business together, there should be some force to make them. He paid a tribute to the electrical Press, which had done its very best to bring before supply undertakings and contractors the necessity for co-operation.

Country House Possibilities.

Mr. C. G. NOBBS drew attention to the fact that there was a big field for small-current-consuming devices in country houses owning their own small plant. There was also a large field for small motors in dairies and farms, and in connection with refrigerators.

Mr. BOSTEL considered that in order to develop this side of the industry a small fixed rate was needed. Contractors reaped a greater benefit from the sale of this apparatus than did the supply authorities, but supply authorities should always endeavour to create interest in them.

Advertising Too Late.

Mr. A. G. WHYTE agreed with Mr. Beauchamp that in this country we commenced advertising fans too late in the year, and pointed out that the American journals were advertising them in January. His experience of the one type of dish-washer he had had on trial was that the amount of trouble involved in using it was greater than the trouble of washing dishes in the ordinary way.

Mr. E. R. MORTON reiterated an argument he had used at previous conferences, that higher-priced appliances sold better than cheaper ones. A great advantage when selling on the hire-purchase system was that usually payments were smaller than the actual cost of the laundry bills. He paid 8d. per kWh, and his washing machine cost him 2d. per week. He pointed out to Mr. Whyte that dish-washers did not sell well in America. He believed the reason they did not sell very well was not that they were not efficient, but that the difficulty in the home was the capacity.

The Importance of Hire Purchase.

Mr. LOWER emphasised the importance of a hire-purchase system, as well as a maintenance scheme for vacuum cleaner motors, as these motors were likely to give out. He suggested that one reason why the dish-washer was not popular was that it only did a small portion of the work.

Mr. KING, dealing with outlets, said that at Ilford they proposed to instal a 12-point installation and hire that out at a rental of 7s. 6d. per quarter, but if they put in plugs they would have to pretty well double that rental, and would probably not get the business they otherwise would do.

Mr. F. POOLEY said what was necessary was the development of a motor which would have a more or less universal use in a house, because there were so many duties which could be done at the same speed and at about the same power.

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Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

MEASUREMENT OF HIGH-FREQUENCY POTENTIAL.

To the Editor of THE ELECTRICIAN.

SIR,—I append some figures which may be of interest to your readers relating to a comparison of the readings of an electrostatic voltmeter and a Moullin high-frequency voltmeter at various frequencies.

TEST OF MOULLIN VOLTMETER TYPE "A" AGAINST E.S.V.

Frequency per second.	Moullin Voltmeter, V.	E.S. Voltmeter, cm.
50	1·5	1·6
100	1·5	1·55
10^3	1·5	1·55
2×10^3	1·5	1·6
5×10^3	1·5	1·55
10^4	1·5	1·6
$8{\cdot}7 \times 10^4$	1·5	1·6
$1{\cdot}75 \times 10^5$	1·5	1·6
5×10^5	1·5	1·6
10^6	1·5	1·6

The electrostatic instrument was of the Ayrton-Mather reflecting type, having a range of about 9 V. Its readings were uncertain to about 0·5 mm. in 15 mm. owing to unavoidable vibration.

The Moullin voltmeter* was of the type without anode battery; with the unipivot movement fitted it gave full scale deflection for 1·5 V.

Remembering that the deflections of the electrostatic instrument obey a square law, it will be seen that the greatest discrepancy is only about 2 per cent.—I am, etc.,

W. H. LAWES.

New Southgate,
February 19th.

HIGH VOLTAGE TRANSFORMERS.

To the Editor of THE ELECTRICIAN.

SIR,—It is with interest I have read the correspondence in your columns *re* high tension transformers, especially since I have been intimately concerned with the design, manufacture and testing of such apparatus.

It might interest Mr. W. T. Taylor to know that as far back as 1912 and 1913, large power transformers for 50 000 V were being built in this country. I refer to two 1 000 kVA three-phase, shell type, water cooled transformers, 50 000 V star/10 000 V star built by the British Westinghouse Co. for Trollhatten Power Co., Norway.

These transformers were tested for 15 minutes at 100 000 V to earth on the h.t. windings. There were also built about the same time, four 3 000 kVA three-phase, shell type transformers, 55 000 V star/10 000 V star, two of which were water cooled and two oil insulated air blast. These are in operation in Christiansand, Norway.

Mr. Taylor, in his letter in your issue of the 16th inst., states that British manufacturers are concentrating on core type transformers. This, in the writer's opinion, is not correct, for the 2 500 kVA 132 000 V transformer referred to in previous letters is of the shell type construction.

The relative advantages of the two types of construction can only be assigned by those who have had experience in the manufacture, design and operation of both types. It is in general a question of the mechanical stiffness of the coils, which depends on the size of unit and also on the ventilation.

For smaller units, the core type is preferable, for large units the shell type. I give this opinion after twelve years' experience in the design and manufacture of both types.

In general, the shell type offers a more robust job against short circuit faults, as the coils are held rigidly in the plane of the coils on which the major stresses come.

The major stress on a core type transformer with concentric coils is radial; these tend to burst the coils and coil supports are almost impossible, with safety, to fit on the outside circumference of extra high tension windings.

Mr. Taylor has perhaps not studied the position of the leads on the two types, for with the shell type the leads are taken from the top of the transformer, and so at a maximum distance from any earthed parts, while in the core type the leads have to come up the side adjacent to the tank, and this renders a large tank necessary or special guards to prevent flash over.—I am, etc.

J. LINDLEY THOMPSON.

Trafford Park.
February 19th.

* "Journal I.E.E.," December 6th, 1922.

To the Editor of THE ELECTRICIAN.

SIR,—British transformer manufacturers will appreciate Mr. W. T. Taylor's letter of the 9th inst., as expressing his opinion that there is no need for engineers and others to go outside this country with their orders for 110 kV, and even 132 kV, high tension apparatus.

There is, however, one point which I cannot pass unnoticed, and that is, regarding the type of transformers. Mr. Taylor states that the upright core type is the more common type for this class of work. This is not a safe generalisation, as our experience and that of several other large Continental and American manufacturers has shown that, for other than small e.h.t. units, the shell type of transformer is the most satisfactory.

We have, in fact, standardised on this type for other than relatively small e.h.t. units. For example, the 2 500 kVA single phase 132 kV transformer mentioned in my letter of the 8th ult. is of the shell type, while the 1 000 kVA, 88 kV, three-phase transformer mentioned in the same letter is of the core type.

There is a certain fairly well-defined line of demarcation where it is desirable to change over from one type to the other, but a technical discussion of this would take up too much of your space.—Yours faithfully,

METROPOLITAN-VICKERS ELECTRICAL CO., LTD.
A. G. ELLIS,
Chief Engineer, Transformer Dept.

Trafford Park,
February 19th.

ANOTHER TRANSFORMER PROBLEM.

To the Editor of THE ELECTRICIAN.

SIR,—In reply to "Wireman's" queries concerning the single-phase loading of three-phase transformers, we would say that it is quite possible to supply three entirely separate single-phase loads all at the same voltage or all at different voltages, from a three-phase transformer. It is, however, essential that the primary winding should be delta connected, as otherwise any out-of-balance current flowing in the primary side, as a result of unbalanced load, would act as magnetising current to two of the phases, with the result that the phase voltages would become severely unbalanced. On the secondary side the loads may be supplied.

(1) Each from an entirely separate transformer phase (*a*) without midpoint connection; (*b*) with midpoint connection.
(2) Each from line to neutral of a three-phase 4-wire star connected winding.

This applies irrespective of whether the voltages of the three separate single-phase circuits are the same or different, but, of course, the line wires will have to be capable of carrying their respective maximum currents, while the fourth wire must be of sufficient cross section to carry the maximum out of balance current which is likely to occur under the most severe operating conditions. It should be borne in mind that although the single-phase load circuits operate distinctly from each other as such, the three voltages are, of course, not in phase with one another, but between them the ordinary three-phase relationship is maintained.

There is no particular difficulty in manufacturing the secondary coils for currents as high as 5 000 A, but if each phase was required to give 5 000 A at different voltages a rather freak design would result.

We trust that others of your readers will avail themselves extensively of our offer, made in your advertisement columns, to provide wherever possible solutions to their transformer problems.—We are, etc.,

JOHNSON AND PHILLIPS, LTD.
S. AUSTEN STIGANT,
Engineer and Manager,
Transformer Advisory Engineering Section.

DANGEROUS PROPAGANDA.

To the Editor of THE ELECTRICIAN.

SIR,—With about one hundred others I attended a meeting yesterday at the Royal Photographic Society to hear a lecture by Mr. A. E. Bawtree, F.R.P.S., on "The Dangers to Eyesight in Domestic Electric Lighting and Kinema Picture Displays," of which the following is the printed synopsis: "Theoretical considerations—Collected evidence—Demonstrations in support of the contentions—Effects of electric light shown to be injurious by reason of its colour, intrinsic qualities, and

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mode of generation—The kinema picture display shown to impose the utmost strain upon the eyes."

On the seats for the audience there was a printed slip, headed :—

DANGERS IN ELECTRIC LIGHT.

1. Instantaneous lighting up.
2. Intrinsic intensity at least 80 times that of a flame.
3. Large volume of light obtainable.
4. Difference in colour to that of a flame.
5. Much ultra-violet emanation.
6. Possibility of X ray, electron and undiscovered emanations.
7. Induced currents from alternating supply.

DANGER IN THE KINEMATAGRAPH (*sic*) DISPLAY.

Intermittant (*sic*) intervals of darkness of constant periodicity.

Mr. Bawtree, a fluent speaker, had assembled many interesting lantern slides and much data from well-known sources, and gave a lecture eminently convincing to the lay mind, and herein lies the danger, as his apparent object is the substitution of the wax candle, or resin torch of our ancestors, for modern illuminants of all kinds, including gas flames and mantles.

At the meeting every person, including the chairman, who joined in the discussion, pointed out the errors and fallacies embodied, so that the display of red and white wax candles found no supporters.

The object of this letter is to ask you to warn members of the electrical industry of the possibility of this well prepared lecture being repeated at local societies, where discussions are not permitted, and to get members to attend lectures where discussion is permitted, and then easily destroy the unique accusations built on assumptions and false analogies.

The lecturer mentioned that there would be a full report, I assume in the "Journal" of the Royal Photographic Society, and this should be obtained and read. It will be there seen how much appreciated names as those of Dr. Silvanus Thompson and Dr. Kenneth Mees are cunningly introduced to give an air of verisimilitude to an otherwise bald and unconvincing yarn.—I am, etc.,

London, JUSTUS ECK.
February 14th, 1923.

BROADCASTING—THE AMATEUR PROBLEM.
To the Editor of THE ELECTRICIAN.

SIR,—The decision of the P.O. and the Broadcasting Co. that licenses for listening-in are only to be issued to purchasers of instruments from one or other of the associated Companys, thereby ruling out the issue of licenses to home-made instruments is inflicting a great hardship on a very large number of young fellows throughout the country.

So far as I am able to find out there has, until this last week, been no official notice issued of this regulation with the result that there must be thousands of people making sets who will not learn that they cannot get licenses till they apply for them, for quite 95 per cent of the makers of these sets would be unable to pass the test for the experimental licence.

It must certainly have been within the knowledge of the Broadcasting Company's officials, who are presumably business men, that quite a large industry has sprung up for the supply of parts for assembling and I think I am correct in saying that "Conquest" which is published by The Wireless Press has not only given full details as to making-up sets but has advertised parts for sale for the purposes of making them up to their specification.

Now the Wireless Press, if not controlled from Marconi House, is generally supposed to be very closely in touch with it and I therefore assume that this regulation is one not originally contemplated.

It is, of course, easy to see that the reason for this regulation is probably the comparatively small number of licenses applied for and the fact that there is no royalty on the home-made sets, but, surely, this regulation is automatically going to stop the addition of a large number of license applications during the next few weeks so that the Broadcasting Co. and the P.O. are losing that almost certain revenue because they cannot get royalty on the made-up sold sets.

Incidentally, the regulation seems likely to produce a new form of "crime," and all this trouble might surely be avoided if the Broadcasting Co. had had the foresight to anticipate what was sure to happen and had from the first made the license for home-made sets somewhat more expensive than for bought ones. I hope that it is still not too late for them to issue *without any delay* an amended regulation in this form.—I am, etc.,

M. J. E. TILNEY.
Watford,
February 15th, 1923.

BROADCASTING DIFFICULTIES.
To the Editor of THE ELECTRICIAN.

SIR,—Regarding your article of February 9th on "Broadcasting Difficulties," it seems that the whole trouble is due to the unbusinesslike way the licences are issued. I feel quite confident that the real experimentalist would not object to pay a much larger fee than 10s. for the facilities and free scope he possesses ; on the other hand, the fees being identical is an incentive for crafty people to make up their sets and save royalties, etc. The way to prevent this is to increase the experimentalist fee. It is not only the B.B.C. who are suffering, but the manufacturers of wireless sets, because a number of home-made sets consist of parts purchased *via* Holland.—We are, etc.,

THE ELECTRICAL APPARATUS COMPANY, LTD.
p.p. V. DELEBECQUE.

British Industries Fair.

Electrical Exhibits at Birmingham.

The number of electrical exhibits at the Birmingham Section of the British Industries Fair is not large, and for that reason, presumably, it has not been possible to group them in any way. So far as electrical machinery is concerned, there are one or two interesting stands. The WILD-BARFIELD automatic electric hardening equipment is shown in operation, and a feature is made by NEWTON BROTHERS (DERBY), LTD., of their reversing drive for machinery, of which parts are required to reciprocate. They are also showing a light-weight wireless generator of the type used by the airship *R*34 on her trans-Atlantic flights. The total weight is only 11½ lb. There are two solitary exhibits of switchgear, one by J. H. TUCKER AND CO., and the other by the PARK ROYAL ENGINEERING WORKS.

The displays of electric lighting, cooking and heating apparatus are not, on the whole, representative of recent progress. There are one or two stands which succeed in giving the impression that some progress has been made, and praise is due to the CABLE ACCESSORIES CO. for their efforts in this respect. Their stand is filled with electric labour-saving devices of all kinds. The EDISON SWAN stand is hardly large enough to enable the firm to show their productions to advantage. At the stand next door, the time controlled mechanism shown by VENNER TIME SWITCHES, LTD., should come in for some attention.

It is surprising that so little attempt has been made to show buyers from overseas something of the developments made in the manufacture of wireless apparatus. There is only one good display, namely, that of BIRMINGHAM PRODUCTS, LTD. A new terminal of handy design has just been brought out by the firm, and their stand contains everything for the wireless amateur from this article to a five-valve receiving set. Apart from this exhibit, however, the buyer in search of large displays of wireless apparatus will go away disappointed.

Hardware occupies considerable space at the Fair, and aluminium cooking utensils are shown on several stands in variety. If these articles had been shown in conjunction with electric cookers it is probable that the manufacturers of both would have benefited. Such a plan might well be put into operation in future exhibitions.

The stand of HOLT AND WILLETTS furnishes a good example of the industrial uses to which electricity can be put. Electric winches, blocks, and lift gear are shown, and it is to be regretted that there are not more exhibits of the same kind.

Halifax Electricity Works Despute.

As intimated in THE ELECTRICIAN last week, a dispute is in progress between the E.P.E.A. and Halifax Corporation. The Town Council recently passed a resolution giving a calendar month's notice to the technical staff in the electricity department, and instructing the Town Clerk to send a covering letter with each notice stating that as from the date of the notice the Corporation would be willing to reappoint each member of the staff at a salary provided in a list.

Later, a second notice was sent intimating that unless a reply was received by February 15th the Electricity Committee would take such steps as it deemed proper.

Having, it is stated, received no satisfactory reply, the Committee has now decided to withdraw any offer or conditions previously made, and has appointed a small Emergency Committee which, along with the electricity manager, is to take steps to fill up the vacancies as they occur.

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Watford Decides on German Meters.

English Home and Export Prices Compared.

At the last meeting of the Watford Urban District Council it was decided to purchase electric light meters in Germany, in spite of the fact that a resolution to that effect had been referred back to the Electricity Committee. The Committee reported that they had considered the matter and adhered to their previous decision. The additional cost of English meters would be £1 300, or an additional loan charge of £300 per annum.

Councillor Coates moved that the minute be referred back to the Electricity Committee, with an instruction that they should purchase British meters solely. Alderman Timberlake seconded.

Alderman Summerfield said that, as a working man and a trade unionist, he would not support German meters if it were possible to make a fair and reasonable purchase in this country. The figures placed before the committee convinced him that they were bound to decide for the German meters. The British firms were sending meters to the other side of the globe, and selling them at one-third or one-quarter of the price charged here. The position was that purchasers were asked to subsidise manufacturers to enable them to meet foreign competition.

Councillor Bridger said that Councillor Coates suggested paying 33s. for an English article rather than 20s. for a German one. The British makers had apparently—he thought admittedly—entered into a combine for the purpose of keeping up prices to the home consumer. They were selling goods in Australia at a lower price than in the home market. The Electrical Engineer had offered to place an order at the same price as was accepted in Australia, and the makers had refused to accept the order. They also refused to supply at the prices quoted for the French market. Given anything like fair conditions, it was better to support the home market, but they were not prepared to deliver themselves into the hands of a combine.

Forty Years Ago.

"The Electrician," February 24th, 1883.

A CONTRAST.—The cost of taking out an American patent for seventeen years is about £7, whilst in England the same patent would cost about £200 for fourteen years.

"THE ELECTRICIANS' DIRECTORY."—"The Electricians' Directory" for 1883 is now published, and may be had from this office, or through any bookseller. The price is 2s.

APPLICATIONS FOR PROVISIONAL ORDERS.—According to a report by the Board of Trade on the Bills of the Session, there are 106 applications for provisional orders relating to electric lighting, the capital proposed being £2 752 778. According to the list of provisional orders applied for, given in Vol. X., p. 91, of THE ELECTRICIAN, and reprinted in "The Electricians' Directory" for 1883, there were 152 applicants. Comparing this with the Board of Trade report, it will be seen that of this number, 46 have allowed the matter to drop, on Mr. Micawber's principle, we suppose.

ELECTRIC LIGHTING FOR THE HOUSE OF COMMONS.—It has been stated, says the "Daily News," "that the use of the electric light is to be extended in the House of Commons, and that the corridors and other parts of the House are to be lighted by the incandescent lamp. On the contrary, the electric light in Palace Yard will henceforward be discontinued. There is a proposal to light the Commons dining-room and the library by the incandescent light, but the matter has not gone beyond the stage of consideration." The system in use in the Palace Yard is the Brush. The system proposed for use in the dining-room, etc., is, we believe, Edison's.

Workshop Heating and Ventilation.

A Paper on "Heating and Ventilation of Engineering Workshops" was read recently before the CHELMSFORD ENGINEERING SOCIETY by Mr. Maurice F. Stevens. The president, Capt. H. Riall Sankey, occupied the chair.

Mr. Stevens said that unfortunately heating and ventilating of workshops had received very scant attention in the past, and even now was generally the last thing considered when constructing new shops. It was, in reality, a most important point, since staffs worked better in properly heated and ventilated premises. In shops (such as grinding shops) where the dust was removed by suction pipes, it was essential to consider the heating and ventilating systems together, since large quantities of warm air were being withdrawn from the shops, making it necessary to increase the incoming supply.

Mr. Stevens described, with slides, several different systems, including gravity and accelerated hot water with one or two pipes, steam systems with one or two pipes, and the "Pleman" system, in which air was heated and then delivered through pipes to the shops.

Figures issued in connection with the 1921 CENSUS show that there are 24 171 men employed in London as "electrical appointment makers, fitters, etc."

On Friday last the twin-screw CABLE STEAMER "Faraday" built to the order of Siemens Brothers and Co., was successfully launched at the Jarrow shipyard of Palmers Shipbuilding and Iron Company. Further details of this vessel will appear in a subsequent issue.

N.A.S.E. Dinner.

Mr. Gill on the Need of Education.

Speaking at the annual dinner of the NATIONAL ASSOCIATION OF SUPERVISING ELECTRICIANS on Saturday, Mr. F. GILL said that the educational scheme of the Association was of enormous importance. Unless young men were properly educated we should not make our way as a nation in future, and the education of the engineer must deal, besides technicalities, with economics, administration and psychology (knowing what to do when a man got hot). Not enough attention had been paid in the past to motives. The encouragement of ideals was essential, as ideals made for fine work. He was a great believer in the future of the electrical industry, which might easily be the biggest industry in the world. To attain that meant the encouragement of enthusiasm. Great growth meant great change, and minds must be kept flexible or we should be left behind. Mr. Baldwin, in a recent speech, had said that work was one of the things which was required to pull the nation through, for unless each one of us did our bit the Government could do nothing. Mr. Gill gave some interesting figures of his experiences in the Ministry of Munitions, where, by proper organisation, waste had been cut down and production increased owing to the intense desire of those concerned to help the country. The resources of the British Isles were coal and a very good type of human being. If the latter failed we had no other resources and the study of the human element was, therefore, of enormous importance.

Mr. T. H. WINDIBANK in reply said the Association was now a strapping infant, its career had been fortunate, it had been through the hard school of experience, and the annual report augured a happy future. He gave a detailed account of the activities of the Association and pointed out that it had a more broad-minded conception of the duties of a Trade Union than hours, wages and conditions.

Standard Plugs—G.E.C. Enterprise.

The GENERAL ELECTRIC CO. inform us that they have decided to adopt a bold policy in regard to standard plugs, so as to bring the prices as far as possible into line with those of the ordinary plugs. The difficulty, they point out, has been that the demand has not warranted manufacturing in such quantities as to produce the plugs on the same basis of cost as the ordinary plugs, while the standard plugs are bound to be more expensive owing to the heavier design. Nevertheless, large orders for the three main sizes, 5, 15 and 30 A, have been put in hand, the prices are to be immediately reduced, and the existing stock sold on the basis of the new manufacturing costs.

The new list prices, per dozen, subject to a trade discount of 33⅓ per cent., are as follows:—S.791 5 A, complete, £1 14s. 6d.; S.793 5 A, plugs only, 17s.; S.794 15 A, complete, £2 13s.; S.795 15 A, plugs only, £1 6s.; S.796 30 A, complete, £5 15s.; S.798 30 A, plugs only, £2 12s. The old list prices, per dozen, are:—S.791, 5 A, complete, £2 11s.; S.793, 5 A, plugs only, £1 5s. 6d.; S.794, 15 A, complete, £3 18s.; S.795, 15 A, plugs only, £1 19s.; S.796, 30 A, complete, £6 15s.; S.798, 30 A, plugs only, £3 7s. 6d. The list prices of the ordinary plugs, per dozen, are:—S.652, 5 A, standard gauge, £1 9s.; S.654, 5 A, plugs only, 10s. 6d.; S.637, 10 A, standard gauge, £2 4s.; S.639, 10 A, plugs only, 19s. 6d.

Books Received.

"Nickel." By F. B. Howard White. (London: Sir Isaac Pitman.) Pp. x+118. 3s. net.

"Direct-Current Machinery." By Harold Pender, Ph.D. (London: Chapman and Hall.) Pp. x+314. 15s. net.

"Bibliographical History of Electricity and Magnetism." By Paul F. Mottelay. (London: Charles Griffin.) Pp. xv+673.

"Handbook for Electrical Engineers." Edited by Harold Pender. 2nd Edition. (London: Chapman and Hall.) Pp. xxiii+2 263. 30s. net.

"Electrical Engineering Laboratory Experiments." By C. W. Ricker and C. E. Tucker. (London: McGraw-Hill Publishing Co.) Pp. xiv+310. 11s. 3d.

"British (Terra Nova) Antarctic Expedition, 1910–1913. Determinations of Gravity." By C. S. Wright. (London: Harrison and Sons.) Pp. 106. 7s. 6d. net.

"British (Terra Nova) Antarctic Expedition 1910–1913. Observations on the Aurora." By C. S. Wright. (London: Harrison and Sons). Pp. 46. 7s. 6d. net.

"Science Abstracts, January 25th, 1923, No. 301, Sections A and B." Issued by the Institution of Electrical Engineers. (London: E. and F. N. Spon.)

"British Standard Specification for Air-Break Circuit Breakers for Voltages not Exceeding 660 Volts." Issued by the British Engineering Standards Association. No. 110—1923. (London: Crosby Lockwood and Son.) 1s. 2d. post free.

"British Standard Specification for Air-Break Knife Switches and Laminated Brush Switches for Voltages not Exceeding 660 Volts." Issued by the British Engineering Standards Association. No. 109—1923. (London: Crosby Lockwood and Son.) 1s. 2d. post free.

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Legal Intelligence.

British Thomson-Houston Patent Litigation.

In the Chancery Division on Friday the case of the British Thomson-Houston Co. against the Leicester Electrical Engineering Co. came before Mr. Justice Sargant on a motion for an injunction to restrain infringement of letters patent. Mr. Travers Watson, for plaintiffs, said the defendants were willing to treat the motion as the trial of the action, and there would be the usual order in terms of the notice of motion and an injunction. There would also be an inquiry as to damages, and delivery up of the infringing articles, and costs as between solicitor and client because the validity of the patent had been upheld.

Reduction of Capital Sanctioned.

In the Chancery Division on Friday, Mr. Justice Astbury sanctioned the reduction of the capital of the Electric Lamp Supplies Co. Mr. Hodge, for the company, said the reduction was of a simple character. It was a case where one shareholder was surrendering 4 000 fully-paid shares to make up loss sustained by the company. The surrender had been made, but it could not be effective without his Lordship's order.

Damages for Electric Light User.

Judge Higgins at Tavistock County Court last week had before him a case in which Leonard Bowden Combes, of Yelverton, claimed from Major-Gen. J. H. Swanton, also of Yelverton, £10 for electric light supplied, and the General claimed £10 for damages.

Plaintiff said the electric light was supplied to defendant from Christmas, 1921, to March, 1922, and on March 25th the account was sent in. The light was cut off on April 3rd, and after some dispute regarding the testing of the meter, it was sent away to be tested, and subsequently returned set to zero. The only question was whether a week was sufficient notice.

The defence was there must have been a default in the meter, or in the reading of it, because there was a considerable difference between the accounts for electric light in Christmas and March quarters. Defendant said that by the cutting off of the light he was caused great inconvenience and annoyance.

Judgment was given for plaintiffs for light supplied from March 25th to April 4th for two kWh at 3s. 6d. per kWh; and on the claim for £4 6s. 6d. for 40 kWh. Regarding the counter-claim for damages, General Swanton was awarded £5 5s., with costs.

£100 000 for Research.

Sir Alfred Yarrow's Gift to Royal Society.

Sir Alfred Yarrow has made a gift of £100 000 to the Royal Society with the object of encouraging original scientific research. Writing to the president of the Royal Society, Sir Alfred says that, in his view, the prosperity of the country has been greatly hampered for the want of better promotion of scientific investigation and its application to practical affairs.

"I desire," he proceeds, "to mark my sense of the value of research to the community by offering, as a gift to the Royal Society, £100 000 to be used as capital or income for the purposes of the Society, as the Council may think fit, because I recognise conditions alter so materially from time to time that, in order to secure the greatest possible benefit from such a fund, it must be administered with unfettered discretion by the best people from time to time available.

"I should prefer that the money be used to aid scientific workers by adequate payment, and by the supply of apparatus or other facilities, rather than to erect costly buildings, because large sums of money are sometimes spent on buildings without adequate endowment, and the investigators are embarrassed by financial anxieties."

Industrial Administration.

Dr. C. C. Garrard on Modern Costing Systems.

Dr. C. C. Garrard (General Electric Co., Witton) addressed the Institution of Industrial Administration in Birmingham last week. He stated that one of the most striking aspects of the development of modern industry was the application of what was known as "scientific method." By that was meant that instead of applying the old qualitative methods of judgment, they used quantitative ones. In the domain of management they were passing from management by qualitative judgment to that of quantitative measurement. One cause of this was the increasing complexity of machinery and goods in general. To-day, human work was so specialised that the connection between the individual's share of it and the final product was lost sight of. Hence, in order to avoid waste and misguided effort, an accurate control at all stages was essential. Industry to-day was carried on in a very wasteful manner. The measurement of human effort demanded the fixing of standards. It was difficult to overestimate the importance of the costing departments in a works, but in many concerns the true elements of costing were not understood. The test of a proper cost and works' book-keeping system was that if at any time the works were totally destroyed and the books saved, it should be possible to tell exactly the financial position of the concern at the time of its destruction.

Mid-Lancs Electricity District.

Questions Affecting the Textile Industry.

The Electricity Commissioners opened their enquiry at Preston, on Tuesday, into the joint scheme of Blackburn and Preston Corporations for electrical development in Mid-Lancashire under the Supply Act of 1919. The scheme proposes a joint authority for the district with powers to deal with the generation and bulk transmission of electricity. To this end it is suggested that between now and 1931 all existing stations except those at Blackburn, Preston and Rawtenstall shall be closed, and that the normal supplies for the district shall come from three "capital" stations at Blackburn, Burnley and Preston, existing generating stations to be retained for a time as peak load or emergency stations. The new authority is intended to consist of representatives of local Councils in the district who are authorised undertakers, and they are to agree to afford financial assistance under the provisions, including the Lancashire County Council. The district comprises the county boroughs of Preston, Blackburn, Burnley and Blackpool, the boroughs of Accrington, Bacup, Chorley, Clitheroe, Colne, Darwen, Haslingden, Nelson and Rawtenstall, and various urban district and rural district councils in the area. The scope extends between Preston (in the west), Colne (in the north-east), and the residential districts of the Fylde. The industrial portion is important, for it represents all branches of the textile industry.

Opposed to the scheme are Burnley, Accrington, Colne, Nelson, Bacup, Haslingden, Rawtenstall, Blackpool and Darwen, and the urban locality of Brierfield. They propose a joint electricity board with advisory functions only. They contend that a retention of existing control and supply will result in more efficient and economic distribution.

The Commissioners were:—Sir J. Snell (chairman), Sir H. Hayward, (vice-chairman), and Mr. W. W. Lackie, with Mr. E. W. Hudson (legal adviser), and Mr. D. S. Cumberlege (clerk).

The Case for Blackburn and Preston.

Mr. R. Harker, for Blackburn and Preston, regretted the opposition of neighbouring towns, and expressed the hope that the inquiry would go far towards removing the differences which existed. The first question to consider was whether the suggested grouping was most conducive to efficiency and economy in electrical finance and administration; and, secondly, whether any improvement was required in the organisation and supply of electricity in the area. Quite apart from the question of cost, there was a sharp difference of opinion among those interested in the textile industry as to the use which might be made of electrical energy. It had been said that manufacturers would agree to instal electricity if it were not for the high cost. The Blackburn and Preston Corporations believed, so far as the cotton trade was concerned, that there was a great future for electrical development, and that the time would come when practically all mills would be using electricity for power purposes. He believed that in the Burnley district there was a contradictory view. Blackburn and Preston hoped the inquiry would satisfy these objectors that they were wrong.

Large v. Small Stations.

Since the Blackburn station was established in October, 1921, ten mills had adopted electrical energy and eleven more had applied for it. In Blackburn, there were some 120 mills left, and he hoped to satisfy the court of the enormous possibilities there were in the district. There was also the question of railway supply, and the line from Blackburn to Burnley seemed to be one which lent itself to electrification. Altogether, the suggested district was one which had infinite possibilities. All other stations except Blackburn and Accrington were inadequate, and the sites were not suitable for economic expansion. The Blackburn scheme provided for intercommunication between all important centres, with a possible new station in the Burnley district. On the other hand, the Burnley scheme seemed to him to provide for numerous extensions in existing stations and the partial linking up between some of the important centres. In the view of his clients, the contest seemed to be between the large and the small generating stations.

The Technical Side.

Mr. Harker dealt with the technical part of the Blackburn-Preston scheme. The pivot of it was the Preston station and the linking up with Blackburn. They proposed to close down the stations at Colne and Darwen. Preston's new station would be completed as soon as possible, and a new station erected in the rural area of Padiham. With these three stations in commission, all others would be closed down with the exception of Rawtenstall.

Blackburn and Preston were prepared to finance the construction of their stations up to the limit named in the particulars—50 000 kW at Blackburn and 30 000 kW at Preston. He did not put the scheme forward as an ideal one, but it seemed the only one which had a real chance of success. The East Lancashire authorities seemed to refuse to accept the Preston site as the centre of supply, and to recognise the linking up between these towns. If there could be safeguards on these points he believed Preston and Blackburn would favour a joint authority at once.

The inquiry was adjourned.

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Imperial Notes.

AUSTRALIA.

An Electrically-Worked Butter Factory.

DORRIGO (N.S.W.) hydro-electric works and butter factory have been opened and are working satisfactorily. The total cost of the hydro scheme is £40 000, and the butter factory £22 000. The butter factory is equipped with all the latest appliances and labour-saving devices. Electric motors are installed throughout. Power for driving the electrical plant is taken from the Dangar Falls, near Dorrigo. Two turbo-generators, each of 100 kW, are used. Ten times the water power now utilised could be obtained by the construction of a dam and by tapping another creek.

Bulk Supply Scheme Round Brisbane.

Municipalities in the vicinity of BRISBANE are gradually building up a large BULK SUPPLY SCHEME. Balmoral Shire Council obtained an order in Council, and started operations in January, 1920. Coorparoo and Wynnum Councils soon expressed a wish to co-operate, and an electricity supply board representing the three councils was formed. The board has now been enlarged by the inclusion of representatives of Toombul, Enoggara, Kedron and Sandgate Councils. It is proposed to spend about £90 000 on the combined undertaking. The erection of the distribution lines in Wynnum has been in progress for some time.

CANADA.

Railway Electrification.

An investigation will be held shortly with a view to determining the desirability of the ELECTRIFICATION OF CERTAIN LINES of the Canadian National Railways in Ontario.

American Firms in Ontario.

Several American firms are negotiating for BRANCH FACTORIES IN ONTARIO. The Maloney Electric Co., St. Louis, have purchased premises in Toronto for the manufacture of transformers, and the Vesta Battery Co., Chicago, makers of storage batteries, will secure branch works in Ontario.

INDIA.

Electrical Developments in Cawnpore.

An extraordinary general meeting of the Indian Electric Supply and Traction Co. will be held at Orient House, New Broad Street, London, E.C., on February 26th, to pass a resolution changing the name of the company to "THE CAWNPORE ELECTRIC SUPPLY CORPORATION, LTD." The Board, in consequence of representation, is of opinion that the time has arrived when it is desirable to change the name so as to indicate the field of present operations. Up to the present the company has confined its business to Cawnpore and its environs only, and as that city is a very active centre of trade and industry its rapid development offers ample scope for the extension of operations without exploiting new fields.

Electricity in Bombay Mills.

The majority of the BOMBAY MILLS have already begun to make use of electric power. The Tata Hydro-Electric Co. now supplies to 48 consumers electric energy to the extent of 60 000 H.P., of which about 54 000 H.P. is consumed by cotton mills. The other hydro-electric concern of the Tatas, the Andhra Valley Co., has now begun to produce and supply energy, and all the available power has already been disposed of. A third scheme, also of the Tatas, is making progress. It is estimated that altogether from the Western Ghats half a million H.P. will be obtained, to be transmitted to Bombay or to be utilised on the coasts for electro-chemical industries, such as the extraction of aluminium from bauxite and the manufacture of nitrogen compounds from the air. The Tata Companies are about to complete an agreement with the Bombay Electricity Supply and Tramways Co., by which they will take up gradually the whole of the Tramway Co.'s demand.

Foreign Notes.

EUROPE.

New Telegraphic Works in Sofia.

A new firm manufacturing telegraphic apparatus is to be started in Sofia, with a working capital of 5 millions of levas. Half the funds will be supplied by the BULGARIAN GOVERNMENT, the remainder by the "Telegraphia" Czechoslovak Society.

Electrification of Northern Bohemia.

The administration of the joint stock company known as "Electrical Works of Northern Bohemia," has decided to increase its capital from 6 to 10 million crowns, and to conclude an AMALGAMATION AGREEMENT with the SIEMENS ELECTRICAL WORKS, subject to State approval. If sanctioned, this amalgamation will represent a great advance in the systematic electrification of Northern Bohemia.

LATIN-AMERICA.

Tram Fares in Buenos Aires.

The ANGLO-ARGENTINE and the LACROZE TRAMWAY COMPANIES have asked the Municipal Intendent of Buenos Aires for authority to increase their fares. In return for this concession the former company offer to proceed with the construction of the underground railway between Avellaneda and Retiro, whilst the latter undertake to construct 25 km. (15½ miles) of new lines in the city. In the event of the increased tariffs being authorised the two companies also undertake to grant an increase of 20 per cent. in the salaries of all employees up to $250 (about £22 at pre-war rate).

Obituary.

Walter Farrow.

Mr. WALTER FARROW, head of the firm of Farrow and Sons, electrical engineers, New Street, Chelmsford, has died at the age of 67. He succeeded to the business of his father, the late Mr. Henry Farrow, with whom he served his apprenticeship. For some years he had served on the Town Council. It is announced that the business will be carried on as hitherto.

E. P. Haslam.

We regret to announce the death, which took place at Brighton on Monday, of Mr. E. P. HASLAM, formerly a director of Benn Brothers, Ltd., proprietors of THE ELECTRICIAN. Mr. Haslam, who was very well known in the advertising world, and had won many friends by his cheerful and kindly disposition, was formerly one of the proprietors of "The Gas World." When that journal was amalgamated with Benn Brothers, Ltd., in 1917, Mr. Haslam became a director of the firm, and continued to serve on the board until a breakdown of health necessitated his retirement about three years ago. He was principally concerned with the management of "The Gas World" and "The Chemical Age," and took a principal part in the foundation of the latter journal.

A. Rowley.

We regret to learn of the death of Mr. A. ROWLEY, who has been associated with the Siemens lamp sales organisation for the past eleven years. He recently underwent two serious operations in St. George's Hospital, and although these appeared to have been fairly satisfactory, complications set in with fatal result. He had a wide circle of friends in the electrical industry, and was well known in the London area. The interment took place last week at Hanwell.

Thomas William Stratford-Andrews.

On Saturday last the death took place of Mr. THOMAS WILLIAM STRATFORD-ANDREWS. He succeeded his father in 1899 as managing director of the Indo-European Telegraph Co., and later joined the boards of the London Platino-Brazilian Telegraph Co., Delhi Electric Tramways and Lighting Co., Galletti's Wireless Telegraph and Telephone Co., and the Radio Communication Co., the latter as chairman. He was a member of the expedition which proceeded 800 miles up the Amazon for the purpose of laying a telegraph cable in extension of the Western and Brazilian Telegraph system, and in 1897 he rode on horseback through Russia and across the Caucasus to Teheran, Persia, on a tour of inspection of the Indo-European land line, describing his journey in a small book, "Overland to Persia." Mr. Stratford-Andrews, in conjunction with Sir Henry Kirk, introduced direct automatic Wheatstone working throughout the Indo-European system, by means of which direct messages can be transmitted between Manchester, Liverpool and London on the one hand, and Karachi on the other. He held the Persian order of the Lion and Sun, and his services were also recognised by the Russian Government. The funeral took place at Elstead, Surrey, on Wednesday.

Francis Sales Thomas.

The death has taken place of Mr. FRANCIS SALES THOMAS, chairman of the Saxonia Electrical Wire Co., Roan Street, Greenwich. He established the business of the company in 1895.

Personal Items.

Mr. L. H. DAVIS, chief inspector (London) in the Post Office Engineering Department, has been promoted to assistant engineer (London).

Mr. C. B. GRESHAM, late of H. W. Sullivan, Ltd., has been appointed sales manager of the radio department of Radio Instruments, Ltd., as from March 1st next.

We regret that the name of Mr. ALFRED L. LUNN, who has been appointed resident engineer by Manchester Corporation at their Stuart Street station, was incorrectly spelt in our last issue as Lann.

Mr. T. MALCOLM RITCHIE, managing director of the Electrical Equipment Manufacturers Pty., of South Melbourne, Australia, has been elected president of the Electrical Federation (Victoria) for the current year.

Mr. DONALD SHAW, of the Birmingham Corporation tramways department, has been appointed permanent way engineer to the Sheffield Corporation tramways department, at a salary of £500 per annum.

Sir THOMAS BAKER, late chairman of the Plymouth Corporation Tramways Committee, has been presented by the employees with an illuminated address, bearing photographs of the tramways undertaking, as a token of esteem.

Sir CHARLES PARSONS has been selected by the Council of the Institution of Electrical Engineers as the second recipient of the Faraday Medal. The medal is awarded for "notable scientific or industrial achievement in electrical engineering, or for conspicuous service tendered to the advancement of electrical science."

Mr. JAMES SMITH, the oldest member of the staff of the Edinburgh Telegraph Department, has retired. He entered the service in 1877, and became an expert in Wheatstone signalling work. He has been lecturer on telegraphy, telephony, and telegraph engineering at the Heriot-Watt College for over 20 years, and represented Scotland at Como, Italy, at the centenary of Volta's discovery of voltaic electricity.

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Electricity Supply.

Extensions and Developments.

Mains, etc., extensions are to be put in hand at STOCKTON at a cost of £17 206.

BATH City Council has sanctioned extensions at the electricity works at a cost of £30 000.

PLYMOUTH Town Council has sanctioned the expenditure of £192 160 for the development of the electricity undertaking.

DERBY electrical engineer has reported that it will be necessary to extend the e.h.t. cable and that a sub-station will ultimately be required.

KIRKCALDY generating station is to be extended at a cost of £51 000. A further 3 000 kW turbo-alternator is to be installed and a new cooling tower.

BURTON-ON-TRENT Town Council have decided to re-lay the l.t. electricity mains in Station Street, which have been in use for thirty years, at a cost of £8 000.

DORCHESTER Town Council has instructed the borough surveyor to prepare plans and estimates of extensions to the electricity works needed for the installation of additional plant, and the Weymouth Town Council has been asked if their electrical engineer, Mr. Nicolson, can be permitted to advise on the additional plant needed.

The surveyors of the National Electric Construction Co., which is the parent body of the Musselburgh Tramways Co., have commenced work with the supply cable to convey electricity from the Edinburgh Corporation's super-power station at Portobello to the LOTHIANS. The first line is to feed a large sub-station near Monktonhall, Musselburgh, and it is expected that a supply by this channel will be available in a few months' time.

Loans Applied for and Sanctioned.

ALDERSHOT is applying to the Commissioners for sanction to borrow a further sum of £824.

AYR Town Council has applied to the Electricity Commissioners for a loan of £5 000 for electricity purposes.

DARLINGTON Town Council has applied to the Electricity Commissioners for a loan of £17 206 for extensions to mains.

SUNDERLAND Corporation Electricity Committee is seeking sanction to borrow £15 000 to lay new mains, £5 000 for re-cabling, and £2 236 for sub-station expenses. In addition to this latter amount, £10 593 will be spent from revenue account in extending the Chester Road sub-station.

Alterations in Charges, Proposed and Actual.

NEWPORT (Mon.) Chamber of Commerce is urging the Corporation to make a reduction in electricity charges.

CHIPPENHAM Town Council is to approach the Electric Light Co. with a view to a reduction in their charges.

CHISWICK Chamber of Commerce is protesting against the present electricity charges of 8d. per kWh for lighting and 3d. per kWh for power.

The question of a reduction in electricity charges was raised at a Town Council meeting at HAMILTON, where charges are just 100 per cent. above those ruling in 1914.

CHEADLE AND GATLEY Urban Council has reduced the fixed charge for electricity supplied for trade purposes from £4 per quarter per kW of maximum demand made in a year to £2 10s.

At NEWCASTLE-UNDER-LYME charges have been reduced from 10d. to 8½d. per kWh (lighting), and flat rates of 3½d. and 2½d. per kWh have been put into force for power and heating respectively.

GLOSSOP Urban Electric Supply Co. has obtained an order fixing the maximum charge for electricity at 10d. per kWh, with minimum payments of 12s. 6d. for each winter quarter and 8s. 4d. for each summer quarter.

BANGOR Corporation engineer has recommended that reduced rates be offered for the use of electricity for the lighting of shop windows after 7 p.m. Concrete proposals on the subject are to be considered at the next meeting of the Electricity Committee.

HORWICH Electricity Committee has had an interview with Bolton Committee relative to the price of electricity supplied to i's area. The supply to the railway company is at the same price as that paid by the Council to Bolton. It was pointed out that, although no direct profit would be obtained from the railway company's supply, the price of electricity to other consumers in Horwich would be reduced, as the company's load would reduce the price of the bulk supply from Bolton Corporation.

Tapping New Areas.

DRONFIELD is anxious to obtain a power supply from Sheffield.

Crompton & Co. are about to arrange for the electric lighting of RYE.

A syndicate has been formed with the object of supplying electric light to DEVIZES.

TILEHURST Ratepayers Asociation is asking the Reading Electric Co. to extend their supply to that district.

On February 17th the works of the WARMINSTER Electric Supply Co. were opened by Lord Bath, who switched on the current.

WALLINGFORD Town Council has decided to facilitate the Crowmarsh Mill Syndicate in their application to instal electric light and power in the town and district.

Mr. Pryce F. White, who was recently engaged as special adviser to the ABERGELE Urban District Council, has been invited to submit a detailed scheme for lighting the town with electricity.

It is anticipated that the CORWEN electric light scheme, the power for which is to be generated at the Cynwyd Waterfalls and conveyed by overhead cable to the town, will be completed and the light switched on early in March.

Miscellaneous Supply Items.

It has been decided that the following PRIVATE BILLS shall originate in the HOUSE OF LORDS: London Electricity Supply; Lytham St. Anne's Corporation; Morley Corporation; Oakham Gas and Electricity; Plymouth Corporation; Shropshire, Worcestershire and Staffordshire Electric Power; Stoke-on-Trent Corporation, and Swanage Gas and Electricity.

The North Metropolitan Electric Power Supply Co. have applied to the Electricity Commissioners for a special order to supply electricity in WANSTEAD, WOODFORD, BUCKHURST HILL and LOUGHTON Urban Districts. Objections to the Secretary, Electricity Commission, Whitehall, London, by March 12th. Walthamstow Urban Council has decided to lodge an objection and to apply itself for a special order.

It is probable that LLANDRINDOD WELLS Urban District Council will take over the local electric light installation at the beginning of the next financial year. A conference of representatives of local authorities, electrical power companies and private concerns producing electricity in South Wales was held at Cardiff on February 15th for the purpose of preparing a scheme of co-operation between the various producers for submission to the Electricity Commissioners of the Ministry of Transport. A preliminary committee has been set up and a draft scheme will be submitted to a further conference.

New Edition of the Blue Book.

The Electrical Engineer's Vade-Mecum.

The dismalness of this time of year is to some extent lightened in the electrical industry by the publication of THE ELECTRICIAN "Electrical Trades Directory and Handbook"—the well-known Blue Book. The publication of the forty-first edition of the Directory has been slightly delayed owing to labour troubles, but copies are now available at the offices of the publishers, Benn Brothers, Ltd., at the price of 25s. net.

It is the proud boast of those who produce this book that it is the one publication to which reference with regard to those working in the electrical industry can be made with absolute confidence and accuracy. To justify this boast, thorough revision is essential, and a careful lookout has to be kept for additions which become necessary from time to time. A cursory examination shows that in the current edition this work has been done as well as usual, and we have no doubt that this opinion will be confirmed as the book is constantly used during the coming twelve months.

This policy of revision applies equally to the Handbook Section, and in the case of this particular edition the electro-technical tables, commercial information and statistics, the legal digest and the departmental regulations have all been carefully checked and corrected. In view of the numerous tariff changes during the year, the matter relating to the import duties levyable on electrical machinery and apparatus in the British Dominions and foreign countries has been re-written and several new items have been included, thus greatly improving the utility of the matter.

Broadcasting and Electricity Supply.

An electrical directory without any reference to broadcasting, and especially the regulations which hedge it round, would indeed be "Hamlet" with the prince left out. We are not, therefore, surprised to find that these regulations are included in the Directory, or that important details relating to another sphere of electrical activity in an abstract of the Electricity Supply Act of 1922 and in particulars of the progress made with the reorganisation of electricity supply and the constitution of joint electricity districts are also to be found.

The classified trade sections for both the British Isles, the Dominions and abroad have been re-organised with a view to suppressing unnecessary duplicate headings, which do not add to the value of the Directory.

We are told in all directions that trade is developing, but trade will not develop without hard work, especially on the part of those whose business it is to sell the productions of manufacturers. The salesman's task is enormously lightened by the provision of complete and accurate information as to the requirements of potential customers. From this point of view, and it is not by any means the least important point of view, the Electrical Trades Directory may be justly called the salesman's vade-mecum.

The Air Ministry announces the expansion of the Reserve of Air Force officers. Applications will be considered from gentlemen with qualifications in WIRELESS TELEGRAPHY IN CONNECTION WITH AIRCRAFT.

A Canadian METHOD OF METER READING is likely to be introduced into this country shortly. A camera and lamp are used to obtain a photograph of the meter, thus preventing any mistake in entering the reading.

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Tenders Invited and Accepted.

UNITED KINGDOM.

SHOREDITCH (LONDON) BOROUGH COUNCIL.—The Lighting Committee report that they have given instructions for specifications to be prepared and tenders obtained for the third new boiler and for a 1 500 kW converter, with switchgear, for the Whiston Street station.

TILBURY URBAN DISTRICT COUNCIL, February 24th.—One 60 kW steam-driven c.c. compound wound generating set, including battery charging panels, and two 3½ ton electric vehicle chassis, with hand operated end tipping bodies. Forms of tender from Mr. S. A. Hill-Willis, Engineer to the Council.

KIRKCALDY CORPORATION, March 1st.—Steam turbine, three-phase alternator, condensing plant and piping. Specification (No. 15) from Kennedy and Donkin, Broadway Court, 8, Broadway, Westminster, S.W.1.

ISLINGTON (LONDON) GUARDIANS, March 3rd.—Six months' electrical supplies, ironmongery, paints, oils, engineers' goods, etc. Forms of tender from the Clerk, St. John's Road, Upper Holloway, N.19.

LEEDS EDUCATION COMMITTEE, March 5th.—Repairs to buildings for twelve months, including electric wiring work. Particulars from Architect's Section, Education Department, Calverley Street, Leeds.

BELFAST TRAMWAYS COMMITTEE, March 6th.—Six or twelve months' supply of stores and materials, including cable, lamps, brass and copper strip, insulating tapes, carbon brushes, controller fingers, spares for Westinghouse controllers, and tramcar equipments, coils, trolley heads, trolley wire, paints, varnishes, oils, etc. Forms of tender from the General Manager, Napier Street, Sandy Row, Belfast.

BELFAST ELECTRICITY COMMITTEE. March 10th.—Stores and materials, including cables, electrical accessories, lamps, carbon brushes, bitite strip, tapes, box compound, fuse wires, copper cable connectors, meters, m.d. indicators, automatic time switches and house-service cut-outs. Forms of tender from the City Electrical Engineer, East Bridge Street, Belfast.

WEYMOUTH CORPORATION, March 10th.—One 350 kW vertical gas engine and dynamo, with gas plant. Specification from the Borough Electrical Engineer, Stavordale Road, Weymouth.

BELFAST CORPORATION, March 12th.—Three-phase h.t. switchgear for sub-station. Specification (W5) from the City Electrical Engineer, East Bridge Street, Belfast.

BEDFORD CORPORATION, March 13th.—Extra high-tension, high-tension and low-tension underground cables for one year. Specification and particulars from the Borough Electrical Engineer, Prebend Street, Bedford.

AUSTRALIA.

SYDNEY CORPORATION, March 19th.—Static condenser.

MELBOURNE AND METROPOLITAN TRAMWAYS BOARD, April 4th.—H.T. copper cable and l.t. feeder cable.

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, April 10th.*—1 877 tons h.d. copper wire. April 17th.*—Covered wires (schedule 104).

AUSTRALIAN POSTMASTER-GENERAL'S DEPARTMENT. April 11th*—Positive plates for batteries (schedule S.A. 750). April 17th—Covered wires (Vic. 104). April 18th—Telephone apparatus (S.A. 653). April 24th—Telephones and handsets, and switchboard cable (Vic. 114). Tender forms from Supply Officer, Room 101, Australia House, Strand, London, W.C.2.

NEWCASTLE (N.S.W.) CORPORATION, April 10th.—Potentiometer and accessories, and portable type combined voltmeter for Sydney Street power house, Newcastle.

AMALGAMATED WIRELESS (AUSTRALASIA), LTD., April 30th.—Erection and equipment of a high-power duplex station at a site selected by the company within 100 miles of Sydney or Melbourne. Particulars are given in our Wireless News column.

NEW SOUTH WALES RAILWAY DEPARTMENT, SYDNEY, May 23rd.—Eight water-tube boilers, with accessories for White Bay power house, Sydney.

BELGIUM.

MINISTRY OF RAILWAYS, MARINE, POSTS AND TELEGRAPHS, Brussels. April 18th.*—Telephone equipment for the City of Antwerp.

WATFORD CORPORATION have accepted the tender of the Industrial Construction Co. for extensions to the electricity works at £16 315.

Cable Accessories, Ltd., have secured a contract from EASTBOURNE CORPORATION for 150 swan-neck brackets, reflectors, etc., at 32s. 6d. each.

HALIFAX ELECTRICITY COMMITTEE have accepted the tender of the British Thomson-Houston Co. for spare parts for turbo-generator, £476 9s.

The tender of British Insulated and Helsby Cables, Ltd., for cables at £7 395 15s. 10d. has been accepted by DARLINGTON CORPORATION.

*Particulars from the Department of Overseas Trade.

BETHNAL GREEN (LONDON) BOROUGH COUNCIL have accepted the tender of the Hackbridge Electric Construction Co. for a 500 kVA three-phase transformer, at £364.

James Howden & Co., Ltd., have secured an order for the supply of turbo-generator plant to WINNIPEG (MANITOBA) MUNICIPALITY. The amount of the contract is about £50 000.

SHOREDITCH (LONDON) BOROUGH COUNCIL have accepted the tender of the Western Electric Co. (lowest tender received) for renewal of telephone installation at £343 5s. 6d.

SWANSEA ELECTRICITY COMMITTEE have accepted the tender of the Stirling Boiler Co. for a boiler and accessories at £11 972, and that of the Pulsometer Engineering Co. for a feed pump at £248.

STOCKTON-ON-TEES CORPORATION have accepted the tender of British Insulated and Helsby Cables, Ltd., for cables required for extensions of the electricity supply system at £7 395 15s. 10d.

SUNDERLAND CORPORATION have accepted the following tenders:—Hadfields, Ltd., 12 pairs of tramway points; Steel, Peech and Tozer, 100 tramcar wheel tyres; Lea Recorder Co., eight coal meters.

The tenders of Ferguson Pailin, Ltd., for switchgear, £3 477 10s., and Drysdale and Co. for sludge pumps with Oerlikon motors, £1 321, are recommended for acceptance by DUBLIN CORPORATION.

Institution Notes.

The annual dinner of the BIRMINGHAM AND DISTRICT ELECTRIC CLUB will be held on March 2nd, at the Grand Hotel, Colmore Row.

The annual convention of the INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION will be held at Scarborough from June 18th to June 22nd.

Mr. Frank Gill, president of the INSTITUTION OF ELECTRICAL ENGINEERS, will address the North Midland Centre at the Queen's Hotel, Leeds, on February 27th. Dinner will be served at 6 p.m.

It is proposed to hold the examination for associate membership of the INSTITUTION OF ELECTRICAL ENGINEERS in London and other places at home and abroad towards the end of April. Entry forms and full particulars can be obtained from the Secretary of the Institution, Savoy Place, Victoria Embankment, London, W.C.2.

The annual report of the Council of the INSTITUTION OF MECHANICAL ENGINEERS shows that there was a total increase of membership during 1922 amounting to 740. The total membership is now 8 734. Income for the year was £28 655 7s. 1d. and expenditure £28 737 17s. 5d. The total assets now amount to £165 804 7s. 5d.

The following officers for 1923 have been elected by the INSTITUTION OF RAILWAY SIGNAL ENGINEERS:—President, Mr. R. J. Insell; vice-president, Mr. W. J. Thorrowgood; hon. treasurer, Mr. A. E. Tattersall; hon. secretary, Mr. M. G. Tweedie. The annual report shows that 76 new members were elected in 1922, the total membership being now 434.

A Joint meeting of the RONTGEN SOCIETY and the PHYSICAL SOCIETY is being held to-day (Friday) at the Imperial College of Science, London, S.W., at 3 p.m. There is to be a discussion on "The Measurement of X-Rays." The Council announce that the Sixth Silvanus Thompson Memorial Lecture will be delivered by Dr. C. Thurston Holland on May 1st.

A meeting of the Sheffield students' section of the INSTITUTION OF ELECTRICAL ENGINEERS was held in the Mining Lecture Room, University of Sheffield, on February 14th, when Mr. H. Taylor (chairman of the secton) read a paper on "Electro-Magnets." The paper dealt chiefly with electro-magnetism as commercially applied to lifting magnets, and covered their construction, application, performance and design.

On Tuesday next Sir Arthur E. Shipley will deliver the first of two lectures at the ROYAL INSTITUTION on "Life and its Rhythms"; and on Thursday Mr. Theodore Stevens begins a course of two lectures on "Water Power of the Empire." The Friday evening discourse on March 2nd will be delivered by Dr. G. C. Simpson on the "Water in the Atmosphere"; and on March 9th by Dr. C. W. Saleeby on "Sunlight and Disease."

At the next meeting of the DIESEL ENGINE USERS' ASSOCIATION on March 2nd at the Institution of Electrical Engineers, the subject of "Heavy Oil Engine Working Costs" is to be considered and discussed. The Association has collected data of the actual working costs of a large number of Diesel and semi-Diesel engine installations during the last few years, and the Committee will be making a report to serve as a basis for a discussion of the whole subject.

The BRITISH NON-FERROUS METALS RESEARCH ASSOCIATION is arranging lectures for communicating the results of its research investigations to its members. The lectures are private and have so far been applied to two subjects. Dr. W. Rosenhain has reported on the investigations on copper and the influence upon its properties of small quantities of impurities, which are being carried out for the Association by Dr. D. Hanson and others at the National Physical Laboratory. In the second case, Mr. E. A. Bolton spoke on "The Cause and Prevention of Red Stains on Brass." The Association has now arranged a third lecture to be given both in Birmingham and Sheffield, by Mr. Dartrey Lewis on his work on "Materials used for the Abrasion and Polishing of Metals." The Birmingham lecture will be held on February 26th, and the Sheffield lecture on February 23rd (to-day).

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Electric Traction.

Tramway Extensions and Developments.

Consideration is being given by various bodies to the proposal of GLASGOW Corporation to extend their tramway system from Eastwood Toll, Giffnock, to Newton Mearns, a distance of two miles. Some opposition is forthcoming.

CARDIFF Tramways Committee has deferred to a later date a scheme for allocating 1½ per cent. on the capital of the undertaking to the relief of the rates. The tramways manager has pointed out that many of the cars need renewing. The " bordering " of certain tracks in the City is to be undertaken.

EDINBURGH Tramways Committee has been considering a proposed draft agreement between Edinburgh Corporation and the Musselburgh and District Electric Light and Traction Co., under the terms of which each party would grant running powers over their respective systems when the Portobello section of the Edinburgh system is electrified. The agreement would be operative for a period of three years, when it would be subject to renewal.

GLASGOW Corporation Tramways Department has issued a handsome souvenir volume containing a record of the jubilee celebrations last year. Many interesting details regarding the history of the undertaking, first under the management of the old company, and latterly as one of the many branches of civic activity, are set forth in the book, which is illustrated by photographs of men intimately connected with the service, and of incidents during the re ent celebrations. It is pointed out that in 1917 the whole indebtedness of the undertaking was cleared off, and that no municipal undertaking has ever been in such a financial position.

Fares, Receipts and Passengers.

Inquiries at SHEFFIELD have elicited the information that the city will not at present follow the example of Leeds in reducing tram fares.

ACCRINGTON Tramways Committee is unable at present to make any recommendation to the Town Council regarding fares. It was quite certain, the Chairman said, that they could not go back to pre-war fares. There was, however, a certain amount of revenue they could possibly dispense with, and they hoped to give the public the benefit of any saving which they would be able to effect in the new financial year.

Hours and Wages Questions.

A ballot has been taken of the GLASGOW tramwaymen as to whether they should work their eight hours without a break or continue on the present system of having two or three breaks in the day. The result is that 2 088 have voted in favour of working without a break, while 606 are in favour of the present method. The Tramway Committee will be approached as to whether a change is practicable.

BURNLEY Town Council recently passed a regulation that all employees should be paid the standard rate of wages for the district. It was found that fitters and turners were being paid 5s. 6d. more than the men engaged on the trams. These men claim they have been paid extra by reason of special circumstances. On the Council enforcing the resolution, the men decided to cease work as a protest against the reduction.

Electric Railway Items.

Improvements in the lighting of certain important stations have recently been made on the LONDON " Underground " system.

Interviewed by " The Times," LORD CLAUD HAMILTON said that in his opinion railway electrification was an excellent thing for distances of not over forty miles. It was the ideal thing for traffic within a wide suburban area.

Presiding at the annual meeting of the South Eastern and Chatham Railway, Mr. COSMO BONSOR said that the initial difficulties in connection with the scheme of electrifying portions of the line had been overcome and it was hoped to get to work on the electrification scheme practically in the next few weeks.

Lieut.-Col. Ashley stated in the House of Commons last week that the METROPOLITAN RAILWAY CO. were considering whether any tube railway extensions could advantageously be constructed northwards from Finsbury Park. No powers for such lines at present existed, and the preparation of any scheme for submission to Parliament with a view to obtaining powers or removing any existing legal difficulties would necessarily take a considerable time.

The late Mr. J. M. HENDERSON, a director of Ferranti, Ltd., Lancashire United Tramways, and other companies, left £110 340.

The question of installing FLAME SAFETY LAMPS in places where electric lamps are in use has not, it is stated, been lost sight of by the Mines Department, and, by the way of finding a solution, the problem was some time ago referred to the Miners' Lamps Committee who have taken much evidence on the point, and will shortly issue their report.

In connection with the Scottish Ideal Homes Exhibition, Edinburgh, members of the ELECTRICAL CONTRACTORS' ASSOCIATION last week entertained Lord Provost Hutchison and other municipal representatives at an " electrical lunch " in the Exhibitors' Club. The premises were heated and lighted, and the whole luncheon cooked, by electricity.

Wireless News.

Tenders Invited for Australian Station.

An important step has been taken in regard to the establishment of an EMPIRE WIRELESS SERVICE by Amalgamated Wireless (Australasia), Ltd. Tenders are being invited for the erection of a modern high-power wireless station in Australia designed for direct commercial communication with England twenty-four hours daily throughout the year, as well as for the provision of a suitable corresponding station in England. It is stipulated that the English and Australian stations must be equipped and operated for high speed working in both directions simultaneously. Further provision is required for communication with Canada, by means of a high speed duplex station in that country. The Australian Government requires the tenderer to undertake the entire work of erecting the Australian station and making arrangements for the corresponding stations in England and Canada. He must also provide guarantees as approved by the Australian company for the erection, completion, and efficient working of the Australian station, and for the provision and operation of the two other stations. The work is to be carried out on behalf of Amalgamated Wireless (Australasia), Ltd., which will take over and operate the Australian station as soon as it is completed, and which at the same time will establish a comprehensive system of feeder stations between the main station and other centres throughout Australia, in order to provide for the wireless transit to and from all parts of the Commonwealth of all messages passing over the high power service. That company will also establish additional services to those which it is now conducting from Australia with New Guinea and with some of the important islands in the vicinity of Australia.

Broadcasting Developments in India.

Manufacturers of wireless receiving apparatus in this country will learn with interest that the Indian Government has decided to permit PRIVATE ENTERPRISE TO UNDERTAKE BROADCASTING by wireless in British India and Burma upon similar lines to those obtaining in the United Kingdom. It is proposed to ascertain whether similar arrangements could be made in India to form a company open to both British and Indian manufacturers of receiving apparatus. The Government are accordingly convening a conference to be held at Delhi on March 7th, under the presidency of the Director-General of Posts and Telegraphs, to discuss preliminary details, and manufacturers and others who desire to undertake broadcasting are invited to attend. The Government is also issuing a draft form of licence.

To-night's Trans-Atlantic Concert.

To-night (Friday) the initial attempt is to be made to BROADCAST A COMPLETE CONCERT from America to Europe. The attempt is being made by the Bamberger Broadcasting Station (WOR) of Newark, New Jersey, and will commence at midnight, New York time. The entire programme will be given by the American soprano, Miss Edith Bennett, who will sing in Italian, French, and English. American wireless engineers are positive that Miss Bennett's singing will be plainly audible throughout Europe.

Broadcasting a Debate.

A new departure in broadcasting was made last night (Thursday), the London Station sending out the DEBATE ON " COMMUNISM," between Sir Ernest Benn and Mr. J. Walton Newbold at the Kingsway Hall. The debate was arranged by the Industrial League and Council.

Business Items.

F. E. WOOTTEN, LTD., High Street, Oxford, have joined the British Broadcasting Co., and intend to manufacture their own wireless sets.

The BERKSHIRE RUBBER CO., of Maidenhead, have removed their wholesale and retail electrical business from 75, King Street, to 51, Queen Street.

Attention is drawn by the BRITISH MANNESMANN TUBE CO. to the fact that their address is now G.P.O. Box 272, 67 Queen Victoria Street, London, E.C.4.

AMOR AND EAST, electrical engineers, have opened new premises at 84, King Street, Maidenhead, for the maintenance and repair of automobile electrical apparatus.

Following the recent fire at his premises, Mr. A. W. S. Sanderson, proprietor of the ALTRINCHAM RUBBER CO., has taken new premises at 2 and 4, Kingsway, Altrincham, where he is carrying on business as usual.

Mr. A. HINDERLICH has now moved into new premises at 1, Lechmere Road, London, N.W.2, where he will hold a complete range of wrought copper cable soldering sockets, copper wire in all coverings between 20 and 50 S.W.G., and wireless crystals in lump form and cut to size. He will continue the rewinding of telephone receivers and similar instrument repair work.

Leave was granted on February 5th to AMEND PATENT APPLICATION No. 11901, of 1922, by W. J. Cole for " Electric Condensers " so as to include the Telegraph Condenser Co., Ltd., and Joseph Arthur Lovel Dearlove, of 4, Great Winchester Street, London, as applicants.

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Companies' Meetings, Reports, etc.

MIRRLEES WATSON CO.—Dividend of 10 per cent., less tax, for 1922.

LIVERPOOL OVERHEAD RAILWAY CO.—Dividend recommended of 5 per cent. on the preference shares for the year.

TELEGRAPH CONSTRUCTION AND MAINTENANCE CO.—Final dividend proposed of 7½ per cent., free of tax, making 10 per cent. for the year.

ST. MAURICE POWER CO.—Aldred and Co. intimate that their offer of £200 000 6½ per cent. debenture stock was largely oversubscribed.

MATHER AND PLATT.—Final dividend of 7 per cent., making 10 per cent. in all, and, in addition, a bonus of 5 per cent., all free of tax; £200 000 to reserve, £174 953 forward.

LANCASHIRE UNITED TRAMWAYS.—Interest at the rate of 2½ per cent., less tax, is to be paid on the second mortgage debenture stock for 1922. £230 is carried to depreciation account.

MERSEY RAILWAY CO.—Dividend proposed of 2 per cent. on the three per cent. perpetual preference stock, placing £6 000 to depreciation and renewal fund and carrying £1 798 forward.

FULLER'S UNITED ELECTRIC WORKS.—An issue of £80 000 6 per cent. first mortgage debenture stock is being offered at par to preference shareholders and noteholders in the company.

UXBRIDGE AND DISTRICT ELECTRIC SUPPLY CO.—Dividend proposed at the rate of 8 per cent. on the ordinary shares, placing £19 000 to the depreciation fund and carrying £692 forward.

TISBURY ELECTRIC SUPPLY CO.—The profit for eleven months to December 31st was £73 16s. 6d., of which £67 7s. is written off from the preliminary expenses and £6 9s. 6d. carried forward.

CALCUTTA ELECTRIC SUPPLY CORPORATION.—Dividend of 6d. per share net (i.e., at the rate of 5 per cent. per annum) on the £ cumulative preference shares for the half year ended December 31st.

London Underground Railway Figures.

Dividends declared by London underground railway companies appeared in this column last week. Further figures as to receipt are now available.

The METROPOLITAN DISTRICT RAILWAY CO. reports a total net income for 1922 of £725 219, an increase of £62 665 on 1921. After adding £60 550 brought forward, and deducting interest, rentals, and other fixed charges, a sum of £85 000 (against £65 000) is carried to reserve for contingencies and renewals. The dividend is 3 per cent. (as against 1 per cent.) on the ordinary stock for the year, and £77 075 is to be carried forward.

The total net income of the CITY AND SOUTH LONDON RAILWAY for 1922 amounted to £224 827, an increase of £44 960, to which is added £25 276 brought forward. A sum of £46 000 (against £36 000) is carried to reserve for contingencies and renewals, and £27 500 (against nil) to reserve for equalising the charge in respect of interest on 4½ per cent. second debenture stock. The dividend on the year for the consolidated ordinary stock is 4 per cent. (against 3½ per cent.), and the balance so be carried forward is £27 864.

Including rents, interest, etc. (£71 362), the total net income of the CENTRAL LONDON RAILWAY CO. for 1922 amounted to £271 692, an increase of £10 570, while £59 644 was brought forward. Interest, rentals, and other fixed charges require £46 325, and £69 000 (against £29 000) is placed to reserve for contingencies and renewals. The dividend for the year on the ordinary stock is 4 per cent. (the same), on the preferred ordinary stock 4 per cent. (the same), and on the deferred ordinary stock 4 per cent. (the same), and a balance of £74 411 is carried forward.

The accounts of the LONDON ELECTRIC RAILWAY CO. for 1922 show a total net income of £978 668, an increase of £170 625. Interest, rentals, and fixed charge absorb £299 505, a sum of £90 000 (against £65 000) is placed to reserve for contingencies and renewals, and £55 000 (against nil) to reserve for equalising the charge in respect of interest on 4½ per cent. second debenture stock. The dividend for the year on the ordinary shares of 4 per cent. compares with 3½ per cent. for 1921, and the balance to be carried forward of £73 842 compares with £39 744 brought in.

London Supply Companies' Dividends.

SOUTH LONDON ELECTRIC SUPPLY CORPORATION.—Final dividend on the ordinary shares at the rate of 15 per cent. per annum, less tax, for the half-year ended December 31, making 10 per cent. for the year (against 7 per cent.), and in addition a bonus of 1 per cent. (against nil).

KENSINGTON AND KNIGHTSBRIDGE ELECTRIC LIGHTING CO.—Dividend recommended at the rate of 14 per cent. per annum, making 12 per cent. for the year on the ordinary shares. £12 113 is carried forward. The available net profit for 1922 was £26 199, compared with £18 147 in 1921.

METROPOLITAN ELECTRIC SUPPLY CO.—Final dividend of 6s. per share, making 8½ per cent. (against 7 per cent.) for the year ended December 31. A sum of £120 000 has been transferred to the depreciation and reserve account (against £94 893), and £6 758 is carried forward (against £3 608).

WESTMINSTER ELECTRIC SUPPLY CORPORATION.—The net profit for 1922 was £67 505, after providing for sinking funds and reserves, and £65 035 was brought forward. A final dividend on the ordinary shares of 7s. 6d. per share is proposed, making 12 per cent. for the year, and carrying forward £17 116.

SOUTH METROPOLITAN ELECTRIC LIGHT AND POWER CO.—There is a total of £165 222 available. A dividend is recommended of 10 per cent. less tax, on the ordinary shares. £55 000 is placed to reserve, £25 000 to depreciation fund, £10 000 to employees' benefit fund, and £28 843 is carried forward.

LONDON ELECTRIC SUPPLY CORPORATION.—As announced last week, a dividend of 10 per cent. is proposed. Details of the account are as follows: Profit for 1922, £150 199 against £102 286 in 1921. The total available is £62 978. Debenture interest absorbs £16 580, reserve £15 000, depreciation £20 000, contingencies £5 000, and £22 652 is carried forward.

COUNTY OF LONDON ELECTRIC SUPPLY CO.—Final dividend on the ordinary shares at the rate of 14 per cent. per annum, making 10 per cent. for the year, compared with 8 per cent. for 1921. The profit, after paying interest charges, is about £457 000, compared with £277 817. Carry forward is about £42 000, an increase of £20 000, and this is after providing £312 500 for reserves, as against £180 000 for 1921.

New Companies.

DOLYWERN AND DISTRICT ELECTRICITY SUPPLY CO., LTD.—Private. Reg. Feb. 14th. Cap., £1 000 in £1 shares. To carry on the business as indicated by the title. Reg. office: Gwern-y-Glyn Dolywern, Denbigh.

FORUM AND CO., LTD.—Private. Reg. Feb. 14. Cap., £5 000 in £1 shares. Manufacturers, and assemblers of, concessionaires for and dealers in scientific instruments, electrical accessories, mechanical, illuminating, advertising, telephonic, telegraphic, aerial, wireless, and other apparatus, etc. Reg. office: Sydenham Buildings, 7 and 9, Pershore Street, Birmingham.

BLOOM'S (WIRELESS), LTD.—Private. Reg. Feb. 13th. Cap., £100 in £1 shares. Radiographic, telegraphic, telephonic, electrical and general engineers, suppliers and distributors of electricity and electrical energy, manufacturers of and dealers in all apparatus and appliances, including installations for wireless or any method of communication, etc. W. A. Zabell, 11, Queen Victoria Street, E.C.4, solicitor, is a subscriber.

RHEOSTATIC CO., LTD.—Private. Reg. Feb. 14th. Cap., £12 000 in £1 shares. To acquire the business of electrical engineers carried on by L. Satchwell and D. H. John, at Slough, Bucks, as the "Rheostatic Co.," and the inventions, letters patent, and patent rights of the said L. Satchwell, and to carry on the business of sheet metal workers, electricians, electrical and mechanical engineers, suppliers of electricity, etc. Reg. office: Buckingham Avenue, Trading Estate, Slough.

Yorkshire Electric Power Co.

Strong Position Indicated at Annual Meeting.

The twenty-first annual meeting of the Yorkshire Electric Power Co. was held at the Hotel Metropole, Leeds, on Tuesday. Mr. Arthur G. Lupton (the chairman) presided over a large attendance of shareholders and, in moving the adoption of the report and statement of accounts, said the accounts showed a net profit of £101 003, as against £74 316 in 1921—a substantial increase. The directors recommended the same dividend of 8 per cent. and increases in the general reserve fund and in the carry-forward, which was possible after providing for dividend on preference capital issued a year ago. The commitments and contemplated extensions made it necessary to apply for an increase of capital, which by the Act obtained in 1901 was limited to £2 000 000. Less than £400 000 of the original sum remained to be issued, and the Act obtained in 1922 authorises the issue of preference and ordinary capital up to £4 000 000 and to borrow up to one-third that amount. The Act also provided for conversion of the capital into £1 shares. An issue of £190 000 of 5½ per cent. debenture stock had been made, and the preference capital had been increased to £830 000. It was satisfactory to know that to-day the three classes of the company's securities stood above par on the market. The revenue was slightly less owing to reductions in the price of electricity, but there had been a substantial increase of about 43 per cent. in the amount of electricity sold.

The company was now supplying over a large part of the area, and the increased demands were an index of improvement in trade. The most satisfactory feature was the large decrease in costs due to substantial reductions in the price of coal, to the use of larger and more efficient plant, and to economies from the larger output. A new 12 500 kW turbo-alternator was now nearing completion at Thornhill, which should enable further economies to be effected. The expenditure on works was now over £2 000 000, and the company had 506 miles of underground and overhead mains and 208 sub-stations. Supply was available in 90 districts, and the mains of the company were being carried into the new Doncaster coalfield. The continued growth in demand would, it was anticipated, considerably increase the revenue.

Mr. A. H. Meysey-Thompson seconded the report and the accounts were adopted, and dividends of 8 per cent. on the preference shares declared, of which 3 per cent. on each class of share was paid in August, 1922. £25 000 was added to the general reserve fund, against £15 000 last year, and £265 384 was carried forward.

Messrs. Robert Geoffrey Ellis, M.P., Walter Geoffrey Jackson, George Herbert Peake, and Reginald William Wickham were re-elected directors, and Mr. L. L. Samuels was re-appointed as auditor.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inabi ity to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

DUNN AND CO. (CHELTENHAM), LTD., electrical engineers. £10 15s. 8d. December 30th.

ELCO ELECTRICAL MANUFACTURING CO., LTD., 59-61, Upper Maudlin Street, Bristol, electrical engineers. £10 14s. 10d. January 9th.

FERGUSON (WM. J.) (REDDITCH), LTD., 15, Market Place, Redditch, electrical engineers. £23 8s. 10d. January 10th.

MOUNTSTEPHEN, SPRINGHAM AND CO., 8A, Clarence Street, Richmond, electrical engineers. £17 17s. 5d. January 9th.

WOOD, H. L., AND SON, 2, Palmerston Arcade, Southsea, electrical engineers. £19 5s. 9d. January 9th.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

CONCORDIA ELECTRIC WIRE CO., LTD., Burton-on-Trent. Registered January 31st, £25 000 debenture, to H. S. Fellows, 16, High Street, Burton-on-Trent, and another; general charge (except certain freehold properties). *Nil. July 25th, 1922.

HOWARD ELECTRICAL CO., LTD., Nottingham. Registered January 29th, £1 500 debenture, to Branch Nominees, Ltd., 15, Bishopsgate, E.C.; general charge. *£3 000 mortgage. September 12th, 1921.

PALMER, RILEY AND CO., LTD., Accrington, electrical manufacturers. Registered February 3rd, mortgage, etc., securing £900, to O. Clegg, 93, Dowry Street, Accrington, butcher; charged on 90 and 94, Abbey Street, Accrington, with fixtures, etc. *——. March 10th, 1922.

WOKING ELECTRIC SUPPLY CO., LTD. Registered January 30th, £600 debentures, part of amount already registered; charged on hereditaments, etc., as specified in Trust Deed, also general charge. *£64 170. March 4th, 1922.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Bankruptcy Information.

CHECKLEY, Herbert Edmund, 20, West Street, Morecambe, in the county of Lancaster, electrician. Receiving order, February 16th. Debtor's petition.

RUSSELL, Reginald William, 30, King Street, electrical engineer. Receiving order, February 17th. Debtor's petition.

SATTERTHWAITE, Albert (trading as GREGSON AND CO.), 22, Dutton Street, Liverpool, electrical engineer. First meeting, February 27th, 11.30 a.m., Offices of the Official Receiver, 11, Dale Street, Liverpool. Public examination, March 13th, 10.30 a.m., Court House, Government Buildings, Victoria Street, Liverpool.

SEDDON, Leonard, lately at 276a, Buxton Road, Stockport, as THE ELECTRICAL ENGINEERING CO. First meeting, February 27th, 3 p.m., Official Receiver's Offices, Byrom Street, Manchester. Public examination, March 13th, 10.30 a.m., Court House, Vernon Street, Stockport.

Notice of Dividend.

MAGSON, Reginald Silver, 10, Stoney Stanton Road, Coventry, as R. S. MAGSON AND CO., electrical engineer. First dividend of 5s. per £, payable February 22nd, Official Receiver's Office, 9-11, High Street, Coventry.

Notices of Intended Dividends.

BAKEWELL, John, 43, Waterside Road, Barton-on-Humber, Lincolnshire, electric light and power engineer. Last day for receiving proofs, March 3rd. Trustee, J. F. Wintringham, St. Mary's Chambers, Great Grimsby.

TRUELOVE, Harold (trading as H. TRUELOVE AND CO.), 19, Shepley Street, Stalybridge, in the county of Chester, electrical engineer. Last day for receiving proofs, March 3rd. Trustee, J. G. Gibson, Official Receiver, Byrom Street, Manchester.

Partnerships Dissolved.

McGREGOR AND JOHNSON (William Donald McGREGOR and Edmund James JOHNSON), electrical engineers, 149, Brighton Street, Wallasey, by mutual consent as and from February 5th, 1923. Debts received and paid by W. D. McGregor.

SECCOMBE AND SQUIRE (Raleigh Frederick Main SECCOMBE and Major SQUIRE), electrical engineers, 202, Manningham Lane, Bradford, by mutual consent. Debts received and paid by Major Squire.

Bankruptcy Proceedings.

EMBURY, Henry John William, and EMBURY, Kenneth Stuart, trading as H. AND K. EMBURY, 110, Queen Street, and 29, Queen Street, both Newton Abbot, Devonshire, electrical engineers. The public examination of these debtors was held last week at the Castle, Exeter. The statement of affairs showed liabilities of £4 684 and a deficiency of £1 194. Debtors attributed their failure to trade depression, depreciation in present value of stock, heavy capital outlay on electric light plant at Kingskerswell, and loss of £100 to £150 in providing water power machinery there, which proved useless owing to the dry season, law costs, over £150 on writs, etc., during the previous six months, and illness of partner for three months. Debtor K. S. Embury stated that his brother started the business in April, 1919, and debtor joined him in November with £50 capital, added to £160 of his brother's. In May, 1921, they started providing electric light for Kingskerswell, and the poles, wires, and plant were erected at a cost of between £2 500 and £2 800. They also had a shop at Totnes which was unsuccessful and was closed two years ago. Debtor said he believed they paid their way in 1921, but in 1922 they lost considerably owing to depreciations. They became aware of their position in December last. The examination was closed.

SOUTH, Harry, electrical engineer, 43, Rathbone Place, Oxford Street, W., and late of 10/12, Garrick Street, W.C. This debtor, who was adjudged bankrupt in April, 1903, applied at the London Bankruptcy Court on Tuesday for his discharge. The Official Receiver reported that the proofs of debt and probable claims amounted to £1 413. The assets were valued by the debtor at £35, but had realised nothing. He began business as an electrical engineer in 1884. Five years later he took the premises at 10/12, Garrick Street, where he traded until 1899, when he transferred the business to a company called Harry Smith and Co. (Ltd.), formed with a nominal capital of £10,000 for that purpose. He acted as a director until the company went into liquidation in December, 1901. The debtor mainly attributed his failure to depreciation of shares in the company and to liability for the costs of an action. The Official Receiver opposed the application on the grounds that the debtor's assets were not of a value equal to 10s. in the £ and that he had contributed to his bankruptcy by rash and hazardous speculations. Mr. Registrar Mellor granted the debtor an immediate discharge subject to his satisfying a judgment for £5.

Prices of Metals, Chemicals, etc.

TUESDAY, February 20.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£72 10 0	£2 10s.	—
Electro Wirebars ..	,,	£76 0 0	£3	—
H.C. Wire, basis ..	per lb.	10 11/16d.	1/8d.	—
Sheet	,,	10 3/4d.	1/4d.	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2 11/16d.	3/8d.	—
Brass 60/40—				
Rod, basis	,,	7d.	—	—
Sheet, basis ..	,,	0 3/8d.	—	—
Wire, basis	,,	10 1/2d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£5 12 6	2s. 6d.	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£18 10 0	—	—
Lead Pig—				
English	,,	£29 10 0	—	—
Foreign or Colonial	,,	£28 5 0	—	2s. 6d.
Tin—				
Ingot	,,	£193 5 0	£7	—
Wire, basis	per lb.	2s. 6 3/8d.	1/8d.	—
Aluminium Ingots ..	per ton	£100 0 0	—	—
Spelter	,,	£35 15 0	12s. 6d.	—
Mercury	per bottle	£10 2 6	—	2s. 6d.

Sulphur (Flowers)—Ton £9 *Sodium Chlorate*—Per lb. 2 3/4d.
,, (Roll-Brimstone)—,, £8 10s. *Sulphuric Acid* (Pyrites, 168°) per ton, £7 10s.
Copper Sulphate— ,, £26
Boric Acid (Crystals). ,, £55 *Sodium Bichromate*.—Per lb. 4 1/2d
Rubber.—Para fine, 1s. 5d.; plantation 1st latex, 1s. 5 3/4d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Company.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

188 709 S. G. BROWN. Electric transmission or reproduction of sound. (9/7/21.)
188 714 P. GRANT (R. F. ZIMMERMANN). Electric heating-devices. (12/7/21.)
188 718 SIEMENS BROS. & Co. and D. A. CHRISTIAN. Circuit arrangements for automatic or semi-automatic telephone systems. (14/7/21.)
167 505 SIEMENS-SCHUCKERTWERKE GES. Regulation of asynchronous dynamo-electric machines. (7/8/20.)
188 744 TELEPHONE MANUFACTURING Co. and R. L. MURRAY. Mine-rescue telephone apparatus. (11/8/21.)
188 757 S. COXON and F. M. SOULSBY. Shade carriers for lamp holders. (15/8/21.)
188 763 L. DE FOREST. Sound transmitters and reproducers. (16/8/21.)
188 768 BRITISH POWER RAILWAY SIGNAL Co. and H. E. COX. Connecting conductors to railway rails. (16/8/21.)
188 769 EVERSHED & VIGNOLES and J. C. NEEDHAM. Magnetic detents for revolution counters. (16/8/21.)
188 771 W. H. HIGGS. Means for increasing sound transmitted by telephone instruments. (16/8/21.)
188 775 E. J. DAVIS. Testing magnetos, sparking-blocks, and the like. (17/8/21.)
188 789 W. E. M. AYRES. Windings for electrical machines. (18/8/21.)
188 792 G. E. WEBB. Dimming electric lamps of automobiles. (19/8/21.)
169 150 O. H. and A. F. PIEPER. Apparatus for projecting light and other electro-magnetic radiation. (15/9/20.)
188 795 J. T. IRWIN and A. RUSHTON. Automatic excitation regulator for electrical machines. (20/8/21.)
188 797 METROPOLITAN-VICKERS ELECTRICAL Co. and G. A. CHEETHAM. Electric meters. (20/8/21.)
188 814 POWDERED FUEL PLANT Co. and J. S. ATKINSON. Magnetic separators. (25/8/21.)
174 320 FELTEN & GUILLEAUME CARLSWERK A.-G. Self-induction coil pair for telephone lines. (17/1/21.)
188 815 GENERAL ELECTRIC Co., LTD. (PATENT-TREUHAND-GES. FUR ELECTRISCHE GLUHLAMPEN). Transforming crystal structure of wires and filaments. (25/8/21.)
188 819 BRITISH THOMSON-HOUSTON Co. and H. W. TAYLOR. Cooling and ventilating electrical machines. (26/8/21.)
188 820 NORWEST ELECTRICAL MANUFACTURING Co. and C. W. McDOWALL. Switch fuses. (27/8/21.)
188 823 GENERAL ELECTRIC Co. LTD., and C. G. EDEN. Holders for thermionic valves. (30/8/21.)
188 824 CUTTING AND WELDING Co., W. H. FLOOD and D. T. SMOUT. A.C. Electrodes for welding, cutting, etc. (31/8/21.)
188 827 AUTOMATIC TELEPHONE MANUFACTURING Co. (AUTOMATIC ELECTRIC Co.) Telephone systems. (1/9/21.)
188 834 VICKERS, LTD., and J. ETCHELLS. Electro-magnetic regulation or control of electrical machines. (8/9/21.)
188 843 W. PRESTON and W. HORTON. Lead terminals. (19/9/21.) (Cognate Application, 16 839/22.)

APPLICATIONS FOR PATENTS.

February 5, 1923.

3 307 G. A. DAUBNEY and E. D. FRENCH. Aerial tuning condensers.
3 312 A. M. TAYLOR. Electric power transmission.
3 335 E. MARRE. Multiple contact panels for luminous signboards. (4/2/22 France.)
3 350 A. G. KENT-JOHNSTON. Electrically igniting gas jets.
3 353 O. S. PUCKLE. Electronic valves.
3 368 E. R. BARTRUM. Variable resistances.
3 370 SANDYCROFT, LTD., and L. J. HUNT. Multi-speed induction motors.
3 380 F. J. EMPSON. Resonators for telephones, etc.
3 389 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Starting a.c. motors.
3 414 METROPOLITAN-VICKERS ELECTRICAL Co. (WESTINGHOUSE ELECTRIC AND MFG. Co.). Lighting arresters.
3 416 H. J. ROUND. Means for reproducing sound.
3 417 H. J. ROUND and P. W. WILLANS. Thermionic valve circuits.
3 426 T. GRAHAM-FARISH. Inductances.
3 427 ROTAX MOTOR ACCESSORIES, LTD., and J. T. KEIGHTLEY. Switches.
3 437 G. H. JACKSON. Automatic telephone exchanges. (9/2/22 Sweden.)

February 6, 1923.

3 464 W. AITKEN. Automatic telephone switching.
3 465 P. A. McCARRY. Disconnecting undesired coils or circuits.
3 496 W. J. RICKETS. Adjustment of grid potential in thermionic apparatus.
3 511 T. ARMITAGE. Accumulators.
3 516 G. KJAER. Suspension of electric lines. (11/2/22 Denmark.)
3 519 F. G. YOUNG. Belting for driving dynamos, etc.
3 525 BRITISH THOMSON-HOUSTON Co. Electric discharge indicators. (11/2/22 U.S.)
3 527 FORGES ET ATELIERS DE CONSTRUCTIONS ELECTRIQUES JEUMONT. Device for rupturing electric arcs. (28/2/22 Belgium.)
3 528 ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI. Stators for electric machines. (9/5/22 Belgium.)
3 540 H. HOPKINS. Magneto and plug tester.
3 550 GAMEWELL FIRE ALARM Co. Storage batteries. (15/4/22 U.S.)
3 558 G. L. WARD, T. N. COLE and R. P. RICHARDSON. Wireless telegraph receiving apparatus.
3 563 J. B. BOWER. Rectifiers for alternating current.
3 564 H. ST. G. ANSON. Magnifying intermittent electric impulses.

February 7, 1923.

3 587 E. R. BATTS. Wireless loud-speaking telephone.
3 591 B. S. HORNBY. Method of transmitting multiple a.c. through separate cables for each phase.
3 617 J. SCHUIL. Fusible contacts for electric circuits.
3 624 JACKSON BOILERS, LTD., and H. HARGREAVES. Electrically heated water boilers.
3 652 C. G. MILLAR. Detachable handles for wireless apparatus, etc.
3 653 H. W. HALL and A. G. KENT-JOHNSON. Completing and breaking electric circuit.
3 654 E. V. HAYES-GRATZE. Electric illuminating devices.
3 655 E. V. HAYES-GRATZE. Luminous electric signs, etc.
3 661 M. W. W. MACKIE. Dynamos and motors.
3 663 J. R. QUAIN. Electric heating apparatus.
3 664 A. REYROLLE AND Co. and F. COATES. Lightning, etc., arresters for electric conductors.
3 668 A. T. JONES and F. A. PEREIRA. Wireless receiving apparatus.
3 673 L. W. HUGHES. Permutation lock for electric globes, etc.
3 675 R. M. ABRAHAM. Crystal detectors.
3 679 MUIRHEAD AND Co. and E. S. HEURTLEY. Submarine cables.
3 683 G. J. BROWN. Burglar or fire alarms.
3 684 P. HOLMES. Couplings of transmission mechanism for magnetos.
3 699 A. C. GREENE. Couplings for connecting aerials to radio apparatus.
3 700 BRUSH ELECTRICAL ENGINEERING Co. Securing turbine blades.
3 708 G. C. BEDDINGTON. Telephone receivers, relays, etc.
3 721 CAMBRIDGE AND PAUL INSTRUMENT Co. and SIR H. DARWIN. Method of recording speed, etc.
3 725 P. V. CASTELL-EVANS and L. M. LONGE. Receiving filaments of thermionic valves.
3 729 W. MAURICE. Portable lamps.
3 730 H. CAEN. Telegraphy and telephony.

February 8, 1923.

3 750 W. H. HUNTER. Tuning coils for wireless telegraphy, etc.
3 760 E. E. FOURNIER D'ALBE. Apparatus for obtaining steady current from lighting circuits.
3 773 J. R. OLIVER and J. E. STOTT. Electrically-driven trucks.
3 789 E. A. ASHCROFT. Electrolyzing fused salts of metal and recovering metals and acid radicles.
3 790 E. V. HAYES-GRATZE. Vacuum tubes for advertising.
3 796 H. BOOTH. Wireless telegraphy, etc.
3 798 NEW ELECTRIC SIGN Co. Illuminated display devices.
3 800 M. MACFARLANE. Portable vapour burner incandescent lamps.
3 806 ELECTRO-DYNAMIC CONSTRUCTION Co. and N. PENSABENE. A.C. commutator motors.
3 807 C. R. BELLING and C. L. ARNOLD. Pins for electric plug connectors, etc.
3 810 G. UNTERBERG. Magneto-electric ignition and lighting apparatus.
3 841 C. F. ELWELL, LTD., and K. WILSON. Control of wireless receiving apparatus.
3 844 A. HUGUENIN. Hydro-electric installations. (21/3/22 Switzerland.)

February 9, 1923.

3 852 G. A. SMITH. Electric lighting switches for road vehicles.
3 878 L. W. BURCHAM. Wireless amplifier switch and filament resistance.
3 879 E. A. KNAPP. Screen lock for block telegraph instrument.
3 880 B. A. PILKINGTON. Transmitters.
3 894 R. A. MACAULAY. Tumbler switches.
3 919 BETWINNINGS' and R. E. BESWICK. Holders for thermionic tubes, etc.
3 943 BRITISH THOMSON-HOUSTON Co. and R. C. CLINKER. Telephone receivers.
3 944 H. BARON (ALDENDORFF). Electro mechanical telephone systems.
3 945 BRITISH THOMSON-HOUSTON Co. (INTERNATIONAL G.E. Co.). Insulators.
3 946 F. M. VAN GELDERAN. Insulating cap for cable joints.
3 948 R. I. ATHERTON. Resistance switchboard for charging accumulators.
3 952 G. H. JACKSON. Automatic telephone exchanges. (9/2/22 Sweden.)

February 10, 1923.

3 989 J. R. D. BRIDGER. Attachment to acetylene burners for electric ignition.
4 018 A. E. SOUTHERTON. Receiving apparatus for wireless telegraphy, etc.
4 020 H. E. SIMPSON. Fixing attachments to mouthpieces of telephone transmitters.
4 023 WESTERN ELECTRIC Co. Telephone switching apparatus.
4 039 J. HETHERINGTON. Wireless apparatus.
4 040 V. KUIEBAKIN. Eliminating disturbance in wireless signals, etc.
4 051 R. M. RADIO, LTD., and H. R. RIVERS-MOORE. Supports for wireless aerials.
4 052 G. M. HOWARD. Incandescent lamp.
4 054 W. C. DAVEY. Wireless telegraph apparatus.

Arrangements for the Week.

FRIDAY, FEBRUARY 23rd (To-day).

ROENTGEN SOCIETY AND PHYSICAL SOCIETY.

3 *p.m.* At the Imperial College of Science, South Kensington, London. Joint meeting. Demonstrations. 5 p.m. Discussion on the "Measurement of X-Rays."

JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette entitled "Characteristics, Operation and Maintenance of Underground Cables," by Mr. A. J. Tracey.

EDINBURGH ELECTRICAL SOCIETY.

8 *p.m.* At Philosophical Institute, 4, Queen Street, Edinburgh. Lecture entitled "Faults on A.C. and D.C. Plants," by Mr. J. Thomson.

MONDAY, FEBRUARY 26th.

INSTITUTION OF ELECTRICAL ENGINEERS (NORTH-EASTERN CENTRE).

At Armstrong College, Newcastle-on-Tyne. Lecture on "Some Problems in High Speed Alternators and their Solution," by Mr. J. Rosen.

UNIVERSITY OF LONDON.

5.15 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Second of series of four lectures on "The Control of the Speed and Power Factor of Induction Motors," by Prof. Miles Walker.

INSTITUTION OF MECHANICAL ENGINEERS (GRADUATES' SECTION).

7 *p.m.* In the Hall of the Institution, Storey's Gate, London, S.W.1. Lecture on "Photo-Elastimetric Researches on Mechanical Engineering Problems," by Prof. E. G. Coker.

BRADFORD ENGINEERING SOCIETY.

7.30 *p.m.* At the Technical College, Bradford. Lecture entitled "Some Notes on Power Production," by Mr. A. Hugh Seabrook.

TUESDAY FEBRUARY 27th.

NATIONAL ASSOCIATION OF SUPERVISING ELECTRICIANS AND ASSOCIATION OF ENGINEERS-IN-CHARGE.

7 *p.m.* At St. Bride's Institute, Bride Lane, London, E.C.4. Joint Lecture on "Preparation of Estimates, Specifications and Contracts for Electrical Work," by Mr. W. E. Highfield, Mr. Alan Kirk and Capt. A. E. Penn.

INSTITUTION OF ELECTRICAL ENGINEERS (NORTH MIDLAND CENTRE).

7.15 *p.m.* At the Queen's Hotel, Leeds. Address by the President, Mr. F. Gill.

INSTITUTION OF CIVIL ENGINEERS, LEEDS.

7.30 *p.m.* At the Philosophical Hall, Leeds. Lecture on "Engineering Factory Organisation," by Sir Henry Fowler.

WEDNESDAY, FEBRUARY 28th.

ROYAL SOCIETY OF ARTS.

8 *p.m.* At John Street, Adelphi, London. Lecture on "Heat Resisting Glasses," by Prof. W. E. S. Turner.

THURSDAY, MARCH 1st.

ROYAL INSTITUTION.

3 *p.m.* At the Institution, Albemarle Street, London, W.1. Lecture on "Water Power of the Empire" (Lecture I.), by Mr. Theodore Stevens.

INSTITUTION OF ELECTRICAL ENGINEERS.

6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London. Ordinary meeting. Report presented on behalf of the British Electrical Research Association by Messrs. S. W. Malsom and E. Fawsett, on "Permissible Loading of British Standard Paper-Insulated Electric Cables."

CHELMSFORD ENGINEERING SOCIETY.

7 *p.m.* In the East Anglian Institute of Agriculture, Chelmsford. Lecture on "Combined Gas and Electricity Undertakings," by Mr. A. H. Seabrook.

FRIDAY, MARCH 2nd.

ELECTRICAL POWER ENGINEERS' ASSOCIATION (SOUTHERN DIVISION).

7 *p.m.* At the Institution of Electrical Engineers, Victoria Embankment, London. Lecture on "High Power Mercury Arc Rectifiers, with special reference to Traction Service," by Mr. R. L. Morrison.

JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette entitled "Glass-forming Machines," by Mr. C. Sixton.

BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION.

7.30 *p.m.* At Caxton Hall, Caxton Street, London, S.W.1. Salesmanship Conferences. Lecture on "The Industry, the Press, and the Public," by Mr. A. Gowans Whyte.

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CONTENTS.

Notes of the Week	213	E.P.E.A. Dinner	233
Induction Motor Design	215	Legal Intelligence	233
The Control of the Speed and Power Factor of Induction Motors. Illustrated	216	Municipal Contracts Going Abroad	233
The Institution of Electrical Engineers. Illustrated	220	Imperial Notes	233
Research and Industry. Illustrated	222	Foreign Notes	234
Power Circuit Interference with Telephone and Telegraph Lines	225	Parliamentary Intelligence	234
A 1 000 000 kVA Circuit Breaker. Illustrated	226	Electricity Supply	234
Advertising in the Engineering Press	227	Obituary	235
Standard Switches and Circuit Breakers	227	Personal Items	235
The Maintenance of Voltage on a D.C. Distribution System by Means of a Fully Automatic Substation	228	Tenders Invited and Accepted	235
Correspondence	228	Electric Traction	237
Mid-Lancashire Electricity District	229	Wireless News	237
Local Exhibitions	232	Stage Lighting	237
Old Finsburians and Old Centralians	232	Communism and Business	238
Ideal Home Exhibition	232	Companies' Meetings, Reports, etc.	238
Books Received	232	New Companies	239
British Science Guild	232	Business Items	239
N.A.S.E. Annual Meeting	232	Europe's New Economic Centre	240
North-Western Centre Annual Dinner	233	Institution Notes	240
		Commercial Intelligence	240
		Prices of Metals, Chemicals, etc.	241
		Patent Record	241
		Arrangements for the Week	242

Notes of the Week.

London Supply Statistics.

The layman glancing through the accounts of the London electricity supply companies for the year ended December 31st, 1922, may well wonder why those who speak for these bodies tune their song to such a mournful note. Is it because of the human need for sympathy that even the most prosperous feel from time to time, or is it merely habit? For in almost every case the figures that should increase have increased, the shareholders have obtained a larger return, output is expanding and prices are falling. We hope all these tendencies will continue, especially the last, and we hope also that the efforts for fresh business, by increasing the red corpuscular contents of the bodies concerned, will bring about a more optimistic frame of mind; and thereby generate fresh energy for further development. For the task is not yet done, and the object of all these companies should be to sell, and to continue to sell, more and more electricity.

Domestic Policy Justified.

The domestic policy of the Westminster Electric Supply Corporation has been justified by results. We are glad to see this undertaking are again reducing their prices, and have no doubt that further expansion will follow. In 1922 the gross receipts were £458 700 as against £437 100 in 1921, while expenses fell from £348 800 to £326 700. The kilowatt hours sold increased from 25 253 700 to 30 261 300, and the dividend on the ordinary shares from 10 to 12 per cent., the best showing since 1906. The contribution to reserve was trebled. The St. James's and Pall Mall Electric Light Co. furnish another example of the same tendency. The net profit increased from £31 200 to £45 800 and the ordinary dividend from 12 to 14·5 per cent. Revenue from sales increased from £244 200 to £268 900, and connections from 21 167 kW to 21 324 kW, the number of kilowatt hours sold being 15 826 507. We see that this increase is ascribed to the danger, disability and cost of gas, but if that is so, the movement can hardly be said to have become rapid. With a vigorous sales policy and cheap electricity the possibilities for the heating and cooking loads in the area served by the company are almost unlimited, and a large increase in revenue could be obtained with but a small rise in development charges for plant and mains. We recommend this policy to the attention of the directors, who already have a low price for lighting.

Low Coal Costs.

The London Electric Supply Corporation is distinguished from other London companies by the fact that it supplies a traction load. This, at least to some extent, explains the excellent showing of this concern, whose working profit increased from £102 300 in 1921, to £150 200 in 1922. The dividend on the ordinary shares has risen from 4 to 10 per cent. This prosperity is likely to increase rather than diminish with the traction developments that are foreshadowed, and makes a pleasing contrast with the state of affairs that existed in the early history of the company. Mr. G. W. Partridge and the other directors of the company are to be congratulated on the fruit of their careful management. The number of kilowatt hours sold increased by 4½ per cent. the 1921 figures being 47 490 802 kWh, and the results are ascribed to diminished generating expenses, particularly as regards coal and other fuel. In 1921 the coal costs were only 0·69d. per kWh sold, and the 1922 figures are 0·373d., a reduction of which the company may well be proud. Generally, the adjective prosperous may be given to the London companies, and we hope this will continue to be the case.

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Transatlantic Telephony.

By his lecture at the Institution of Electrical Engineers last week, Dr. H. W. Nicholls to some extent removed the self-denying ordinance which he had imposed upon himself and upon us not to publish more than the most meagre details of the method and apparatus employed in the Transatlantic wireless telephone experiments. Read in conjunction with the article which we published in The Electrician of January 19th last, the account which we publish on another page of this issue enables all those who are interested to understand exactly what the tests are for and how they are carried out. Research in this case is preceding practice; and it is obvious that that is the only right course. The enormous variation in signal strength at different times of the year and day makes the problem more difficult, and this difficulty is more economic than engineering. There seems no doubt that a Transatlantic telephone service could be established. The only question is at what cost. These tests should answer the question and open up interesting possibilities which we hope will be realised.

Research and Industry.

At this stage in the history of the electrical industry it should hardly be necessary to remind our readers of the importance to electrical development of systematised research. We do so for two reasons. One is that too many electrical engineers still remain "unseized" of the real necessity of constant work on the properties of the raw material we have to use and of constant investigation into the performance of the finished product into which those raw materials are made. The other is that two examples of successful research work which have recently been made available in the electrical industry show how unnecessary and how unwise it is that such heresy should longer persist. The first of these works is the Second Report on the Heating of Buried Cables, which was presented at the Institution of Electrical Engineers last night and with which we shall deal fully in our next issue. It will be sufficient to say here that it contains a mass of technical information which, properly applied, should lead to a cheapening of cable manufacture, the more efficient use of cables themselves and generally to a development in this important part of the electrical economy which should have the most beneficial effect on electrical progress.

G. E. C. Enterprise.

The second example is of the Research Laboratories of the General Electric Co., which were formally opened on Tuesday. The General Electric Co. has long recognised the need of that research which is the duty of individual concerns as apart from the industry as a whole. The well-built and excellently equipped department which we describe elsewhere in this issue should enable Mr. Clifford Paterson and his assistants to apply their imagination and their knowledge in the most efficient way. For in research, important though they are, buildings and equipment are but the dry bones of the business. Human brains and human endeavour are the life blood of such a concern and interest in the work the staff has to do is as essential as the work itself and as the results obtained. As Sir J. J. Thomson finely said at the opening ceremony: "The aspirations attached to research work are more than intellectual, they are almost spiritual." The enterprise of the Company has enabled ways and means to be placed at the disposal of the research staff. We feel sure the staff will respond to this trust and that the work performed will make the enterprise worth while.

Electricity in the Rubber Industry

The world's largest rubber factories are in America, where, according to the figures given by Mr. H. C. Young, in a Paper read before the Institution of Mechanical Engineers, one factory alone handles 500 tons of crude rubber a week. The special nature of the manufacturing processes raises interesting problems. One very serious matter is the prevalence of dust, which is not only liable to clog the machinery but may be prejudicial to the fine finished product. Accordingly, a vacuum cleaning system is practically essential. Dusty conditions also affect the lighting, which must be exceptionally good in view of the dark tint of the material handled. Avoidance of overhead shafting, etc., is obviously desirable, and this circumstance is favourable to the electric drive. From the fluctuating load-diagrams presented by the author for such processes as masticating, warming and extruding it is obvious that the requirements imposed on the motors must be severe. The choice of motor depends largely on the importance attached to power factor. If this is not of much consequence and low first cost is important the ordinary induction motor may be selected. Otherwise a corrected induction motor, a synchronous motor with damper windings for starting, or a synchronous induction motor should be used. The comparatively slow speed of the various milling operations makes the motor drive an important element in the equipment. The back line shaft speed in British and Continental mills may be as low as 56 revs. per min., and a reduction of 6 or 7 to 1 from the motor speed is necessary. In this country 95 per cent. of the mill drives are of the gear-reduction type. Data regarding energy requirements for various processes are given in the original paper, which shows considerable knowledge of the industry. Apparently the energy consumed per pound of rubber washed may range from about 0·01 to 0·06 kWh, according to the class of mill and material, and from 0·19 to 0·31 kWh per lb. of rubber masticated.

Electric Propulsion of Ships.

In a recent paper before the Liverpool Engineering Society, Mr. R. S. Johnson remarked that the electrical transmission of power on ships enables us to secure both the most efficient propeller speed and the best speed of the prime mover in relation to fuel economy. Years ago it was necessary to gear up the propeller. With the introduction of high speed reciprocating engines this became unnecessary. But with the introduction of turbines reduction gear again became essential. Experience with single reduction gearing has been fairly satisfactory, but there have been many failures with the double reduction gear with a ratio of 40 to 1, rendered necessary by modern high speed turbines. The severe strains to which the mechanism is subjected in a rough sea are liable to lead to trouble but with turbo-electric power transmission these difficulties are avoided. The over-all efficiency (91·7 per cent.) is substantially the same as that of single reduction gear, but is higher than that usual with double reduction (88 per cent.). In addition, reversing can be conveniently carried out electrically and the ease of control of the electric drive is a great advantage. In a case mentioned, a twin-screw installation of about 20 000 S.H.P., the turbo-electric machinery could be put in an engine room 6 ft. shorter than when reduction gearing was used, and space is everything on board ship.

The Diesel Electric Marine Drive.

The development of the Diesel-electric drive, which is particularly applicable to smaller vessels, should not be lost sight of. It compares favourably even with Diesel direct coupled machinery. With a direct Diesel drive the heavy starting torque on the engine has to be specially provided for in the design, and as the engines are directly coupled to the propellers they have to withstand severe shocks in bad weather. But with the Diesel-electric drive the engine can be designed without reference to the speed of propeller. As the engines run at high speed in one direction only, and are not directly coupled to the propeller, a high speed engine without any reversing gear can be adopted. The elaborate and complicated reversing gear necessary for Diesel direct drive is eliminated. According to a table presented by the author, the cost of the Diesel-electric drive is only slightly greater than that of other types. On the other hand, it is estimated that with the increased carrying capacity the additional cost could be written off

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in 18 months of ordinary service. At the present time it is considered that very high powers cannot be anticipated from Diesel engines. Power is definitely limited by temperature conditions in any oil engine. This difficulty might disappear if the internal combustion type of turbine becomes a reality. But for the time being the demands of high power large passenger vessels are best met by turbo-electric methods.

The Effect of Temperature on Engineering Materials.

In the address on "The Effect of Temperatures on the Properties of Engineering Materials," which he recently delivered to the Junior Institution of Engineers Prof. F. C. Lea once again emphasised the need for greater knowledge of the properties of those materials which are commonly used in engineering. There are two ways in which this knowledge can be obtained. Either one or more materials may be taken and tested under working conditions and the experience subsequently applied or the conditions that have to be met may first be determined and the materials subjected to tests which shall show their behaviour under those conditions. It is obvious that the latter is both more scientific and more economical, and Prof. Lea gives a number of instances where it has been successfully applied. That it should be employed when the effect of temperatures is being considered is of equal importance whether the material is being used or being worked. And a further knowledge of the properties of metals expressed in a quantitative as distinct from a qualitative way would avoid some of the troubles that not infrequently arise in the working of metals when hot. Prof. Lea expands his thesis with a number of interesting examples from his own experience. They should be studied not only by the junior engineer but by those whose chief responsibility is the production of a cheerful-looking balance-sheet.

Sulphation of Battery Plates.

An investigation has been undertaken by the Bureau of Standards to establish a speedy and accurate method for the measurement of the effect of impurities in storage battery electrolytes. As is well known, methods which have previously been used require considerable time, and accurate and consistent results are difficult to obtain. The new method is based upon successive weighings of the positive or negative plates while immersed in the solutions to be tested, which solutions are maintained at a constant temperature. The battery plates were immersed in the various electrolytes contained within a thermostat bath and so arranged that any plate could be brought to the arm of a sensitive balance for weighing. Weighings of the plates were made daily, and the results were computed as the increase in weight of the plate per hour. The results showed considerable differences in the rates of sulphation of plates made by various manufacturers, and marked differences in the rate of sulphation produced by different concentrations of the acid solution were demonstrated. Temperature also plays an important part in determining the rate of sulphation. Similar tests might be undertaken by battery makers in this country.

Supplying Hot Water Electrically.

As we have already announced, the competition for the "All-Electric House" is only one of a series, and we are already making arrangements for the second struggle, which will deal with the design of apparatus for hot water supply in the home. This will be more technical, more difficult, and perhaps also more interesting. Every electrical engineer believes, at least theoretically, in the future of electric cooking and room heating. But there are still some who honestly think that to supply hot water in the home by electrical means will never be economical. This is partly a question of price, with which we shall not deal in the competition, but it is largely a question of design and manufacture, and it is there that we seek the help of our readers. We are not pessimists, and we know that the electric hot water problem can be solved. Our second competition is going to do a great deal to assist that solution.

Induction Motor Design.

The method of inversion as applied to a.c. problems is not as well known as it should be by electrical engineering students. This is the more surprising as it is many years since Arnold, Bragstad and La Cour published a description of the method and applied it to circuits in which either the resistance or the reactance varies in a known manner. A very complete description of the method is to be found in "The Theory and Calculation of Electric Currents," by La Cour and Bragstad, and as this book has been translated into English by Dr. S. P. Smith, it is surprising that the method is not more commonly employed.

Uses of the Principle of Inversion.

There are many problems in connection with the control of the speed and power factor of induction motors, in the study of which it becomes desirable for the investigator to deduce his own circle diagrams or current locus diagrams. For such purposes as this the principle of inversion is of the greatest service. Even in cases where the figures to be inverted are not made up of straight lines or circles, the method may still be applied without any great labour, and the investigator is able to foresee what will be the effect of changing any of his constants much better than if he had only got before him an array of r's and of jx's.

It is therefore well that Prof. Miles Walker in the first lecture of a course on the "Control of the Speed and Power Factor of Induction Motors," which he is delivering before the University of London, and of which we give an account elsewhere in this issue, should have impressed upon his hearers the importance of the study of this matter and have given a short explanation of the principle in its application to induction motor problems.

Four Important Complex Constants.

Prof. Walker also did well to draw attention to another matter too often crowded out of the third year course in our universities, namely the use and proper appreciation of the four complex constants C_1, C_2, Y_o and Z_k of the general electric circuit. This matter is also well dealt with in the book above referred to, and we once again fail to understand why it is that these constants are not more generally employed in calculation unless it is that students will not take enough trouble to grasp in the first instance their real meaning.

The green and red pieces of twisted cardboard shown at the lecture should be of considerable assistance in aiding the student to visualise the definitions of these complex quantities, and as soon as their definition has been mastered and become familiar, their application in algebraic equations will be simple, and a very powerful aid to transformations that would be as difficult to see through as the answer to a simultaneous equation would be to think out if we were deprived of the symbolism of x and y.

Theory and Practice.

It is trite enough to say that in electrical engineering theory and high technology must go hand in hand with practical applications. But trite as it is it is not always recognised. Great knowledge of the theory of such a useful machine as the induction motor must lead also to a better utilisation of the materials used in its manufacture and ultimately to a reduction in its first cost. In this age of specialisation it is not to be expected, nor is it desirable, that the commercial engineer and the salesman should have theoretical details at his finger ends, nor is it necessary that the designer should be intimately concerned with selling campaigns. But a knowledge of the difficulties of the methods of working of each class are useful to the other class and from this point of view Prof. Miles Walker's lectures are worth general study. To the specialist they may be recommended as a successful attempt by an expert to deal with a complicated and important subject from a new point of view.

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The Control of the Speed and Power Factor of Induction Motors.

On February 21st Prof. MILES WALKER *delivered at the Institution of Electrical Engineers the first of a series of four lectures which have been arranged by the University of London on "The Control of the Speed and Power Factor of Induction Motors." These lectures have been arranged to supplement those on alternating current machinery given in the various colleges in London. In view of the importance of this matter and the method of the treatment of some of the problems, we propose dealing with these lectures at considerable length. The essential parts of the first lecture are given below.*

Lecture I.

Many induction motor problems can be tackled most easily by employing the principle of inversion as introduced by Bragstad* into alternating current work. This principle may be briefly stated as follows:

Preliminary Statement of Conventions Employed.

If an electrical current follows the law $i = I_0 \sin \omega t$ without lag or lead we may represent it by means of a thick horizontal line drawn from the origin to the right. The length of the

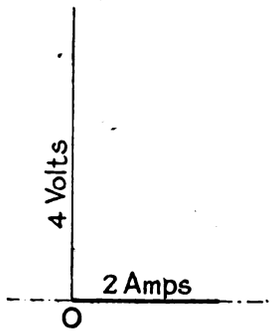

FIG. 1. SCALE 1 cm. = 1A
1 cm. = 1 V

vector represents to scale; the square root means square value of the current. For instance, in Fig. 1, the thick line represents 2 A. The vector is supposed to be rotating anti-clock wise and its projection on the vertical at an instant (multiplied by $\sqrt{2}$) gives the instantaneous value.

A voltage following the law $v = V_0 \sin \omega t$ is represented by a thin line drawn from the origin to the right. If the voltage follows the law $v = V_0 \cos \omega t$ it is represented by a line drawn upwards from the origin as in Fig. 1, which shows 4 V on this phase.

If a known current **I** is passed through a resistance of 2 O the voltage drop, 2**I** is in phase with **I** as in Fig. 2. If there is also an inductance L in the circuit there will be a reactive

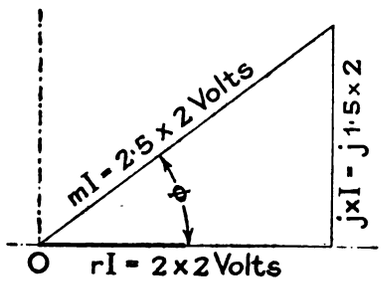

FIG. 2.

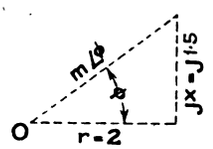

FIG. 3.
SCALE 1 cm. = 1 O

drop $\mathbf{I}\omega L = \mathbf{I}x$. The voltage to overcome this will be vertical as in Fig. 2 and in order to note the fact that it is vertical we use the symbol j and write $j\mathbf{I}x$.

Impedance Vectors.

It should be noted that vectors representing resistance and reactance and impedance are different in their nature from vectors representing current and e.m.f. The former are supposed to rotate, whereas the latter should properly be drawn in a separate figure which remains stationary. Fig. 3, for instance, represents a resistance of 2 O in series with the reactance $x = 2\pi fL = 1{\cdot}5$ O. The sum of the horizontal r and the vertical jx gives us the inclined vector $r + jx = \mathbf{Z}$ = the impedance. The vector $\mathbf{Z}$ has then the length $\sqrt{r^2+x^2}$ and its inclination is given by the angle $\varphi = \tan^{-1}\frac{x}{r}$. For many purposes it is convenient to express the impedance in the polar co-ordinates $\mathbf{Z} = m/\varphi$ where $m = \sqrt{r^2+x^2}$. To get the voltage from the current we multiply the current by m and turn it through the angle φ as in Fig. 2.

If instead of being given the value of the current we are given the voltage $v = V_0 \sin \omega t$, and we wish to find the current

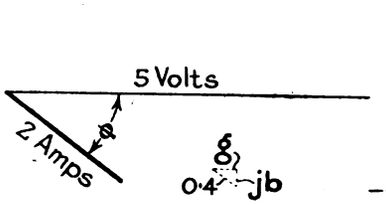

FIG. 4. SCALE 1 cm. = 1 mho
1 cm. = 1 V
1 cm. = 1 A

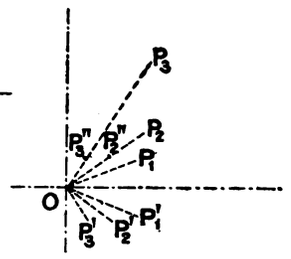

FIG. 5.

we divide by m and turn the vector backwards through the angle $-\varphi$ as in Fig. 4.

This leads us to the conception of the quantity called the admittance **Y** which may be written $\frac{1}{m}/-\varphi$. Admittance may also be expressed in its horizontal and vertical components

$$g + jb \text{ where } g = \frac{r}{r^2+x^2} \text{ and } b = \frac{-x}{r^2+x^2}$$

The Inversion of Geometrical Figures.

The principle of inversion as applied to alternating current problems arises from the relation which exists between the vector representing impedance and the vector representing the corresponding admittance. This is illustrated in Fig. 5. If the vector OP_1 is represented by a unit vector making a positive angle to the horizontal as shown in Fig. 5, the admittance is represented by a unit vector OP'_1 inclined at the same angle below the horizontal as shown in Fig. 5. If the vector OP'_2 represents a greater impedance inclined upwards at a greater angle, the corresponding admittance is a smaller vector OP'_2 inclined downwards at the same angle. Similarly if OP_3 is the impedance, OP'_3 is the admittance. The length of the admittance vector is the reciprocal of the length of the impedance vector and *vice versa*. If the admittances instead of being drawn below the horizontal had been drawn above the horizontal so as to lie in the same lines as the corresponding impedances the ends of the admittance vectors P''_3 and P''_2 would be the inverse points to the ends of the corresponding impedance vectors, the centre of inversion being the origin. Thus $OP \times OP' =$ a constant; in this case unity.

If, therefore, we are prepared for the moment to neglect the fact that the admittance should be on the opposite side of the horizontal line we may employ the principle of inversion directly to obtain the admittance from the impedance or the impedance from the admittance. This is a simplification of

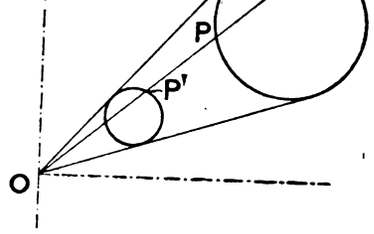

FIG. 6.

many problems because we can make use directly of certain propositions long recognised by the geometricians.

(1) The inverse of all the points lying on a circle lie on another circle. For instance, in Fig. 6, $OP \times OP' =$ a constant

* See in "The Theory and Calculation of Electric Circuits," by J. L. La Cour and O. S. Bragstad, translated by S. P. Smith, D.Sc. (Longmans.)

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for all points on the two circles. By changing the constant of inversion we can make the vector OP' of any length and alter the scale of the inverted figure to suit our convenience.

(2) The inverse of all the points lying on a straight line NM (Fig. 7) lie on a circle which passes through the origin. The centre of the circle lies on a line OQ at right angles to NM. The distance of the centre of the circle from the origin can be put anywhere we like on the line OQ by changing the constant of inversion. Thus $OP \times OP'$ measured in cm. in Fig. 7 is equal to 10 for all points on the line and circle.

Illustrations.

The following problems illustrate how the principle may be employed in simple cases.

Fig. 8 shows a resistance of 2 O in circuit with the permanent reactance 0·5 O and a reactance which varies between 0 and 2·5 O. In order to find the graph of the current when the reactance is varied between these limits we proceed as follows: Set off (Fig. 7) along the horizontal line, $OR = 2$ cm. to represent 2 O. Along the vertical line NM set off the length 0·5 and then in the same direction the points 1, 2, and 3 shown on the thicker line. The thick vertical line is the locus of the impedance of the circuit as x_2 is varied from 0·5 to 2·5. The next step is to invert the straight line NM and in doing so it is

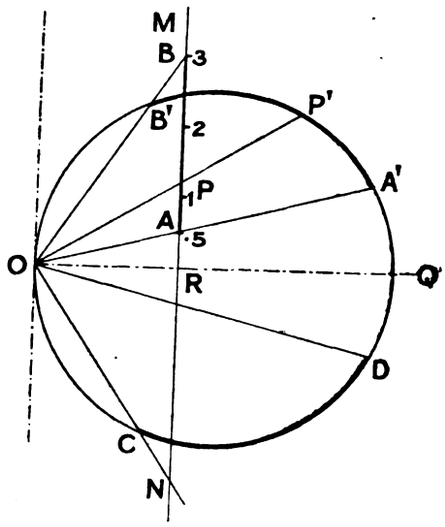

FIG. 7.

well to choose a scale which is convenient for the purpose of the problem. This is best done by fixing the diameter of the circle so that it will come on to the paper and at the same time choosing a scale large enough to be easily read for all the quantities with which we are concerned. OR represents 2 O, the reciprocal of 2 O is 0·5 mhos. We choose the scale 1 cm. equal to 0·1 mho in order that the diameter of the circle may be big enough. We then describe a circle having a diameter of 5 cm. on the line OR produced, the circumference passing through the origin. The inverse of the point A lies at A' and the inverse of the point B lies at B'. The arc $B'A'$ shown by the thicker curves gives the inverse of all the points represented by the variable reactance. Below the horizontal line is shown the arc CD, which is in the correct position for the locus of the admittance vectors.

To arrive at the locus of the current curve when we know that the voltage at the terminals follows the law $100 \times \sqrt{2} \sin \omega t$, we may set off the voltage to scale along the line OQ. The current locus is then the curve CD, the scale of amperes being $100 \times 0{\cdot}1 = 10$ A per cm. If the voltage were in any other phase we could set off the current vector at the correct angle to the voltage for any given reactance, the angle being obtained from the admittance diagram. Thus if the voltage follows a cosine law, we could turn Fig. 7 round through a right angle making OQ vertical. The current vectors would then be in the correct phase position with regard to the voltage.

Another example is worked out in Fig. 9. Here we are supposed to have a constant reactance of 0·5 O and a resistance that varies between 0·25 O and 2 O. The thick horizontal line gives the locus of the impedance vectors. The inverse of this line gives a circle whose diameter we can conveniently make 2 cms. because $\frac{1}{0{\cdot}5} = 2$. As before the black curve $B'A$ is the inverse of the straight black line, and CD is the reflection of $B'A'$, which gives the true position of the admittance locus to one scale and the current locus to another.

Inversion and Reinversion.

It sometimes happens that in a problem it is necessary to invert an impedance into an admittance, then add another admittance in parallel with it and then invert back into an

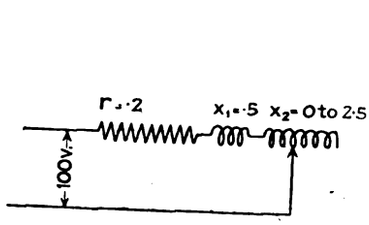

FIG. 8.

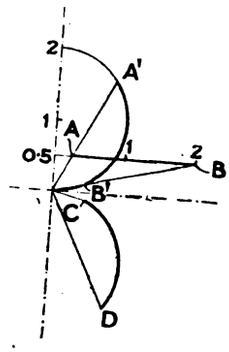

FIG. 9.

impedance; then add another impedance in series and then invert back again into an admittance. When these processes are being carried out it is not convenient to keep the impedances or admittances always on the right side of horizontal line. It is more convenient to keep to one side of the line. We can always remember that one or other of the quantities can be changed over to its correct side before we get to the final result. In what follows we shall draw the impedances on the wrong side of the horizontal line so that the admittances may come on their proper side without any trouble. This gives the final current graph in its correct position.

Deduction of the Circle Diagram of the Induction Motor.

The first step is to lay out the well-known combination of reactances and resistances which is equivalent in behaviour to an induction motor at various states of load. This can be most conveniently done as follows:—

SYMBOLS.

f_1 = frequency of supply and frequency of rotation of the field on a two-pole motor.

f_2 = frequency of rotation of a two-pole motor.

$f_1 - f_2$ = frequency of slip $= sf_1$.

$\frac{f_1 - f_2}{f_1} = s$ = the slip.

E_1 = volts generated in one phase of stator winding by rotation of flux.

$E_2 = sE_1$ = volts generated in one phase of the rotor winding. Ratio of transformation 1 : 1.

x_1 = reactance of one phase of stator winding due to magnetic leakage.

r_1 = resistance of one phase of stator winding.

$Z_1 = r_1 + jx_1$ = impedance of stator winding.

$Z_2 = r_2 + jsx_2$ = the corresponding quantities in the rotor winding, x_2 being taken at the frequency f_1.

jsx_2 = the reactance of the rotor winding when the slip is s.

The rotor current $I_2 = \frac{E_2}{Z_2} = \frac{sE_1}{Z_2} = I_{21}$. The stator acting like the primary of a transformer will supply a current I_{21} equal and opposite to I_2. Therefore, viewed from the stator the rotor impedance is $\frac{Z_2}{s} = \frac{r_2 + jsx_2}{s} = \frac{r_2}{s} + jx_2$.

As s decreases the apparent resistance $\frac{r_2}{s}$ increases. When $s = 0$, $\frac{r_2}{0}$ becomes infinite. $\frac{r_2}{s}$ may be regarded as consisting of two parts, r_2 which remains constant, and $r_2\left(\frac{1}{s} - 1\right)$ which varies between zero and infinity as s changes from 1 to 0.

On the other hand x_{21} the reactance of the rotor, viewed from the stator, appears to be constant. This is because the voltage driving the current in the rotor is always low when sx_2 is low and increases in proportion as sx_2 increases. The equivalent circuit of an induction motor is given in Fig. 10. Here—

$x_1 = 0{\cdot}8$ O $\qquad r_1 = 0{\cdot}09$ O.

$x_2 = 0{\cdot}8$ O $\qquad r_2 = 0{\cdot}09$ O.

Across the circuit is the admittance $g + jb = 0{\cdot}007 + j0{\cdot}06$. The voltage drives a current through this admittance equal to the no load current of the motor. The constants given

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above might belong to a 600 H.P. 3-phase 2 200 V motor, so that the voltage per phase is 1 270 and the short circuit current about 800 A. The no-load current is about 70 A.

Method of Inversion and Circle Diagram.

We can employ the method of inversion to deduce the circle diagram of the motor as follows :—

Begin with the part of the circuit on the right of Fig. 10 which represents the rotor circuit. Adopting the scale 1 cm = 0·1 O set off 8 cm from o to X downward from the horizontal line to represent the 0·8 O reactance, as shown in

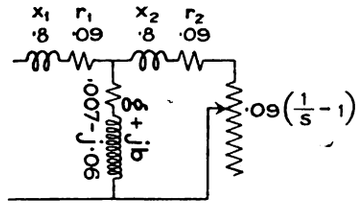

FIG. 10.

Fig. 11. This is put on the wrong side of the horizontal line so that the admittance may come on its proper side.

Set off XS_h to represent r_2 and produce the line indefinitely to represent $r_2\left(\frac{1}{s}-1\right)$. The dotted horizontal line marked Z_2 then gives us the locus of the rotor impedance viewed from the stator.

This must now be inverted to get the admittance graph, and some judgment must be exercised in the choice of the admittance scale. Taking the reciprocal of 0·8 we get 1·25 mhos as the diameter of the admittance circle. Putting 1 cm = 0·1 mho gives us a convenient diameter. This circle is marked y_2. Its centre is at M_1. The point that corresponds to the short circuit point S_h on the impedance line is the point S'_h on the admittance circle. The point corresponding to $s = O$ on the impedance line is at infinity and the inverse of it is at O on the y_2 circle.

We must now add the admittance $g+jb$ to every point of the y_2 circle. If this were done it would result in a new circle 6 mm. lower down and 0·7 mm. to the right. Instead of drawing this new circle it is easier to shift the origin from O to O'. By setting off a line 6 mm. above O to represent $-j'06$ and setting off a little line horizontal to the left 0·7 mm. to represent 0·007 mho we arrive at O'. With respect to O' the whole y_2 circle has been lowered by an amount corresponding to $0{\cdot}007 - j\,{\cdot}06$ and any radius vector drawn to the circle from O' gives the admittance of y_2 and the shunt circuit a taken in parallel.

Before we can add r_1+jx, it is necessary to invert the admittance circle y_2 so as to get the corresponding impedance graph. To do this we begin by drawing a line from O' through the centre M_1. This line cuts the y_2 circle in two points at about 0·6 c.m, and 13·1 cm. away representing about 0·06 mhos and 1·31 mhos respectively. The reciprocals of these give two impedances 16·6 and 0·77 respectively. These two impedances will be on the line $O'M_1$ and may be plotted to any convenient scale. The scale 1 cm. = 1 O is convenient in this case. Thus we get ends of the diameter of the dotted circle, Z_2+a_1. The inverse of the no-load point N' takes up the position N'' on the new circle, while the inverse of S_h' takes up the position S_h'' near to the origin.

Now we can add $r+jx$ by setting off 0·8 cm. upwards from O' and then a short horizontal line 0·09 cm. to the left giving us the position of a new origin O''.

Radii vectors drawn from this new origin to the dotted circle give us the impedances of the whole combined circuit. It is therefore only necessary to invert the dotted circle in order to get the admittance of the whole combination. To do this we must draw a line from O'' through the centre M_2 of the dotted circle. The intercepts of this line with the circumference represent 1·57 and 17·5 O respectively.

The reciprocals of these are 6·35 and 0·057 mhos respectively. A convenient scale to take is 1 cm. = 0·05 mho and thus we get the diameter of a new circle y_t which is the graph of the admittance of the total combination; O'' being now the origin. We therefore set off the voltage 1 270 to scale along the horizontal line through O''. The admittance circle y_t may now be used as the locus of the current vector, the scale being 1 cm. = 0·5 × 1 270 = 63·5 A. The no-load and short circuit point N''' and S_h''' are obtained by inverting and N'' and S_h'' respectively.

The method of inversion described in connection with Fig. 11 can only be carried out if we know the values of x, r, x_2 and r_2. More commonly the only data available are the test figures taken at no-load and on short circuit. It is therefore necessary to consider another equivalent circuit involving the constants of the motor presented in a rather different manner. These are the complex constants $\mathbf{C}_1 = C_1 \angle \psi_1$, $\mathbf{C}_2 = C_2 \angle \psi_2$, $\mathbf{Y}_0 = Y_0 \angle \varphi_0$ and $\mathbf{Z}_h = Z_h \angle \varphi_h$.

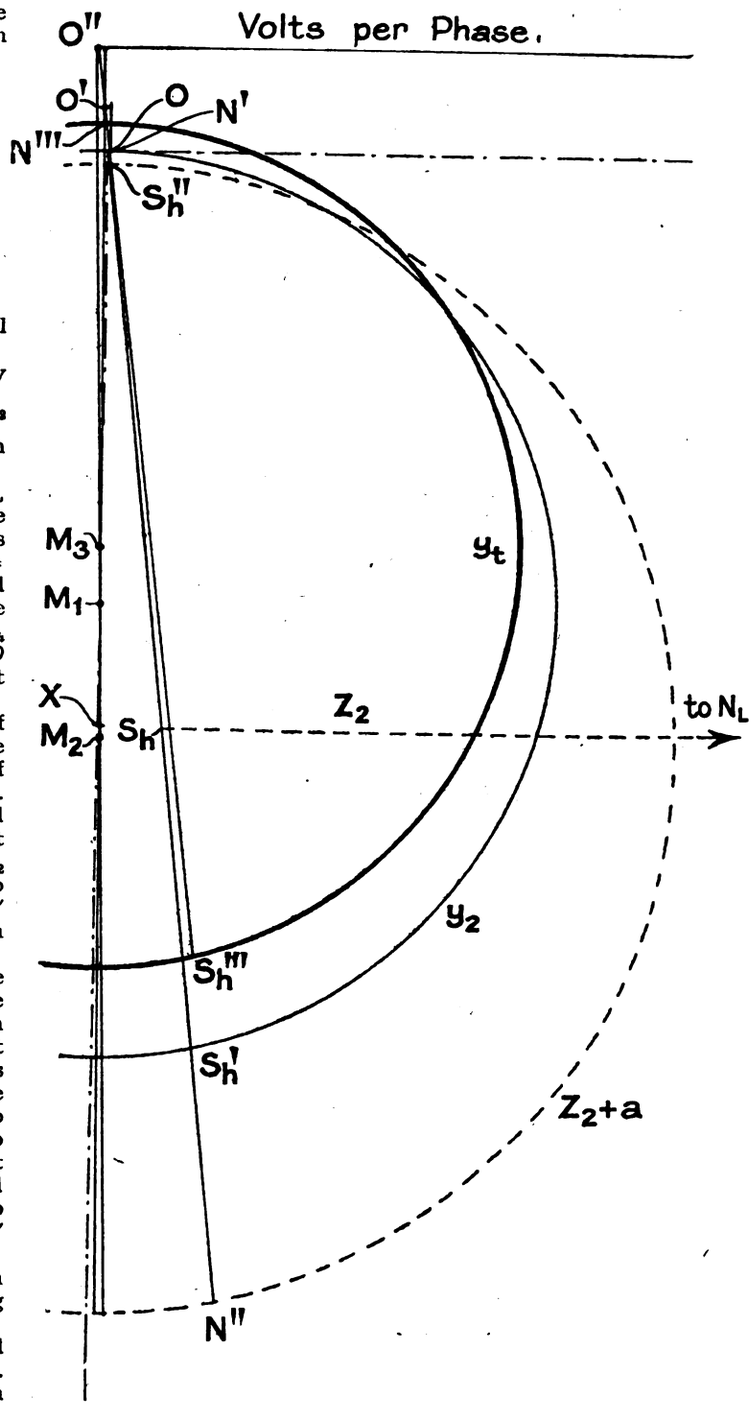

FIG. 11.

SCALE FOR	z_2	1 cm. = 0·1 O
,, ,,	y_2	1 cm. = 0·1 mho
,, ,,	z_2+a	1 cm. = 1 O
,, ,,	y_t	1 cm. = ·05 mho
,, ,,	Current	1 cm. = 63·5 A.

Constants of General Electric Circuit.

These are the constants* of the general electric circuit. In defining them it is perhaps best to consider some specific

* See "Theory and Calculation of Electric Current," by J. L. La Cour and O. S. Bragstad. Translated by S. P. Smith, D.Sc. (Longmans), p. 156.

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apparatus, such as a single phase transformer having a ratio of transformation of 1 : 1.

When the transformer is on *no-load* let $\mathbf{P}_{10}$ V be applied to the primary and $\mathbf{P}_2$ V appear at the secondary. Then $\mathbf{C}_1$ is defined by the equation

$$\mathbf{P}_{10} = \mathbf{C}_1 \mathbf{P}_2$$

Let the no-load current be $\mathbf{I}_0$, then $\mathbf{Y}_0$ is defined by the equation

$$\mathbf{I}_0 = \mathbf{P}_{10} \mathbf{Y}_0$$

When the transformer has the secondary *short circuited* and $\mathbf{I}_2$ A are flowing in it while $\mathbf{P}_k$ V are applied to the primary terminals, we get the definition of $\mathbf{C}_2$ by the equation

$$\mathbf{I}_{1k} = \mathbf{C}_2 \mathbf{I}_2$$

where $\mathbf{I}_{1k}$ is the current in the primary.

The complex quantity $\mathbf{Z}_k$ is defined by the equation

$$\mathbf{P}_k = \mathbf{I}_{1k} \mathbf{Z}_k$$

These four quantities are not independent of one another, they are connected by the equation*

$$\mathbf{C}_1 \mathbf{C}_2 (1 - \mathbf{Z}_k \mathbf{Y}_0) = 1$$

By the principle of superposition of electric pressures and currents we get

$$\mathbf{P}_1 = \mathbf{C}_1 \mathbf{P}_2 + \mathbf{C}_2 \mathbf{I}_2 \mathbf{Z}_k \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

and

$$\mathbf{I}_1 = \mathbf{C}_2 \mathbf{I}_2 + \mathbf{C}_1 \mathbf{P}_2 \mathbf{Y}_0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Where $\mathbf{P}_1$ and $\mathbf{I}_1$ are the primary pressure and current when the transformer carries the load $\mathbf{I}_2$ in the secondary.

Multiplying the lower line by $\mathbf{Z}_k$ and subtracting, we get

$$\mathbf{P}_1 - \mathbf{I}_1 \mathbf{Z}_k = \mathbf{C}_1 \mathbf{P}_2 (1 - \mathbf{Y}_0 \mathbf{Z}_k) = \frac{\mathbf{P}_2}{\mathbf{C}_2} \quad \ldots\ldots\ldots\ldots\ldots \quad (3)$$

or

$$\mathbf{P}_2 = \mathbf{C}_2 (\mathbf{P}_1 - \mathbf{I}_1 \mathbf{Z}_k) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

Now suppose that the load on the secondary of a transformer has an impedance of $\mathbf{Z}_L$. The load current $\mathbf{I}_2 = \frac{\mathbf{P}_2}{\mathbf{Z}_L}$.

Substituting in equation (2) above, we get

$$\mathbf{I}_1 = \mathbf{P}_2 \left(\frac{\mathbf{C}_2}{\mathbf{Z}_L} + \mathbf{C}_1 \mathbf{Y}_0 \right)$$

$$\mathbf{I}_1 = (\mathbf{P}_1 - \mathbf{I}_1 \mathbf{Z}_k) \left(\frac{\mathbf{C}_2^2}{\mathbf{Z}_L} + \mathbf{C}_1 \mathbf{C}_2 \mathbf{Y}_0 \right) \quad \ldots\ldots\ldots\ldots\ldots \quad (5)$$

Now if we write

$$\frac{\mathbf{C}_2^2}{\mathbf{Z}_L} = \mathbf{Y}_b \quad \text{and} \quad \mathbf{C}_1 \mathbf{C}_2 \mathbf{Y}_0 = \mathbf{Y}_a$$

we see that the whole apparatus and load can be completely replaced by a simple circuit with the two admittances $\mathbf{Y}_a$ and $\mathbf{Y}_b$ in parallel both being connected, in series, with the impedance $\mathbf{Z}_k$, as shown in Fig. 12.

The pressure across both admittances is in this case

$$\mathbf{P} - \mathbf{I} \mathbf{Z}_k = \frac{\mathbf{P}_2}{\mathbf{C}_2}$$

The branch $\mathbf{Y}_b$ includes the load, but its admittance is not simply the load admittance for $\mathbf{Y}_b = \frac{\mathbf{C}_2^2}{\mathbf{Z}_L} = \mathbf{C}_2^2 \mathbf{Y}_L \ldots\ldots$ (6)

Now

$$\mathbf{C}_2^2 = C_2^2 \angle 2\psi_2 \text{ and } \mathbf{Y}_L = y_L \angle \varphi_L$$

In the ordinary induction motor both ψ_2 and φ_L may be negative so that the current may lag by the angle $\varphi_L + 2\psi_2$ behind the voltage across $\mathbf{Y}_b$. On the other hand, a phase advancer will make φ_L positive, so that the current leads.

The admittance $\mathbf{Y}_a$ can easily be obtained from the no-load admittance $\mathbf{Y}_0$ by multiplying by $\mathbf{C}_1 \mathbf{C}_2$.

In an induction motor $\mathbf{C}_1$ and $\mathbf{C}_2$ are not very different† from unity and very nearly equal to one another.

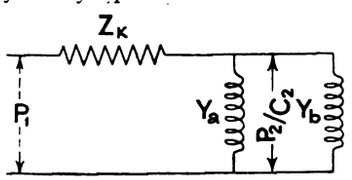

FIG. 12.

We may therefore say, with great approximation

$$\mathbf{C}^2 = \frac{1}{1 - \mathbf{Z}_k \mathbf{Y}_0} = \frac{\mathbf{Y}_k}{\mathbf{Y}_k - \mathbf{Y}_0} \quad \ldots\ldots\ldots\ldots \quad (7)$$

* "Loc. Cit.," p. 158.

† It is possible, by making measurements at both the P_1 and the P_2 terminals, to measure C_1 and C_2 accurately.

As $\mathbf{Z}_k$ and $\mathbf{Y}_0$ can easily be obtained from the short circuit and no-load tests we have no difficulty in finding 2ψ because $\mathbf{C}^2 = C^2 \angle 2\psi$.

Taking, then, Fig. 12 as the circuit equivalent to the induction motor, where $\mathbf{Z}_k$ $\mathbf{Y}_a$ and $\mathbf{Y}_b$ have the values given above and can be determined from the short-circuit and no-load tests, we can proceed to find the locus of the current curve by a method which is more general in its application than the method given in Fig. 11. This is shown in Fig. 13.

Set off OY_a to represent the admittance $\mathbf{Y}_a = \mathbf{C}_1 \mathbf{C}_2 \mathbf{Y}_0$, obtained from the no-load tests. From $\mathbf{Y}_a$ draw a horizontal line from which to set off the angle of lag or load of the rotor current caused by the admittance $\mathbf{Y}_L$. If a phase advancer is

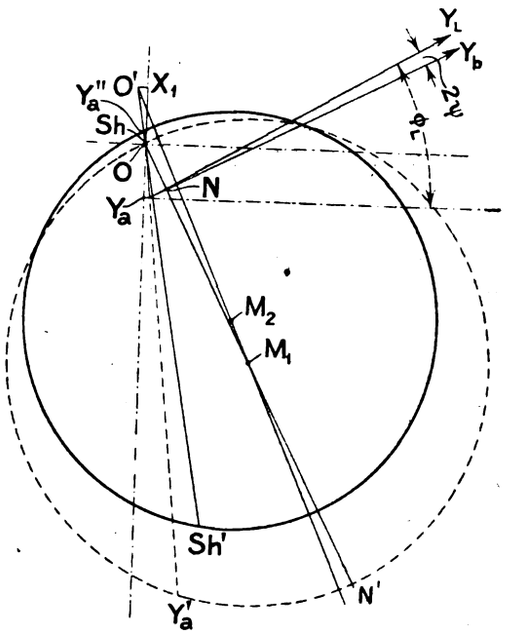

FIG. 13.

in circuit $\mathbf{Y}_L$ will give us a positive φ_L and the admittance $\mathbf{Y}_L$ will be represented by the line $Y_a Y_L$ in Fig. 13, making a positive angle φ_L with the horizontal.

From equations (6) above we see that we have to add the angle $2\psi_2$. This will in general be negative and is set off as shown in Fig. 13. If φ_L is constant (as it would be with an unsaturated phase advancer) the line $Y_a Y_b$ extended to infinity gives the locus of the combined admittances of $\mathbf{Y}_a$ and $\mathbf{Y}_b$ in parallel, as the slip s changes from 0 to 1.

Impedance Locus.

In order to find the locus of the impedance of $\mathbf{Y}_a$ and $\mathbf{Y}_b$ in parallel we must drop a perpendicular OM_1 upon $Y_a Y_b$ and produce it to a convenient point. Any circle having its centre on OM_1 and having its circumference passing through O is the inverse to $Y_a Y_b$, so it is easy to adopt a scale of ohms that will not give too big a circle for the reciprocal of ON scaled off in mhos. Having drawn the dotted circle and set down the scale to which it is drawn we proceed to add the impedance $\mathbf{Z}_k$ by setting off OX_1 vertically to represent jx_k and $X_1 O'$ to represent the resistance r_k. Radii drawn from the new origin O' to the dotted circle now represent the total apparent impedance of the motor and load.

In order to find the admittance we must invert the dotted circle, taking O' as the centre of inversion. This is done by first joining the centre M_1 to O' and measuring off the intercepts of the circle on this line. The reciprocals of these intercepts taken on some convenient admittance scale give us the ends of the diameter of the new admittance circle shown, with the full line. The circle is now the locus of the stator current vectors to another scale obtained as shown in connection with Fig. 11. The voltage vector may be set off as a horizontal line through O'. If we prefer it we may turn the whole figure through a right angle so that the voltage vector is vertical and we obtain the circle diagram of the induction motor for any given power factor in the rotor circuit.

Where the power factor of the rotor circuit varies (as, for instance, where we employ resistance-reactance control) it is still possible to employ the method of inversion to get out the current locus as will appear in subsequent examples.

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The Institution of Electrical Engineers.

Dr. Nicholls on International Radio-Telephony—An Interesting Railway Film.

A special meeting of the INSTITUTION OF ELECTRICAL ENGINEERS was held on Thursday, February 22nd, when a lecture on " Transoceanic Wireless Telephony " was delivered by Dr. H. W. Nicholls. This was followed by the exhibition by Mr. B. Welbourn of some films of the electrification of the Chicago, Milwaukee and St. Paul Railroad. THE PRESIDENT explained that this special meeting had been called in order to catch two things as they ran past, because Dr. Nicholls was returning to America on Saturday and there would not be another opportunity of seeing the electric railway films.

The Ether as a Party Line.

DR. NICHOLLS began by illustrating a simple type of ordinary telephone circuit consisting of a line, microphone, battery and receiver all in series and explaining the function of the carrier current and the method of varying its amplitude. The carrier current, he said, contained no element of signal current and it was not necessary to transmit it to the receiving station. The restriction of the carrier current to the transmitting end enabled great economy in power to be obtained. In other words, the final transmitting current must be small compared with the carrier current, in order to obtain intelligible speech. The difference between wire telephony and radio-telephony, continued the lecturer, was only in the ether inasmuch as

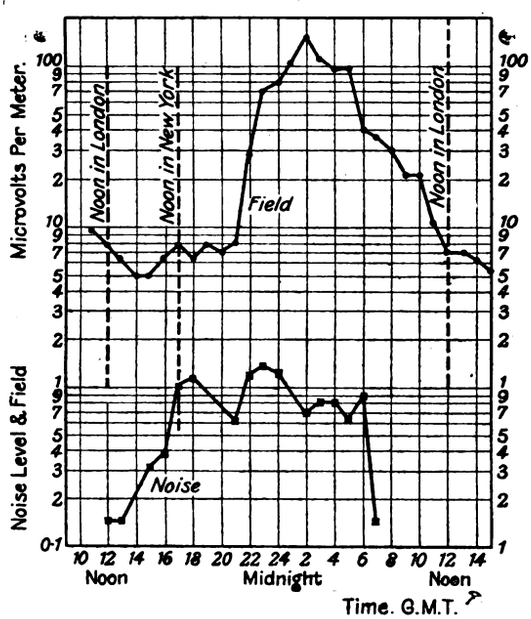

FIG. 1 CURVES SHOWING RELATION OF NOISE AND SIGNAL POWER AT DIFFERENT TIMES OF THE DAY.

the ether differed from a conductor. It was more like a condenser than a copper wire and therefore in order to get signals through it was necessary to use rather high frequencies. Another difference between the ether and a copper wire was that the ether was a " one party " line, for everybody was on the same circuit. The only way therefore in which it was possible to distinguish between channels in the ether was by difference in frequency. One other important difference between a copper wire and ether was that the characteristics of the former were very much more variable. There was a tremendous difference between day and night, and also between day and day and even parts of the same day. Indeed, with short wave lengths there were differences from minute to minute and second to second which it was very difficult to take care of.

Some Factors in Long Distance Radio-Telephony.

In long distance radio-telephony it was necessary to use rather long waves. It was also necessary to secure as great an economy of power as possible, because the amount of power involved in trans-Atlantic radio-telephony was likely in the summer time to be of the order of 1 000 kW, and in the third place it was extremely important not to use any wider range of frequency than necessary. About 3 000 cycles was required to transmit the human voice clearly and more was required to transmit music with a good quality, and it was impossible to transmit more than one channel in a given frequency range in the same direction. The range of wave lengths at present available for trans-Atlantic communication was fixed by the London Convention and probably would not be changed very much in the near future, that range being from 8 000 m. upwards. Now, 8 000 m. was 7 500 cycles. About the longest wave length likely to be used immediately would be 30 000 m., which was 10 000 cycles, and that meant there was available for trans-Atlantic communication a range of 27 500 cycles. Modulating in the usual way, there would be produced a carrier and two side bands, each of the side bands being 3 000 cycles wide, making a total of 6 000 cycles which must be transmitted. It was, however, extremely important to use as few cycles as possible in order to prevent interference with other channels, of which there were 20 or 30 for telegraph purposes. For this purpose it had been found essential to transmit only one of the side bands. In that way, the possible number of channels was multiplied by approximately two; in other words, more were left for telegraph traffic. There might be approximately ten telegraph channels in the frequency range required for one telephone channel. Working on these lines, radio-telephone apparatus had been built which conformed to his ideas of what a radio-telephone apparatus ought to be—i.e., it economised in power and by sending out only one side band it occupied the minimum frequency range.

Modulation and Amplification.

Experiments had started out by developing a modulated wave at very low power, 5 W or something of that order, using repeater types of tubes. Both side bands were generated and the carrier was eliminated by a balanced modulator. Then, by means of valves, one of the side bands was cut out and the result was that they had 2 or 3 W of single side band high frequency telephone current at about 55 000 to 57 000 cycles. The next thing was to amplify that into about 300 W by means of an amplifier consisting of three tubes. From there, the current went to another amplifier by means of which it was raised to a power level of about 5 kW. From there it went to still another amplifier, which was capable of raising the power to 300 kW, but in the tests which had been carried out it was raised only to 60 kW because that was all that was required. From the final amplifier, the current was passed to the antenna of the Radio Corporation at Rocky Point, Long Island.

Another argument for the single side band transmission was that in transmitting at 50 000 cycles it was impossible to design an antenna which would have a perfectly flat frequency characteristic. By sending only one side band it was necessary to have but 12 per cent. of the frequency of transmission, and that enabled the desired result to be obtained.

The Advantages of One Side Band Operation.

The system of sending out only one side band was in commercial use on the carrier telephone circuits in the United States; in this case, the system was used not so much to save power—which was not important—as to cut down cross talk on account of the large amount of power in the carrier, and also to secure a greater number of conversations in a given frequency range, because on the ordinary wire circuit given were available only about 30 000 cycles, and, as a matter of fact, there was not much more frequency available on the wires than in the ether.

In conclusion, Dr. Nicholls referred to the experiments which are now being conducted at New Southgate. These were dealt with on page 58 of THE ELECTRICIAN of January 19th, 1923.

DISCUSSION.

In the course of a short discussion on the lecture DR. W. H. ECCLES said the arrival of Dr. Nicholls in this country really marked an epoch in trans oceanic telephony. What had been told them that evening was the story of a long endeavour dating back to 1913 and continued very strenuously by the best scientific methods and great practical skill, chiefly at the hands of Dr. Nicholls. In 1919 and 1920 Dr. Nicholls perfected a system of speaking from ship to shore and shore to ship which was tried out in New Jersey, and enabled anyone on the Bell system in America to communicate with any ship at sea within a distance of about 300 miles of the coast, if it were properly equipped, just as if the ship were connected by cable to the land wires. The only reason why that had not come into greater favour was that a great many noises occurred, such as other vessels transmitting spark signals and

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that made telephony difficult. In the case of transoceanic telephony that kind of interference could be more easily cut out because a different range of wave lengths was being used. This work, no doubt, had enabled Dr. Nicholls to arrive at the stage he had described, and the curves of day and night conditions were of profound importance to all people who had to design stations and circuits. The noises which Dr. Nicholls had referred to he imagined were stray noises in the wireless region. They were, perhaps, natural electric waves, or what were commonly called atmospherics. He did not think they were of local origin at this time of the year, because in England in winter there were not many thunderstorms and electric discharges.

Two-Way Tests Desirable.

MR. E. H. SHAUGHNESSY said he would like to know whether Dr. Nicholls considered that a similar series of measurements to that which he had taken from America to this side ought also to be taken from this side to America, to ensure that telephony could be condicted both ways, because it would be no good talking one way. His point was that from what we knew, the atmospheric conditions in America were very much worse than they were here, so that deductions as to the amount of power required on the basis of investigations in one direction might be rather misleading.

Radio Screens.

MR. H. E. MORRISH asked whether, if one frequency was

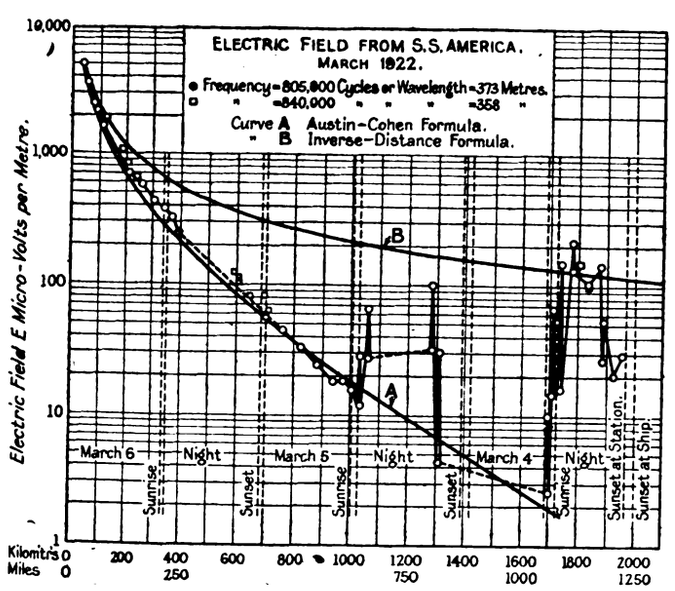

FIG. 2.

used from America and another from this country, the messages could be received on the same aerial or would it be necessary to have two distinct stations for transmitting and receiving. If so, at what distance apart would the stations have to be. As regards directional transmission, under present conditions if we transmitted from America to England, we also had to transmit everywhere, and possibly any transmission from New York to Japan would be affected by transmission from New York to England. Had Dr. Nicholls considered the possibility of forming radio screens with the idea of absorbing the current which was going in a direction in which it was not required to go.

Methods of Measurement.

DR. NICHOLLS, replying, said the method of measuring the strength of the field was to introduce into the loop a syren note running up and down the whole frequency scale which was used in speech, and to determine how low that syren note could be in order that it was just distinguishable above the noise. He agreed with Dr. Eccles that the curves indicated that noises came from far away, and it was almost possible to trace the path of the sun on these curves in that way. Though the atmospheric conditions were very much worse in New York than here, further north, in Maine, the receiving conditions were very much better, although still probably worse than in England and it was necessary to carry on a two-way transmission. One frequency could not be used both ways. Neither would it be desirable to transmit and receive on the one antenna because it was so simple to do it the other way. As regards directional transmission there was no reason technically why screen structures should not be used for directional transmission, but financially there would probably be many reasons against them, by reason of the dimensions involved.

Formation of the Liverpool Centre.

THE PRESIDENT then called upon Mr. B. Welbourn to exhibit some cinematograph films of the electrification of the Chicago, Milwaukee and St. Paul Railroad. incidentally mentioning that Mr. Welbourn appeared for the first time in a new capacity, that of Chairman of the recently formed Liverpool Centre.

MR. WELBOURN before exhibiting the films gave a short account of the electrification scheme in question, but prefaced this with a few comments upon the matter mentioned by the President. He thanked the Council for its broadmindedness in giving full Centre status to the old Liverpool sub-Centre, and expressed his appreciation of the statesmanlike attitude of the Manchester Centre Committee in not only giving the proposal from Liverpool their blessing but in instructing their Chairman to do all he could to assist the scheme. This was the first time that a sub-Centre had been given full Centre status, and he hoped the action of the Council would be seized upon by all the other sub-Centres as a sign of encouragement.

A Railway Film.

Dealing with the electrification of the Chicago, Milwaukee and St. Paul Railroad, Mr. Welbourn said this was the first trans-Continental line in America which had made a commencement with main line electrification, and a great pioneer work had been done in electrifying this line at 3 000 V with only, so far as he knew, the experience of the Butte, Anaconda and Pacific Railway which operated for some time at 2 400 V and was now working in conjunction with the Milwaukee system behind them. Power was obtained from the Montana Power Co. and was transmitted along a single 100 000 V three-phase circuit which paralleled the track the whole way. The length of route which had been electrified was approximately 650 miles, mostly single line with turns out and sidings, making a total single track equivalent of 850 miles. The portion which had been electrified ran from Tacoma on the West Coast right up into the mountains, where there was a break of 200 miles from Spokane, when the electric system began again and continued for over 400 miles further. As regards the power supply, it would no doubt interest supply engineers in this country that the railway company did not consider it necessary to erect its own power station but was content to rely upon the power company. The 100 000 V line was tapped into sub-stations which were placed about 32 miles apart and these sub-stations in the aggregate contained nearly 90 000 kVA of transformer plant. The equipment in each sub-station consisted of two or more 3 000 V d.c. sets driven by a synchronous motor to which was coupled two 1 500 V d.c. generators.

Catenary Equipment.

The catenary equipment was very simple and consisted of a steel messenger wire from which were supported two trolley wires side by side. The construction was of the simplest possible character, presumably dictated by financial considerations. The poles, which were wood throughout, carried quite a number of wires; for instance, there was the negative earth feeder, the 4 400 V signal wires, the telephone circuits and the trolley wires. There were also the automatic signalling arrangements fitted on the 4 400 V signal wires. At the signalling points this was transformed down to 110 V, and again transformed down to 23 V at the signal lamps. The track was of special interest to railway and civil engineers; the severest portion of the line involved a 21 mile stretch, in the Saddle mountains, of 1·7 per cent. gradient, the maximum height to which the line climbed being 6 000 ft. At another point the gradient was 2·2 per cent. The track was an excellent piece of work and was ballasted throughout very much in the same way that our own lines were here, so that dust was kept down to a minimum. A great deal of the interest in the line was centred in the locomotives, of which there were two types. There was a gearless type, which weighed 260 tons and had a continuous rating of 3 200 H.P., and there was also the quill type which weighed 284 tons and had a continuous rating of 3 400 H.P. These locos were fitted with pantagraph collectors and the current collection was excellent. (The operation of these was well shown by slowing down the film, which enabled a good idea to be gained of the working of the pantagraph.)

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Research and Industry

The New Buildings of The General Electric Company at Wembley.

The commodities which are nowadays consumed by the human race may roughly be divided into two classes, those in which the methods of production and the materials employed have long ago reached a stage where no improvement is likely, and those in which constant endeavour must be made to make better use of the materials and to discover more efficient means of production. The articles manufactured by the electrical industry belong emphatically to the latter class. So much is this recognised that that industry not only has a Research Association which tackles fundamental problems of general interest, but many of the undertakings forming the industry have found it necessary to establish research departments where questions of more particular moment to them can be properly dealt with. The endeavours of these two sets of bodies are complementary rather than antagonistic, and both are deserving of equal encouragement seeing how necessary further knowledge of materials and process is to the development of electrical science and engineering.

Among the firms who have established research departments the GENERAL ELECTRIC Co. deserve honourable mention, as anyone who has visited Witton Works will agree, and by establishing special research laboratories at Wembley, which were formally opened on Tuesday, they are only carrying out a policy which has been well begun. These laboratories, which we describe below, are excellently designed and equipped, and should therefore be the birthplace of much interesting and useful information.

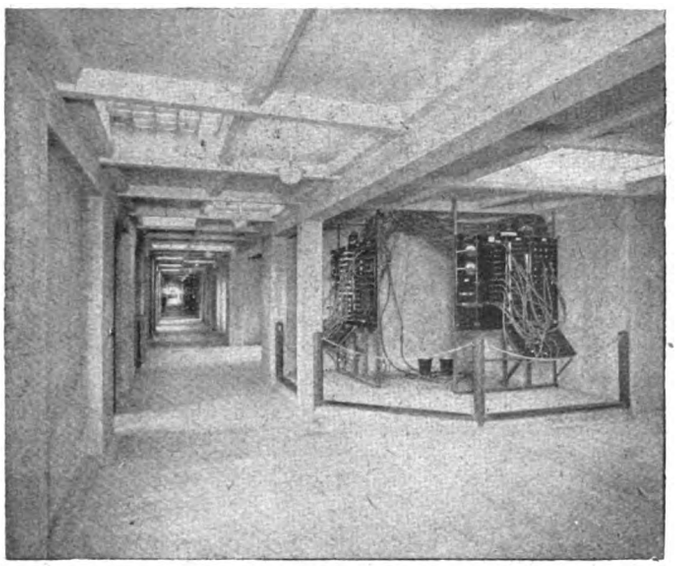

FIG. 1.—ONE OF THE ELECTRIC DISTRIBUTION CENTRES.

The Buildings.

The laboratories are situated close to North Wembley station, and as no restrictions were imposed by shortage of ground space, it was decided to adopt the " one floor " style of building, rather than the multi-storey type, owing to ease of extension, good natural illumination, and need of dealing with heavy pieces of apparatus. The building is mainly of red brick. It has a frontage of 400 ft. and a total floor area of 80 000 sq. ft., occupying an enclosure of four acres.

The main building consists of one long block running east and west, with centre and west wings running north. The east wing has not yet been built. A two-storey central extension to the south forms the administration section. This form of construction gives opportunity for extension at five different points, so that in future any branch of research work can be supplied with additional accommodation without disorganising the scheme of the internal laboratory arrangements.

Layout.

There are nine small groups of rooms built out as private offices from the main laboratories, and arranged so that there is direct access from every laboratory to one or another of the groups of offices. Each research man thus has a personal sanctum near to his experimental work.

One of the guiding principles in the design of the building has been to provide ample accommodation and flexibility for the electrical and other services, such as gas, vacuum, compressed air, etc. It is essential for special experimental work to ensure that such services are easily accessible to any room and are available at any point in a room. Ample and well-lighted storage space for lumber and apparatus not in use is also most important. To permit these desiderata between the main laboratories on each side there is a centre bay running the whole length of the building. This contains a corridor on the ground floor, and above the corridor a gallery, along the whole length of which run the pipe services, and also the cables for the various electricity supplies. This gallery also serves to accommodate the lumber and bulky apparatus not in use, as well as all general service apparatus, such as compressed air reservoirs, gas and water containers, hot water apparatus, motors driving shafting and all those things for which it is difficult to find accommodation in a laboratory and which are not wanted in the experimental rooms themselves.

The space under the central gallery to the right of the corridor is used for small rooms, such as photographic dark rooms and store rooms, or for, the purpose of housing noisy machines. It can, however, be thrown into the experimental laboratory itself to be used for work which requires a subdued light. By this arrangement one of the chief drawbacks of the north light building has been overcome—i.e., the difficulty of obtaining with this construction certain small subsidiary areas which are wanted for special purposes.

Three battery rooms also open out of the gallery, and are situated over three of the experimental rooms. They serve to darken these down and enable work to be done where a strong light is objectionable. By placing the batteries at three points in the building instead of inserting them at one point, three centres are obtained from which electricity supply can be given to the rooms in their neighbourhood.

Lighting.

The useful height of all rooms from floor to underside of roof is 14 ft. The importance of artificial illumination in the experimental rooms has been diminished by the provision of very good natural lighting. For the north-lighted rooms the sloping ceilings are of smooth whitened plaster slabs and the reflecting surfaces of these are utilised for spreading general diffused light from open high candle power frosted units placed well up in the ceilings.

Equipment.

Apart from the special apparatus in individual rooms, there is general equipment which includes various services, electric and piping, which have to be distributed throughout the building.

Main pipe trunks run throughout the length of the gallery, and are tapped off to the different rooms. These supply coal gas, fine vacuum for backing the oil box pumps for exhausting lamps and the like, rough vacuum for the preliminary exhausting of lamps and for vacuum furnaces, etc., general vacuum for chemical work, compressed air, water and hydrogen, the last being over part of the building only.

The three main vacuum pumps are in the central substation, together with the electrical machinery, transformers, and general supply plant and the main switchboard. The hydrogen supply is mainly needed for reducing processes in the preparation of tungsten powder, but it can be made available at any point in the building. The supply is given from a special gas holder, which has to be filled from cylinders of compressed gas.

The usual method of making the supplies available in any laboratory is to bring the pipes down at the centre of the room to within 6 ft. 6 in. of the floor. Two gas and two compressed air pipes come down at the four corners of a rectangle measuring about 6 ft. by 3 ft., and to their lower ends is attached a timber framework which braces it together and forms a kind of cradle, clear of a man's head, but yet accessible for manipulating taps and terminals. The other pipe supplies are brought down to the same level. On this cradle are terminated all supplies—piping or electric, and connections are easily made to them from experimental tables and benches disposed suitably about the floor area below. The taps and

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nozzles of the pipe supplies on the cradles are different for each supply both in colour and form in order that confusion may be avoided between the different supplies.

It may be pointed out that there are no ducts in the floor with the exception of waste-water gulleys running transversely across the room, with openings at suitable points for access when cooling water or other waste has to be disposed of.

Electricity Supply and Distribution.

The various electricity systems in the laboratories divide themselves into two groups, permanent and experimental. The whole of the lighting system is permanent and is not touched for experimental purposes, and so are all the charging feeders and main supplies to the various switchboards.

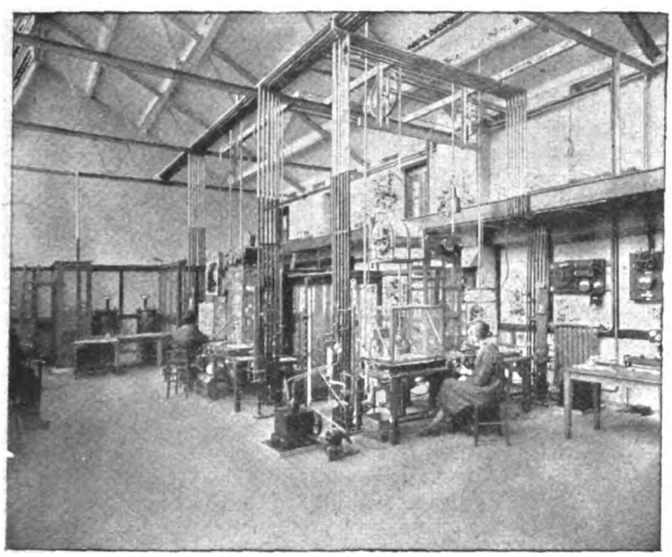

FIG. 2.—THE VALVE LABORATORY-FACTORY.

There are two ring mains round the walls of every room at 110 V a.c. and 110 V d.c., which terminate at plug points on the wall, and also on the cradles. The wiring is all permanent, and is not tampered with for experimental connections as far as these sockets and up to the circuit terminals on the cradles. All feeders and wiring up to their termination on the cradles or up to the wall sockets are under the charge of the laboratory maintenance staff. Beyond these points all circuits are temporary and under the control of the research staff. The main circuits connected with the sub-station and the plug wiring and lighting throughout the premises call for no special comment. The general distribution, however, of the various electrical supplies for experimental use in the different laboratories may be worth describing.

Control Arrangements.

In a building of this size central control of electricity supply for experimental work would be inefficient and cumbersome. Three main control points are, therefore, provided, with seven distribution boards for experimental electric circuits used by the research workers. These points are at the three junctions of the three wing corridors with the main corridor, where are situated switchboards enabling any of the different sources of electric supply to be connected through to any laboratory. An illustration of one of these distribution centres is given in Fig. 1. Each switchboard, of which there are seven, consists of four parts: (*a*) A panel for one battery with some 20 sets of sockets connected to tappings for different voltages; (*b*) a panel with sets of sockets for connecting to all the other electric supply voltages a.c. and d.c. in the laboratory; (*c*) a panel with sockets which are the terminations of interconnecting mains to every other similar distribution board in the building, and (*d*) a panel with sockets terminating the cables which run into those laboratory rooms which the board in question is specially designed to serve.

Connections from the sockets on these last panels to those of any of the first three supply panels are made by flexible cables and plugs. Two sizes of plugs and cables are standard, one for 100 A and one for 15 A. The arrangement is very flexible, and is a fuller application of the system installed in the Electrotechnics Department of the National Physical Laboratory. The advantage of making every electricity supply in the building permanently available at every distribution board is obvious and soon pays for the cost by the saving of time. The supplies which are thus made available are the following: 415 V three-phase four-wire district supply (240 V to neutral); 110 V d.c. machine with Tirrill regulator; 110 V a.c. three-phase four-wire from transformers; 415 V a.c. single phase lamp life test supply with Tirrill regulator; 150–0–150 V d.c. lamp life test supply; 0–75 V motor booster (voltage adjustable); 110/415 V d.c.–a.c. motor generator; 110 V battery (600 Ah) sub-divided; 360 V battery (180 Ah) sub-divided; 360 V battery (50 Ah) sub-divided; 360 V (180 Ah) sub-divided; 80 V battery (180 Ah) sub-divided; 360 V battery (22 Ah) sub-divided; 110 V battery (180 Ah) sub-divided. Larger current or higher voltages than are available from the above supplies are usually required for special purposes only, and are arranged for specially at the point of use.

The greater part of the electrical gear and fittings are the product of the various works of the General Electric Co.

The Laboratory-Factory.

Most factories have laboratories, but the plan of laboratories having factories within them is less generally adopted. It is naturally not possible for all types of products, but wherever it is at all possible the plan has everything to commend it where industrial research is involved. The following are some of the reasons. Firstly, the laboratory personnel can only really know a manufacturing process and its difficulties by experience in working it themselves. It is wanted therefore for the education of the laboratory itself. Secondly, that type of research which has its application in the improvement and cheapening of factory processes usually receives its best inspiration from research people who have had to make these processes work successfully. Thirdly, it is essential, both for the success of efficient factory production and of successful research to keep out of the factory all experimental work which is at all elaborate or fundamental. The disorganisation caused to production is serious, but far more serious is the disorganisation of research which results from attempting research which involves production processes when all the possible variables introduced by such processes are not under rigid control. In the case of many researches it is no use attempting

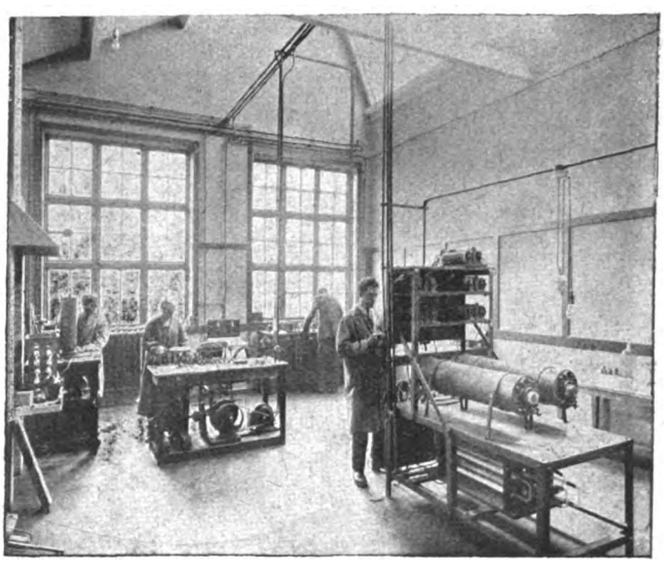

FIG. 3.—PART OF THE TUNGSTEN WIRE LABORATORY-FACTORY.

work without a small factory under research control. Fourthly, when an apparent improvement to a process is involved, it must be tried in the laboratory on as large a scale as possible, in order that both the laboratory and the factory may be satisfied before attempts are made to introduce it into the works. The laboratory-factory is essential for these trials.

Four Small Factories.

There are at present in the Wembley laboratories four small experimental factories for making lamps, tungsten wire, thermionic valves, and primary batteries. The personnel engaged on the work is not large, but sufficient to carry on the regular processes.

Raw material, or when convenient, partly manufactured parts, are drawn from the works and kept in store at the laboratories for the experimental factories to work upon. The finished product, if of the stock pattern, is returned to the works and added to their manufactured product for sale, but, of course, its total is exceedingly small. An appreciable part of the output of the laboratory-factories at any time may be non-standard as the result of the introduction of innovations,

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and such product is usually put to special tests. Views of parts of the valve and Tungsten wire laboratory-factory are shown in Figs. 2 and 3. The space occupied by these factories is about 10 per cent. of the total floor area of the laboratories.

Routine Tests.

Closely allied to the laboratory-factory are arrangements made in certain cases for the routine testing, particularly the life testing of samples of the company's factory products. From the laboratory point of view such testing work is only justified where it assists the laboratory to form a true judgment of the factory product, and to assess the extent and the cause of defects. From the factory point of view managements often prefer to have the regular sampling and testing of their factory product carried out away from the factory control. It is often the case also that the proper conditions of test have themselves to be the subject of laboratory investigation.

At the present time, lamps and valves are the chief factory products which are routine tested at the research laboratory, and, to a lesser extent, primary batteries; but here again it is essential to organise so that the administration of this routine work does not fall on the man whose energies ought to be concentrated on research. Each routine department, therefore, also has a steward who is directly responsible for the work, and the research man who is a court of appeal is brought into matters affecting administration as little as possible.

Workshops.

The main workshops deal with metal and wood respectively. They have a dual function; firstly, to make up for research men such special apparatus as may be needed and the general equipment of the laboratories. Secondly, to undertake problems of their own which may, or may not, be regarded strictly as research work, but which are, nevertheless, of great help to the factory and to the applications of research to production processes. This work consists of the study of manufacturing processes, particularly those which are, or might be carried out by automatic machinery, and the devising of machinery for increasing the speed or the uniformity of production. Often a given product can be entirely redesigned with a view to a better or cheaper form of construction, and the value of doing some of this development work at the research laboratories is that in some cases it is desirable for the designer to have always at hand a research man who will keep him straight on phases of the process and the product with which he himself cannot be expected to be familiar.

The work of improving automatic machines and processes is also always proceeding at the factories, but it is a type of work on which it is always good to have several independent minds working.

THE OPENING CEREMONY.

Speaking at the opening ceremony, which was attended by a gathering of over 500 people, Mr. Hugo Hirst said that he was one of the founders of the General Electric Co. and had been contributory to the laying of every stone in building it up. It had taken the war to teach this country that industrial independence might lead to political and national death. His firm had learnt the lesson and had improved plant and set up new buildings and factories in order to be able to hold its own under all conditions.

The Task before the Country.

Lord Robert Cecil, in formally declaring the buildings open, said that the task now before the people of this country was to do something to repair the waste of war and to enable the world once more to get upon its feet and function as well as, or better than, it had ever functioned before. To do that, the most essential requirement was that they should increase the output of human energy and skill. There were only two ways of increasing output—by reducing expenditure and by increasing efficiency. If they could make every man's skill go farther than before they had really added to the wealth of the world, in a way not attainable by any other method.

Organising the Industry.

The laboratories that were being opened to-day were designed to enable highly-skilled men and women to get greater results out of the material handled. But they must go beyond that. The spirit of research must go through the whole industry. An industry must be organised in a singularly unintelligent fashion which failed to make use of the highest faculties of those engaged in it. Brains had been too much neglected in this country, and a great source of wealth had thus been allowed to run to waste.

Such work as was to be done in these laboratories had no national boundaries. Interchange of scientific knowledge was one of the first duties of civilised man. In promoting research they were improving the relations between this country and the world, and if there were not an advance towards a national and international system, civilisation had no promise of future existence.

Sir J. J. Thomson on Research.

Sir Joseph Thomson said that the ceremony was a conspicuous example of the increased importance that was being attached to the application of research to industry. It was inconceivable that he should have to say anything to support that application. The electrical industry was born in a laboratory, and not so very long ago. He well remembered the birth of the electron—in fact, he assisted at it. It was very difficult to judge what might come out of a new invention, and the best-informed made great mistakes in their estimates. Everybody was now impressed with the necessity of research to industry, but it must not be forgotten that some of the great firms thirty or forty years ago were spending sums on research which would be thought large even to-day.

The Importance of the Personnel.

The research laboratory before all things must have a highly-efficient staff. If the right man were obtained he would get good results in a barn. The wrong man would get none even in those new buildings. The capacity for the highest kind of research was not common, and a man able to direct such a laboratory as they were opening was born and not made. Training might increase the efficiency of such a man, but training would not put insight and originality into him. The results of research consisted in a series of booms and slumps rather than in a continuous outpouring. No research laboratory could guarantee delivery. The only thing one could be sure of was that the process would take three or four times as long as was estimated. The aspirations attached to research work were something more than intellectual, they were almost spiritual. If people did not use their brains they would soon have no brains to use, and it was good for industry to have problems to worry at and so get mental exercise.

The Oldham Accident.

An Explanation by the Makers.

As already announced in The Electrician on February 10th an accident occurred to one of two 7 500 kVA turbo sets which were in operation at Oldham. The Metropolitan-Vickers Electrical Co. inform us that in shutting down one of the sets the excitation was cut off and the machine brought up in speed in order that it might be tripped out by the emergency-overspeed governor, as is the usual practice when testing such emergency feature. When a speed slightly below 3 300 revs. per min. had been reached (the normal tripping speed of the emergency governor), the rotor opened out and jammed in the stator bore. The heat due to friction caused the oil from the bearings to catch fire, and it was necessary to call out the fire brigade to extinguish the flames.

On examination, it was found that the cast iron frame surrounding the laminations had been fractured. The rotor shaft had been broken off at both ends and the ring of stator laminations, with the rotor inside, had fallen into the pit below the machine. The generator foundations sustained some damage. The coupling bolts between the turbine and generator had been sheared off and a piece of the bearing housing cover on the turbine had been broken. The turbine, however, continued to run for several minutes after the accident.

An examination of the rotor (carried out as thoroughly as circumstances would permit) by the suppliers of the forging as well as by the Metropolitan-Vickers engineers, revealed the fact that a large internal defect had been the cause of the trouble; apparently the rotor had opened up on a plane through the axis, bringing the periphery of the rotor into contact with the inside bore of the stator laminations. The friction between the rotor and stator laminations had caused the stator core to revolve, fracturing the cast iron stator frame and the bedplate and leaving no support for the stator, which, as mentioned above, fell down into the pit, breaking the shaft and carrying the rotor with it. The ring of stator laminations prevented the parts of the rotor from flying outwards, and this was undoubtedly responsible for the small amount of damage which was done external to the machine.

We understand that the rotor is a duplicate as regards peripheral speed and stresses, of more than two dozen machines, some of which have been in operation for more than six years.

It is interesting to note the exceedingly small amount of damage which was done external to the machine. The ring of stator laminations acted as a "bomb-proof" shield and prevented the parts of the rotor from flying out.

This report is issued by the Company to counteract the effect of exaggerated reports that have been circulated.

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Power Circuit Interference with Telephone and Telegraph Lines.

An informal discussion, opened by Mr. S. G. BARTHOLOMEW, upon the occurrence and means of prevention of power circuit interference with telegraphs and telephones was recently held at the North Western Centre of the Institution of Electrical Engineers. Confining his consideration to the interference due to leakage and induction, Mr. BARTHOLOMEW pointed out that the sensitive apparatus necessary to transmit and faithfully reproduce telegraphic signals or spoken words was very easily deranged by extraneous influences. The losses due to leakage from power circuits could not be afforded and the liability to these was considerable, especially in proximity to traction circuits having an earth return. The effects of induction were more serious still, consisting principally of disturbing noises which were sometimes so violent as to produce what was termed acoustic shock to an operator. There were possibilities of physical injury in this and the moral effect might be imagined. Actual danger to life might result not only from accidental connections with power conductors, but in extreme cases from induced voltages.

Conditions Producing Induction.

The most difficult effects to eliminate were "residual" voltages and currents due to (*a*) unbalanced capacity and leakage between the various conductors and earth; (*b*) unbalanced loads between phases on a system where the neutral point was earthed and (*c*) the development of the third harmonic and its odd multiples in generators and transformers using star connections with a neutral point earthed.

It was clear, therefore, that the remedies were to arrange conductors carefully, to balance the loads between phases, and to attain as far as possible a pure sine wave in transmission circuits.

Reduction of Harmonics.

The elimination of harmonics which were found in both a.c. and d.c. systems was desirable in the power engineer's interests as well as in those of the telegraph and telephone engineers. Lantern illustrations were shown to indicate how the principal harmonics produced in machines were due to armature slots and the shape of the magnetic flux curve of the poles.

Slot ripples were of frequencies from 275 to 2 500 per second, which fell within the range of speech frequencies, and were therefore especially objectionable to telephone circuits. These could be reduced by care in design as, for instance, by skewing slot tips, by narrowing slot openings, and by ensuring that the number of slots per phase was not a multiple of the number of slots per pole. Flux harmonics could be reduced by pole design that would give flux density with a sine wave shape similar to the sine wave desired in the armature conductors.

Transformer Conditions.

In iron-core transformers the inductance did not remain constant at all values of the magnetising current and flux and current could not therefore have the same wave form. This resulted in the development of harmonics of which the third was usually most pronounced. An unbalanced neutral, whether of machine or transformer, gave what was virtually a single phase circuit with one conductor. Generators feeding direct to overhead lines were usually more troublesome than those fed from transformers, especially where the latter had delta-connected secondaries. It had been found in cases where generators were operating in parallel that it might be of more advantage to earth the neutral of one than the other, according to which machine had the better balanced neutral.

On line and power systems as a rule only one earth connection was allowed upon each distinct circuit. In cases, however, where systems were extensive or different systems were interconnected it was desirable from the power undertaker's point of view to have more than one earthed point. Protective gear might be difficult to operate with only one earth on an extensive system. It was claimed that, although more than one earth would increase normal interference, it would reduce abnormal interference in the event of a lower main failing owing to faults.

Electric Tramway Systems.

Electric tramway circuits were usually unbalanced and resulting interference used to be greater than at present. Induction effects were produced by the motor on the car, this effect varying as the motor gathered speed, and also by the machine supplying current, the latter being the more troublesome. Probably the worst offender in electric tramway and railway systems was the rotary converter. Apart from improvements which might be made in design of rotary converters by adjusting pole gaps so as to throw harmonics out of phase and so tend to eliminate them, good results could be obtained by separation of sub-stations, shunting with a stand-by battery, or the use of a resonant shunt.

Electric Railways.

Interference had been experienced from both direct and single phase systems as both were usually unbalanced. The effect of single phase systems was especially disturbing to telegraph circuits, which were usually dependent upon a earth return. Some details of experience were given in connection with the direct current system of the City and South London Railway, the single phase Midland Railway and the London, Brighton and South Coast Railway, particularly with regard to the use of a resonant shunt to minimise interference with telegraph and the reduction of static effects by an earth wire between contact wire and telephone line.

The Cost of Interference.

Mr. BARTHOLOMEW gave some interesting figures on interference which had been experienced, limiting the rate of signal transmission on the submarine line to Sweden. The cause of interference was found to be the power main between Newcastle-upon-Tyne and Newbiggin-by-the-Sea. Arrangements for a single earth in place of two resulted in the possibility of 12 per cent. increase in rate of transmission and saved the installation of another cable which would have cost £250 000.

DISCUSSION.

In the discussion which followed speakers were unanimous in their hope and belief that such conferences as this would assist greatly to eliminate the many difficulties which had arisen through circuit interferences. As Mr. W. J. MEDLYN pointed out, the services of engineers in all branches were, to a large extent, interdependent and the ideal method of approaching any problem of this kind was first to seek the most economical solution and then to agree as to responsibility.

Pleas were made by Mr. T. E. HERBERT for more extensive use of oscillograph tests in power plant and by Prof. MILES WALKER for experiments which would give quantitive results of electro-static and electro-magnetic interference.

Mr. H. A. RATCLIFF was inclined to believe that much might be done by the replacement of old-fashioned overhead lines and earth returns by conductors paired in metal sheath multi-core cables. In his own experience of a telephone system operated in connection with power supply and totalling 100 miles of such cable, they had had practically no trouble. He stated that with regard to earthing points their 60 miles of 33 000 V cable would be in star-delta connection with earthed star point, but that protective gear could largely be operated by out-of-balance current without earth connection.

Work of the Post Office.

Mr. HERBERT and Mr. G. H. VAUGHAN gave some particulars of the work done by the Post Office engineers in endeavouring to reduce interference effects as, for instance, by careful balancing of capacity of cable length by length before jointing, and by revolving the overhead conductors either on the twist principle or on the American cross-over principle in which there was less danger of accidental contact.

Mr. A. B. FIELD, who deprecated the comparison of our troubles with those of the United States, "where they really have a telephone system," and Mr. R. TOWNEND gave some particulars of how far manufacturers had gone towards reducing the liability to interference, pointing out that, although the permissible limit of harmonics was agreed at 10 per cent., many manufacturers were working within 5 per cent. In the six-phase rotary converter the pole spacing suggested by Mr. Bartholomew was impracticable, but by proportioning of slots and the use of narrow slots tooth ripple had been reduced to one-half to 1 per cent.

After replying to the various points raised in the discussion, Mr. BARTHOLOMEW said that the 1 200-page book before him was composed of committee reports of troubles of one section only of the United States' systems, and urged that sympathetic consideration should be given from both sides in order to avoid the possibility of such chaos in the systems of this country.

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A 1 000 000 kVA Circuit Breaker.

The recent tests at Baltimore conducted to determine the rupturing capacity of oil-switches where powers of over 500 000 kVA at 13 200 V were interrupted, together with tests on switch contacts carrying heavy short circuit currents up to 100 000 A by Mr. Philip Torchio, have brought out a number of important points, which have to be watched in the design of high rupturing capacity breakers. They may be briefly summarised as follows :—

1. It is necessary to provide for freely venting large amounts of gases without at the same time throwing out large quantities of oil.
2. It is possible to design circuit breakers to rupture heavy powers repeatedly if a large amount of copper is provided in the arcing contacts, the condition of the oil not being so important a factor as hitherto thought.
3. The construction must be such that there is no deformation of such parts as tanks, top plates, leading out bushes, etc., due to the explosive forces set up on short circuits, the only depreciation imperative being at the arcing contacts and the oil.
4. Speedy arc rupture is essential. Given this it is shown that on a 25 cycle circuit the arc may be expected to go out in less than one cycle after the arcing tips part.
5. It is necessary that the contacts be of such a form that the passage of heavy short circuit currents will not produce arcing due to electro-magnetic repulsion before the operating mechanism has time to function.

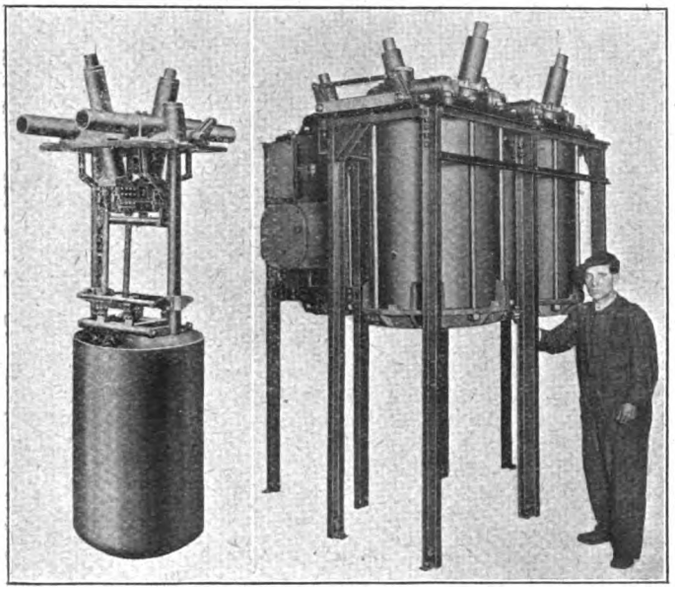

FIG. 1.—AUXILIARY BREAK CONTACTS IN CLOSED POSITION.

FIG. 2.—THREE-PHASE BREAKER FOR MANCHESTER CORPORATION WITH 1 000 000 KVA RUPTURING CAPACITY.

6. Provision must be made for so bracing the contact supports that distortion due to the repulsion of current carrying conductors is obviated.

It is claimed that all these factors have been taken care of in FERGUSON, PAILIN LTD.'s type "R" circuit breakers for high rupturing capacity, of which we give some details below.

From a comparison of the physical dimensions of the switch with others which have been operating for some time on heavy power systems it is estimated that the breaker is capable of breaking 1 000 000 kVA and is designed for various currents and pressures up to 2 000 A and up to 22 000 V. A typical three-phase electrically operated circuit breaker of this class is at present working in the Manchester Corporation Generating Station controlling a group feeder of 2 000 A capacity at 6 500 V and is shown in Fig. 2.

Circuit Breaker Details.

The circuit breaker has a large volume of oil, totalling 180 gallons per three-phase unit and permits a 28 in. head of oil over the arcing contacts thus subjecting the arc to a heavy hydrostatic pressure. The oil tanks are so arranged that any gaseous vapour is expelled through vent pipes provided for the purpose, suitable gaskets being fitted between the tanks and the top plates. These vent pipes, of which four are provided, are each 3 in. in diameter and are fitted to each tank, that is there are four vent pipes to each single-phase tank. These vents are of the liquid baffle type, so that any gaseous vapour can be immediately expelled by internal pressure while the emission of oil is prevented. The vent pipes can be connected a to common exhaust pipe system and non-return valves provided.

A separate oil tank is provided for each single pole unit. Each tank is a solid drawn steel cylinder with dome-shaped bottom. It is 24 in. in diameter and capable of withstanding 700 lb. per sq. in. pressure. The tank is carried on a flat bottom steel cradle, supported from the frame by eight 1⅛ in. diameter rods. A tank lowering device is provided to facilitate inspection of switch contacts. The top frame of each single-pole unit is a substantial dome-shaped steel casting. Hard-drawn high-conductivity tubes constitute the main terminals. They are carried through the steel base in condenser type bushings, no porcelain whatever being used in the construction of the switch.

Contact Design.

The fixed contacts are of the self-aligning finger type while the moving contacts are of "V" shaped section. This type of contact is eminently suitable for high rupturing capacity breakers, as on the passage of heavy short circuit currents the two fingers carrying current in the same direction are attracted to one another and increase, rather than decrease, the pressure of contact between the moving and fixed portion, thus preventing arcing before the operating mechanism functions. Fig. 1 shows the auxiliary break contacts in the "closed" position. When the main breaker is closing the auxiliary break contacts are closed against the action of two powerful helical throw-off springs, contained in the tubular steel guides seen in the illustration.

A very high speed of contact separation is obtained by means of an ingenious mechanism contained in the steel tube guides which superimposed the velocity of the main contact bar on to the velocity of the auxiliary break contact bar. This device in conjunction with the powerful throw-off springs and the quadruple series break enables a 36 ft. per sec. speed of contact separation to be attained. Retardation at the end of the stroke is obtained by allowing a quantity of oil to act as a cushion in the steel tube, thus preventing any shock to the mechanism. The oil for this purpose is automatically supplied from the oil tanks and requires no attention.

Prevention of Arcing.

Large arcing contacts, all of which are renewable are provided with a good mass of metal. This together with a high-speed separation of the contacts enables the breaker to cope with repeated faults. Owing to the disposition of the conductors leading to the arcing contacts a slight reactance is automatically introduced into the circuit before final breaking. The conductors inside the switch are strongly braced together with bakelite spacers so as to prevent any distortion through the repulsive forces set up when carrying short circuit current.

The breakers can be supplied for mechanical operation or electrical operation as desired. The whole of the link mechanism is contained in the top of the oil tank. The insulating material employed throughout in the construction of the switch is bakelite.

It will be noticed from the illustration that the three phases are mounted delta fashion. This was to economise space. Generally the three phases would be mounted in line.

Halifax Electricity Works Dispute.

In connection with the dispute now in progress between the E.P.E.A. and Halifax Corporation, a largely attended meeting of members of the E.P.E.A. was held on February 21st, under the auspices of the West Riding Section of the Association. Mr. J. W. THOMAS, assistant general secretary, urged that the reduction of salaries proposed by the Corporation was a matter for the employers' side of the National Joint Board. He claimed that it was no fault of the E.P.E.A. that the revision in salaries had not been completed owing to the deadlock which occurred on the Board last December.

The following resolution was carried :—"That this special meeting of the West Yorkshire section, including representatives of Barrow, Manchester and Sheffield, fully endorses the action of the Association in their defence of the members of the Halifax undertaking, and are prepared to give the Association and the members at Halifax active and whole-hearted support in resisting the attack on the salaries schedule."

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Advertising in the Engineering Press.

[FROM A CORRESPONDENT.]

Criticism is not a difficult art, nor is it always necessary. Few, for instance, will dispute the many faults of engineering advertising, and it is not needful therefore to catalogue them here. They may, indeed, be summarised very briefly—engineering advertisements in general do not *sell*, they merely *announce*.

Are They Intended to Sell?

Sometimes the reader is even uncertain as to whether they are intended to sell. I call to mind the full page announcements of a well-known electrical firm week by week in the technical papers. At the top in small type was the firm's name and address; below, an illustration; and below this, again, some dozen words detailing the several arrangements in which this particular apparatus could be supplied. Otherwise—vacancy. And this not from any lack of good points in the apparatus, but, it is to be supposed, from a mistaken sense of dignity. As well might their salesmen have been too dignified to do more than hand in their cards!

If an advertisement is to *sell*, then, a "selling point" or two is an advantage. They need not be packed too tightly, but the minimum number is one. Once that is accepted, advertising becomes more than a mere matter of space-buying and filling. Someone, in fact, must prepare the advertisements. And there's the rub—who?

The Refuge of the Incompetent.

Advertising has too often been either the refuge of the incompetent or the hobby of directors. It should not be a counsel of perfection to suggest that even in a comparatively small firm this important duty should be allocated to some responsible member of the staff who is in a position to devote a reasonable amount of time to its performance. Naturally, a thorough technical knowledge is of the first importance, and that will mean, more often than not, a correspondingly slight acquaintance with advertising. A man in such a position, undertaking the responsibility for advertising, but who either has not the time or lacks the inclination to make a proper study of the subject, will perhaps forgive elementary advice.

First as to media. Use the most careful judgment here, your own and that of your salesmen and business acquaintances. If your appropriation is limited, avoid the risk of "scattering" your appeal. Better have an advertisement fortnightly in five papers than monthly in ten. Very small spaces are not always economical. It would probably pay better to cut down your list still farther. Having settled on your scheme, give it twelve months to make good. Don't be tempted to withdraw prematurely, nor on the other hand to go beyond your schedule. Attractive opportunities will present themselves almost daily, but it is safer to stand by your first choice until you have tested it thoroughly.

Some Hints on Copy.

Then as to "copy." Let your "selling points" be facts and figures, not generalities. Your readers are engineers—they'll discount "efficient," but definite consumption and output figures will receive due attention. Make *one* point abundantly clear rather than try to give *all* the features: there's always next week. Don't tresspass on your reader's time: one hundred words is usually a large enough dose at a time. Finally, a word on style. Use short telling phrases in the best English at your command—and the simplest. Having written your "copy," choose a headline; you may reverse the process if you wish, but it isn't always advisable. The primary object of a headline is to attract attention, but it must attract the sort of attention which will compel a perusal of the text. Therefore it should be a pithy introduction rather than an irritating "catch" line. Above all, a headline should be comparatively short and in its right place—at the head of the advertisement.

Need for Good Arrangement.

So far the engineer may proceed without serious difficulty, but the best of "copy" will not redeem a poorly arranged or badly illustrated advertisement. Unless, therefore, he has some marked aptitude in this direction it is as well at this point to consider the merits of the advertising agent. Success in advertisement "layout" demands a thorough knowledge of advertising technique—typography, design, processes of reproduction, etc.—and unless the engineer is prepared to grapple with these subjects he had better consult an expert.

What an Agent is For!

The functions of an advertising agent are many and varied, particularly if he be of that modern variety, the "service" agent. Such an agent will, if you desire, supervise the whole of your publicity arrangements from beginning to end. That is to say, he will submit for your approval a suitable "scheme," write "copy" and prepare "layouts," despatch instructions to the various papers on the required dates, and finally check insertions and accounts. The agent's remuneration for these services will consist of (*a*) charges to his clients for the preparation of layouts and (*b*) his commission from the papers on advertising contracts.

The value of such a service to the engineer is not necessarily quite the same as to advertisers in other fields. For example, it has already been recommended that the engineer should prepare his own scheme and write his own "copy." Do both these things in consultation with an agent by all means, and so obtain the benefit of his expert knowledge, but remember that you are probably better able to judge technical media and to describe your own apparatus than he is. Avoid therefore the temptation to turn the whole business over to an agent. Again, the despatch of "copy" and blocks to the papers is a small matter to the engineering advertiser who is dealing with perhaps a score of journals, and there are actually certain minor advantages in dealing direct with the papers rather than letting the agent render this service.

The Agent and the Copy.

It is, however, in the matter of designs and illustrations that the agent can be of the greatest use to the engineer. Assuming that you have chosen an agent with engineering experience—and there are now several agencies numbering electrical or mechanical engineers amongst their principals or staff—give him a comparatively free hand. Do not hamper him with preconceived notions on a subject in regard to which you are a novice. Give him every help in your power—ideas, information, photographs, "copy" suggestions, and so on. And when criticising the results, remember that the technique of advertising is as serious a study as that of engineering.

In brief, then, buy your space through an agent, choosing one with technical experience. Arrange your scheme in consultation with him. Supply him with "copy" or the data from which to prepare it. Let him arrange the announcement in the most attractive way, and finally supervise yourself the whole thing. Your agent knows more about advertising than you, but not so much about engineering.

Standard Switches and Circuit Breakers.

In 1921 the BRITISH ENGINEERING STANDARDS ASSOCIATION issued specifications dealing with air break knife switches and circuit breakers for voltages not exceeding 660 V., but it has been found necessary to revise the sections covering the tests. As in the first editions, the specifications do not include switches or circuit breakers for use with series motors, circuits of high inductance or traction circuits, all of which may require a higher breaking capacity than is specified.

A distinction between an isolating switch, a switch, and a circuit breaker is laid down as follows: "An isolating switch is intended only for interrupting the circuit when there is no load-current. A switch is suitable for breaking a load-current; and a circuit breaker is suitable for interrupting abnormal conditions such as that of short circuit."

A number of terms used in modern switch-gear practice have been defined, and a series of standard sizes has been included. Dimensions of back connections and the distance apart of the stud centres of knife switches have been agreed.

Since it is not practicable to take out a complete range of tests on every switch or circuit breaker, the tests have been divided into two categories, *i.e.*, tests which are carried out on every switch or circuit breaker, and those which are carried out only on a switch or circuit breaker of a type.

Copies of the specifications, which are numbers 109 and 110 of 1923, may be obtained from the offices of the B.E.S.A., 28, Victoria Street, Westminster, S.W.1, price 1s. each net, post free 1s. 2d.

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The Maintenance of Voltage on a D.C. Distribution System by Means of a Fully Automatic Substation.

In the course of the discussion at Newcastle on Mr. P. J. Robinson's paper on "Automatic Substations," an abstract of which appeared in THE ELECTRICIAN for February 9th, Mr. H. W. CLOTHIER considered the apparent shyness of English engineers towards automatic substations was due to the prevalence of a.c. distribution. The comparisons of costs were favourable to the automatic substation because six men were a large number for the operation of a 500 kW rotary converter. A substation having a much larger plant capacity would not require any more attendants and their cost would therefore be more distributed. The essence of satisfactory operation of all automatic gear was good switch gear, and from this point of view the relays employed should be switchgear constructed relays rather than delicate instruments. Motor converters possessed several advantages over rotary converters or motor generators, as they could be started up without any fear of the polarity being wrong, and their self synchronising arrangements were more simple. High speed circuit breakers would play an important part in automatic substation equipment for the prevention of flashing over on the machine commutators.

The Cost Problem.

MR. R. D. SPURR agreed as to the utility of fully automatic substations, but said that in America, where they had been largely adopted, they were mainly used as booster substations to maintain a straight line voltage. He thought that they should be considered from this point of view rather than as a substitute for manually operated substations. Comparisons of costs were difficult. A single unit manually operated substation would be considered. Three units would probably be adopted to reduce the risk of shutdown because manual operation was not so fool-proof. He considered the authors maintenance figures to be high and thought it would be possible to run the manually operated substation with only one man per shift, provided he had no access to H.T. gear and had to report periodically. He had had satisfactory experience of many substations running under these conditions. For the protection of D.C. lighting circuits he regarded fuses as being more satisfactory than circuit breakers, because fuses always operated whether they had been inspected or not, whereas circuit breakers did not.

MR. W. T. DALTON suggested that the disadvantage of not being able to see what was happening in an automatic substation might be overcome by the use of a telephone, so that it would be possible to hear what was happening. He also inquired whether the varying climatic conditions met with had any effect on the operation of contactors and relays.

MR. W. H. LEESON said that in the case of manually opened substations when a circuit breaker came out on a short circuit or overload the operator could not tell whether the fault was cleared or not and would probably close up again on the fault, causing unnecessary wear and tear to the gear. This was eliminated by the automatic operation. With the reduced wear and tear, inspection would not be required so frequently, further the automatic operating gear enabled the machine to be controlled thermally rather than by the movements of an ammeter needle.

The Duties of Automatic Substations.

MR. F. A. ROSS said that analysing the question of automatic substations, they were required to do more than simply synchronise a machine and put it on load. They were required to anticipate intelligently the conditions both inside and outside the substation better and with more certainty than the average attendant. The majority of relays employed in automatic schemes were not sensitive instruments, but were really small contactors. It was necessary to reduce the work on the contacts of the sensitive relays as much as possible and this was frequently the reason for the introduction of intermediary contactors, which increased the apparent complication of the gear.

MR. H. B. POYNDER referred to the fact that in the event of a heavy short circuit the machine was shut down until visited by an inspecting engineer, and pointed out that in the case of traction work, which was really the main field for automatic substations, this would be impossible.

Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

THE ENGINEER'S CHURCH.

To the Editor of THE ELECTRICIAN.

SIR,—May I appeal to engineers and managers of manufacturing firms, whose offices are in Westminster, on behalf of Christ Church, Victoria Street, which owing to its situation has been well called the Church of the Engineers. The present edifice was built in 1843, and is on the site of a Chapel where, in 1649, Sir Robert Horley trod the stained glass of the windows underfoot, and called it "dancing a jig to Laud."

Milton was a parishioner and Dick Turpin lived in a court hard by, so that even before consulting engineers came on the scene, great and notorious men lived thereabouts. During the last twenty-five years the neighbourhood has changed from a residential to a business centre, and the Rev. P. T. R. Kirk, the present vicar, is following the practice of churches similarly situated, by holding regular weekday services at some of which addresses are given by prominent laymen.

The interior of the Church has not been renovated for very many years and it is especially in need of electric light to replace the present awful gas lamps, which disgrace a district where there are more electrical engineers to the square mile than anywhere else in the world. Also, alas! the heating apparatus is a coal heater and a smoke maker, both of which evils big engineer firms in Victoria Street know well how to cure.

Subscriptions are asked for the renovating fund, but as they are difficult to obtain these days, it is suggested that firms interested in electric lighting and heating, might subscribe in kind, for example, cables, fittings, lamps, heating boiler piping, etc. It is estimated that the electric lighting will cost £300. By making a first class job, engineers will be able to show clients how a church should be lighted and heated.

As a member of the engineering profession, I make a very earnest plea for this historic church. I think it is up to the engineers of Westminster to make it worthy of the rich city in which they do business.—I am, etc.,

E. KILBURN SCOTT.

London, N.
February 26th.

HIGH VOLTAGE POWER TRANSFORMERS.

To the Editor of THE ELECTRICIAN.

SIR,—The writer would like to correct the error given in your issue dated February 16th, 1923, *re* type of transformer. The words *practically all* British makers, etc., should have been mentioned, and not the words British makers, etc. The error would not have occurred if the writer had, at the time, remembered the origin of the Metropolitan-Vickers transformer manufacture.

Certainly British makers of transformers can turn out the shell type if required to do so, but the question was with reference to the "*concentration*" of manufacture.

Taking the American continent alone it is the writer's opinion (based on actual experience of this class of work in many parts of the world) that, for voltages at and above 60 000, the greater number of the *bigger transformer* installations of the past were of the shell type "pancake coil" design, with leads coming out at the top of the tank. Some twenty years ago the writer was installing (in U.S.A.) the shell type for 60 000 V service, and sixteen years ago he was installing them (in the other hemisphere) for 60 000 V operation.

The long-period good service (of the shell type) in all climates at all altitudes and for all characters of loads are sufficient recommendation. The writer has given this type just credit in his book "High Voltage Power Transformers."—I am, etc.,

London, N.10, WILLIAM T. TAYLOR.
February 24th, 1923.

Aluminium Facts and Figures.

The BRITISH ALUMINIUM CO. have sent us a booklet entitled "Aluminium Facts and Figures," which contains a large amount of information on this useful metal. In the electrical industry the use of aluminium is steadily increasing. We notice that one of the modern developments is the steel cored aluminium cable by the use of which the electrical properties of aluminium can be combined with the strength of steel. The book should find a useful place on the consulting engineer's desk.

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Mid-Lancs Electricity District.

Agreed Scheme Brought Forward at Inquiry.

The Electricity Commissioners, at Preston, on February 21st, resumed their inquiry into the joint scheme of Blackburn and Preston Corporations for electrical development in Mid-Lancashire under the Electricity Act of 1919. The scheme proposed a joint authority for the district. In opposition, Burnley and other municipalities proposed a joint electricity board with advisory functions only. The opening proceedings were reported in THE ELECTRICIAN last week, page 205.

Giving evidence on behalf of the Blackburn-Preston scheme, Alderman ASTLEY-BELL, cotton manufacturer, Preston, said they preferred a joint electricity authority to an advisory board because of the former's superior powers. In the present instance they were going to deal with considerable areas of undeveloped country. If he was informed rightly, a joint authority was the only authority with power to enter those undeveloped areas and lay mains. Preston Corporation was committed to an expenditure of £420 000. If there was an extension of 50 000 kW, the expenditure would reach £1 170 000. The Corporation had contemplated extensions, but if a joint electricity authority were established, the responsibility would pass to them.

Advisory Board or Joint Authority?

Sir JOHN SNELL, Chairman of the Commissioners, asked the Alderman which of the following alternatives he would support: (1) Establishment of an advisory board to ensure the construction of a transmission line between Blackburn and Preston, and the extension of the Preston station to 50 000 kW; or (2) the establishment of a joint electricity authority without the assurance of the construction of the transmission line or the extension of the Preston station?

Alderman ASTLEY-BELL said they considered the construction of the transmission line essential, and would support any authority that gave them that. He thought the time would come when the Preston station would be taken over by an authority. But the time was not yet.

Councillor HORNBY, cotton manufacturer, Chairman of Blackburn Electricity Committee, described the position of Blackburn, and said thirteen mills were already using electrical power, and they had eleven other applications from mills. In nearly 600 cases applicants were waiting to be connected up for domestic supply purposes. The demand had increased considerably since Whitebirk station was set up. Blackburn's undertaking had never made a demand on the rates at any time. The charges for electricity in the new scheme would be such as to make the scheme self-supporting.

A Mill Owner on Electricity in Cotton Mills.

Mr. WM. BIRTWISTLE, who admitted being the largest cotton manufacturer in Lancashire, said his mills were driven partly by electricity and partly by steam. If his applications to Blackburn Corporation were acceded to, his Blackburn mills would nearly all be driven by electricity. His experience of electricity for mills showed it had many advantages over steam. It was cleaner and ensured a bigger output. He looked forward to the time when all his mills would be electrically driven. He had found, where his mills were electrically driven, they were getting the same results from a 48-hour week as from the previous 55½-hour week.

Mr. JAMES A. ROBERTSON, consulting engineer, advisor to Blackburn and Preston with regard to the scheme, said the district was only partially developed, and it was more in need of a co-ordinating system than any other district he knew. Preston was the worst example with the sale of 24 kWh per head of population; Blackburn had 63 kWh; and Burnley 34, compared with 140 in Manchester, 140 in South-east Lancashire, 140 in Bolton (200 this year), 119 in Bury, and 170 in Rochdale. Accrington station ought not to be extended. There were no condensing facilities except by cooling towers, and the transport facilities were inadequate. He did not think Blackpool's station could be economically extended. It was better to deal with the district from one or two large stations.

Inter-connecting Cables.

Mr. ROBERTSON said it was proposed to have two cables between Blackburn and Preston, so as to effect economies in working and save capital expenditure by the provision of a stand-by at both stations; also to pass on energy generated at Preston to stations in the north-east district. There was also provision for cables from Blackburn to Accrington, and Accrington to Burnley. These formed the first part of the scheme up to 1926. The total cost of inter-connection was estimated on an actual tender to be £281 050, including £138 000, the price of the cables between Blackburn and Preston. The second part from 1926 to 1931 involved the laying of cables from Preston to Blackpool and Fleetwood, Burnley to Nelson and Colne, and Accrington to Rawtenstall. The Preston to Blackpool line was the longest transmission line in the scheme, and therefore required more justification. If a new station had been built at Blackpool, or the existing station were more favourably placed regarding condensing facilities, there would not be much case for the line. As things were, however, the balance was in favour of supplying current from Preston. He was strongly of opinion that the lines ought to be duplicated. The cost of the second part of the scheme was estimated at £338 215, making a total for the two of £619 265. Dealing with the cost of current in 1931, Mr. Robertson estimated the coal consumption at Blackburn at 2 lb. per kWh, at Burnley 1·9 lb., and Preston 1·75 lb. The difference in favour of Burnley was due to more natural condensing and more modern plant. That was estimated on a maximum load of 20 000 kW at Blackburn, 25 000 at Burnley, and 37 500 at Preston.

The Chairman said probably the Blackburn station would cost £33 2s. 6d. per kW, against Burnley's estimate of £14 5s., and Preston £14 3s. 6d.

Mr. ROBERTSON said Blackburn station was erected at a difficult time, after the armistice, when costs were heavy, but he believed it would justify its existence.

Dealing with Preston station, Mr. ROBERTSON said with the turbine sets working at the maximum in the enlarged station, 2 600 000 galls. of water per hour would be required from the river for cooling purposes. He considered the transmission line from Preston to Blackburn would be worth about £10 000 to £11 000 per annum to the two towns.

Details of the Agreed Scheme.

Before counsel for the Burnley scheme addressed the Commissioner, Mr. R. HARKER who appeared for the Blackburn-Preston scheme, intimated that there was a prospect of an agreed scheme being arrived at, and the inquiry was accordingly adjourned until February 26th.

Upon resumption, Mr. HARKER said the agreed scheme provided for the establishment of a Mid-Lancs Committee to include the county boroughs of Blackburn, Burnley, Preston and Blackpool, with various municipal boroughs and urban and rural district councils. The whole of the outstanding matters had been jointly agreed upon with the exception of one question, which was still the subject of negotiations. The new committee would appoint an inquiry committee consisting of the borough electrical engineers of Preston, Blackpool, Blackburn, Burnley, Accrington, Rawtenstall, and those of the Lancashire Power Co. and the L. M. and S. Railway to give advice and assistance, the scheme to become effective within two years. Proposals would be submitted to the Commissioners for securing the supply of current in any area within the district in which there was a reasonable likelihood of such supply being remunerative. The main provisions for the technical scheme were: For the generation of three-phase a.c., with a standard frequency of 30 cycles; for the transmission of electricity the standard pressure (between phases) in the case of main transmission lines 33 000 V, and in the case of secondary transmission lines 11 000 V and 6 600 V.

The exceptions to the standard three-phase, 30 cycle, alternating system are: Bispham, Blackpool, and Fleetwood Tramways, Preston Tramways, Lytham-St. Annes electricity supply operating on the direct current system; (2) Blackpool Corporation system operating at a frequency of 85 cycles; (3) the existing frequency at Blackpool will be supplied through frequency changers. All extensions will be carried out at the standard frequency of 50 cycles. The following generating stations will be continued under the new scheme: Accrington, Blackburn, Blackpool, Burnley, Colne, Darwen, Fleetwood, Nelson, Preston, Rawtenstall, and St. Annes. A new generating station will be erected in Burnley district either by the Corporation or by the Lancashire Power Co. The other stations will be closed down as required. Main transmission lines will be laid between Preston and Blackburn; Blackburn and Accrington; Accrington and Burnley; Burnley and Nelson; Blackpool and St. Annes. A scheme of control will be prepared by the Engineering Committee for approval.

Sir JOHN SNELL said the Commissioners were gratified that the authorities had been able to arrive at some agreement, and they hoped it would bring about an improvement and larger use of the supply of electricity in the area.

Additional Generating Plant.

Mr. A. COLLINS, financial expert, said the following additional generating plant was proposed to be installed:

	kW.	Capital cost. £
Blackpool	5 000	75 000
Fleetwood	1 000	14 000
Nelson	3 000	21 000
Preston New Station	25 000	430 000
Rawtenstall	5 000	30 000
Total	39 000	570 000

The agreed technical scheme was calculated to supply 130 million kWh before bringing in a new capital station at Burnley which would be built as necessity arose, after the requirements by 1926 reached 40 millions. The cost at Fleetwood was subject to future decision. The cost of transmission lines were: Blackburn-Accrington, £17 000; Accrington-Burnley, £26 000; Burnley-Nelson, £20 000; Blackburn-Preston, £87 000; Blackpool-St. Annes, £21 000; total, £171 000. Transference and switch gear was estimated at £102 000; and total capital outlay up to 1926, £843 000. Witness estimated the saving on plant at stations under this scheme would be £364 000 against which had to be placed £273 000, cost of transmission lines and transformers, or an actual saving of £91 000.

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Merchandise to Sell and Profit By.

In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

The "Bastian" to Oust the Gas Geyser

At a recent E.D.A. salesmanship conference, Mr. Beauchamp gave the audience much to think about when he made the sound declaration that the day of wailing that the hot water problem could never be dealt with electrically (efficiently and competitively, of course) was passed. He stated his opinion that it was not a problem to-day, and that in the future it would prove our salvation. Having thus cleared the air, we assume that contractors will accept the challenge and see to it that they secure more "hot water" jobs. To help them is the Bastian hot water tank, which we illustrate, and of which BASTIAN AND ALLEN have kindly supplied us with details.

The tank is made in heavy gauge hard-rolled copper, tinned inside, complete with electric heater, 2 ft. flexible tube, wiring and

HOT WATER—THE "BASTIAN" WAY.

various other sundries. Among the cardinal points of detail of these tanks three can be precisely put thus :—

1. No matter how rapidly or how slowly it is drawn off, the rate of feed and the heating effect are so proportioned that the water is always at the same even temperature of about 150° Fahr. 2. The tank is made in three sizes with a storage of scalding water of 5, 10 and 20 gallons respectively. 3. The rating is 75, 150 and 300 W respectively, and, it is claimed, that the cost per week at 1d. per kWh is 1s. 1d., 2s. 2d. and 4s. 4d.

A "Tricity" Device as a Wedge.

If we may take our cue from a recent salesmanship conference, we cannot display or describe too many small portable devices in

A "TRICITY" WEDGE.

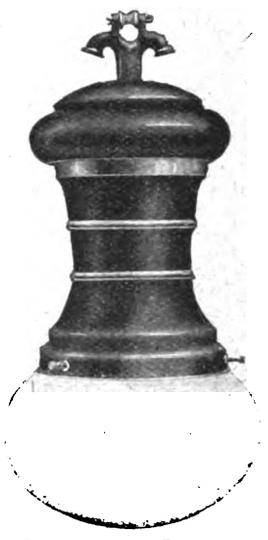
these columns. It was the unanimous opinion that, "getting in" with Mrs. Smith with an iron or a kettle, is but the thin end of the wedge, and that the "all-electric" house follows logically. Certainly an electric cooker results. Therefore, the best market for these "wedges" must be found. Not "best" from the point of view of profits, but from the broader view of what further business will be secured. The range of Tricity devices offered by the BRITISH ELECTRIC TRANSFORMER CO. comes under this heading.

We illustrate their No. 594 kettle, which has nothing in the way of characteristic design, but has a "homely" appearance, and for this reason is probably the best to use as a wedge. It is listed at 45s. in copper in the two-pint size with a 500 W rating.

The "E.W." Outside Lantern.

It is not the intention of these notes to give technical instructions to contractors as how to instal outside lanterns, but it is well within their purpose as a "Buyers' Guide" to emphasise one very important necessity when purchasing lanterns. Owing to the variations of dimensions in different makes of gas filled lamps, one necessity is a simple, yet positive, lampholder adjuster. Even if that possibility can be neglected there is the fact that if the lampholder attachment is a fixture a smaller or larger capacity lamp than standard cannot be used without trouble.

It is for these important reasons that we commend to the notice of buyers the lantern shown in our illustration, as it contains the adjustable lampholder carrier, which does not need any detailed description. The lantern is made of spun copper with oxidised and relieved finish. The suspension shackle is supplied complete, as shown. The lantern is known as the "G" pattern, and, using the adjustable lampholder carrier already described, it is suitable for gasfilled lamps of from 300 to 1 500 W. It is manufactured by ELM WORKS, and is distributed by factors.

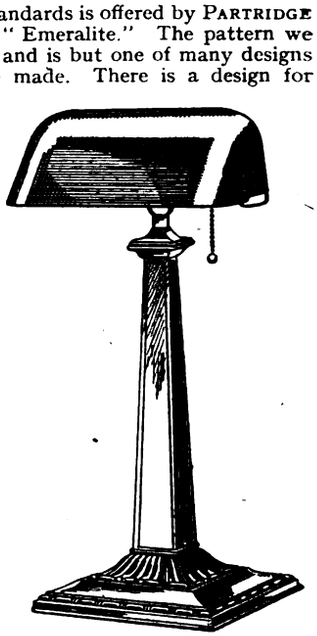


NEW OUTSIDE LANTERN.

"Emeralite" Table Standards.

A most compelling line of table standards is offered by PARTRIDGE & COOPER, the distributors of the "Emeralite." The pattern we illustrate is known as No. 8734AC, and is but one of many designs with which good turnover can be made. There is a design for practically every purse—certainly there are designs to appeal to the domestic field as distinct from the more commercial or office lighting field. It is accepted too readily that the only type of table standard for domestic lighting is the hackneyed "pillar" design with a silk shade. There is not enough flexibility of adjustment in such standards and silk shades as light reflectors are not to be considered. This requirement is essential for such situations as piano lighting and the design which we illustrate can be recommended for that purpose.

The "Emeralite" shade (adjustable to any angle by means of a clamp) is plated outside with a rich emerald green glass and the white opal lining is the necessary reflector. The metal work of all the designs is distinctive and the manufacturers have realised one particular necessity for table standards—a base well weighted and covered with good felt. Another characteristic is that all standards are supplied wired complete with a "pull chain" switch holder, flexible and adaptor.



A USEFUL READING LAMP.

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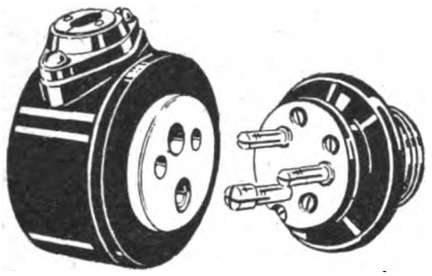
Something New from Simplex.

The great need of the electrical industry is to reduce installation costs, and any contribution helping to that goal must be given very close study. Every one responsible will agree, however, that unless low-priced installations are erected on sound mechanical and electrical principles, the ultimate effect upon the industry will be detrimental rather than beneficial.

It is pleasing to announce, therefore, the introduction of the Durex system of wiring by the SIMPLEX CONDUITS Co. This will make a strong appeal to all discriminating engineers on account of the sound principles incorporated in the design and construction of the component parts.

The conduit system is of general application, and is recognised by all responsible engineers as being the ideal system for almost every class of installation on account of the excellent mechanical



THE "DUREX" SOCKET AND PLUG.

protection it provides for the cables. Lead or lead alloy sheathed cables, however, owing to their comparatively low cost and ease of erection, may be employed to advantage in certain situations, but where they are liable to accidental or wilful damage additional protection is required. The use of the cab-tyre sheathed cables has proved satisfactory, especially in certain mills and chemical works where other systems have failed or given trouble. Although not so liable as lead sheathed cables to accidental or wilful damage, additional mechanical protection is sometimes desirable in certain accessible positions.

The Durex system embodies the advantages and eliminates the defects of this system of wiring by permitting the use of Durex durable metal-sheathed cables or Durex cab-tyre sheathed cables, whichever is the more desirable, and provides additional mechanical protection where they may be liable to injury. In the design of the component parts of the Durex system, practicability and technical merit have been considered of primary importance, yet the total erection and maintenance cost are claimed to be considerably less than for one on any other system.

The new booklet 963, just published by the Simplex Conduits Co., will give all who have to grapple with this problem of low installation costs most exhaustive information of the new system. We illustrate a Durex wall-plug, which is typical of the many accessories included in the system.

Sterling Value by the "Sterling."

The STERLING TELEPHONE AND ELECTRIC Co. recently published a list, No. 342, dealing with "wireless" receiving sets, and we believe it was thoroughly circularised to all on their mailing list. To those who did not receive a copy we tender the advice to secure one. To those who did receive the list (and also to those who now take our advice and obtain a copy) we suggest a careful study

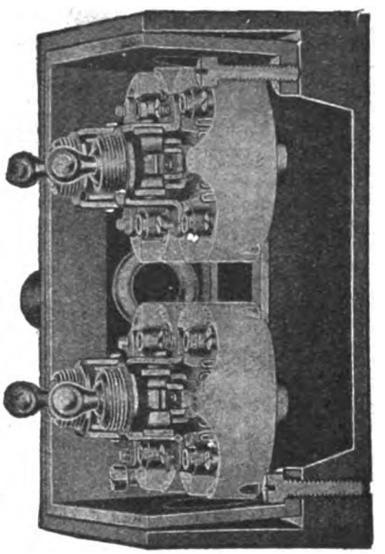
THE "STERLING" WIRELESS SET.

of its contents. It has always been the practice of the Sterling Co. to market apparatus of "sterling worth" and to build up to a standard—not down to a price. We have emphasised this point in our other notes on "wireless" sets, and we shall not hesitate to stress the point again and again. Already the "wireless" market is sinking in the quicksand of a mere price-cutting scramble. Therefore, the retailer will be wiser only to handle sets that are made up to a high standard.

The most popular type of receiving set is, of course, the crystal, and it is for this reason that the retailer should pay attention to our illustration. No useful purpose would be served by describing the technical details of "Sterling No. 1." It is fully described in the publication under notice, which also deals with "Sterling" valve-sets and the "Magnavox" loud speaker.

"Walsall" Adjustable Flush Switch.

The proportion of "flush jobs" to "surface jobs" is very small, and even new houses are being fitted with surface tumbler pattern switches. This is to be regretted, because the flush switch lends itself to artistic effects in switchplates, whereas the surface-

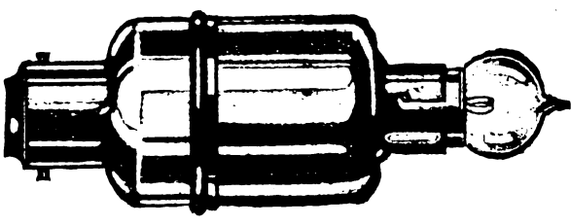


A FLUSH SWITCH THAT IS FLUSH.

pattern tumbler switch is limited to the simple but hackneyed plain cover, or even, if decorated, to a flat cover. The excuse generally put forward is the trouble and consequent labour charges in mounting flush switch with plates in hardwood boxes. The complaint is that, there being no adjustment once the switch is fixed, it makes a "tinker's" job. This trouble is obviated by using the adjustable flush switch-box, which we illustrate. As will be readily seen, the switches are fitted with a cradle, which is really a skeleton box, and fits exactly into the outer case. By a simple adjustment of two screw, the inner box can be extended ¼ in., and so can be made to suit the variation which usually occurs with plastered walls. The boxes are supplied in one-way, up to six-way, and are manufactured by the WALSALL HARDWARE MANUFACTURING Co.

An Electrical Night Light.

It is very unfortunate that the word transformer at once conveys a piece of apparatus far removed from the range of devices which would come under a merchandising programme for a retailer. Therefore the "All-nite-lite" should be sold as a night light and the technical word entirely forgotten. There is a very big field for an electrical night light, and for a.c. circuits the "All-nite-lite" will catch the trade. Briefly stated, the device consists of a small step-down transformer in a brass case equipped at one end with a



SOMETHING FOR THE NURSERY.

bayonet adaptor to fit into an ordinary B.C. holder and the other end to take a small 6 V 3 c.p. lamp. By the use of such a small lamp the needs of a dim light for the night nursery, sick rooms, porches, etc., are provided for. Those retailers who are able to cater for hospitals and hotels on a.c. circuits will at once realise that the "All-nite-lite" has hundreds of applications. The device is listed at 15s., and is stocked by all local offices of the BRITISH THOMSON-HOUSTON Co. in both high and low voltages.

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Local Exhibitions.

Successful Shows at Maidstone, Clacton and Hanley.

A successful electrical exhibition was recently organised by MAIDSTONE Corporation Electricity Department. Good business was done by local contracting firms, through whom the appliances are hired or purchased by arrangement with the Electricity Department. In addition, the following firms had stands:—General Electric Co., Jackson Electric Stove Co., Carron Co., Electric Suction Cleaner Co., Hotpoint Electric Appliance Co., Metropolitan-Vickers Electrical Co. The exhibition was organised by Mr. E. E. Hoadley, electrical engineer, and Mr. P. J. Fletcher, consumers' engineer.

The CLACTON Electrical Co., in conjunction with local firms, has just held an electrical exhibition in the town. The Electrical Co. gave wireless demonstrations, and a number of domestic appliances were sold.

One or two excellent electrical exhibits were included in the recent POTTERIES General Trades Exhibition at Hanley. The Staffordshire Electrical Accessories Co. showed all kinds of electrical appliances, and another good display on similar lines was made by Mr. H. W. Teeton, of Hanley. The Petter light and power plant and the Tricity cooker were in evidence.

MANCHESTER Corporation Electricity Department has had a demonstration house fitted up on the Catterick Hall Housing Estate. It contains everything in the way of domestic electrical appliances.

Old Finsburians and Old Centralians.

Combined Dinner in Manchester.

The Manchester local sections of the Old Finsburians and Old Centralians held a combined dinner, on February 16th, at the Grand Hotel, Manchester, which was attended by about fifty old students.

The chair was taken by Mr. A. G. Livesay (local chairman of the Old Finsburians), supported by Dr. E. Frankland Armstrong (local chairman of the Old Centralians).

Among those present were Messrs. W. M. Mordey (president of the Old Finsburians Association), A. C. Cookson (president of the Old Centralians), and Prof. W. E. Dalby (Dean of the City and Guilds (Eng.) College). Speeches were made by the above, and other old students, which included many interesting reminiscences of both colleges in their early days.

This was the first joint function of the Associations, and any doubts that may have been entertained with regard to the desirability of joining forces of these two local sections for such functions were entirely dispelled by the complete success which it attained. It has been agreed to hold at least one joint function annually.

Old students in the Manchester district who are not already aware of the existence of these local sections are invited to get in touch with either Mr. H. F. Coucher (Old Finsburians), 74, Victoria Road, Stretford, Manchester, or Mr. J. P. Clifton (Old Centralians), "Cargill," Springfield Road, Sale.

Ideal Home Exhibition.

Electrical Displays at Olympia.

Yesterday (Thursday) the Ideal Home Exhibition was opened at Olympia, where it will continue till March 24th. There is a good display of electrical exhibits, domestic appliances and wireless apparatus predominating. Fuller particulars will appear in subsequent numbers of THE ELECTRICIAN, but meanwhile we note that the following firms are among the exhibitors:—

C. H. Smith and Co., domestic electrical appliances. Stand 104.

Siemens Brothers and Co., wireless sets. Stand 26.

Hurley Machine Co., electric washing machines. Stand 71.

Western Electric Co., wireless sets. Stand 34.

Rogers, Foster and Howell, reaction wireless sets. Stand 13.

Sterling Telephone and Electric Co., wireless sets, loud speakers, etc. Stand 31.

Radio Instruments, Ltd., wireless sets, transformers, etc. Stand 41.

Northern Steel and Hardware Co., electrical appliances. Stand 102.

Igranic Electric Co., wireless sets, including transformer coils, etc. Stand 9.

"Twelt" patent candle tubes for electric candle fittings may be seen on Stands 13 and 120.

Books Received.

"Skinner's Cotton Trade Directory, 1923. (London: Thomas Skinner and Co.) Pp. cclvi. 1504. 12s. 6d. net.

"The Physical Society of London: Proceedings." Vol. 35, Part 2. February 15th, 1923. (London: Fleetway Press.)

"Science Abstracts: Sections A. and B. No. 302. February 25th, 1923. Issued by the Institution of Electrical Engineers, London. (London: E. and F. N. Spon.)

"Scientific Papers of the Bureau of Standards." No. 463. Preparation and Properties of Pure Iron Alloys. II.—Magnetic Properties of Iron-Carbon Alloys as Affected by Heat Treatment and Carbon Content. By W. L. Cheney. (Washington: Government Printing Office.) 15 cents.

British Science Guild.

Arousing Popular Interest in Research Work.

The LORD MAYOR OF LONDON presided over a meeting of the British Science Guild at the Mansion House on Tuesday.

Lord ASKWITH, President of the Guild, moved a resolution pledging the meeting to support the efforts of the Guild.

A letter was received from Sir JOSEPH THOMSON, regretting his inability to be present and expressing his desire to support the object of the meeting. The remarkable increase, he said, in the opportunities for scientific research which had taken place in the last thirty or forty years had not been accompanied by a proportionate increase in the means of bringing matters of scientific interest before the great mass of the people—the people who were not in touch with universities. If an interest in science were aroused in such people it would facilitate the passage of measures to promote the progress of science.

Messages were also received from Hfs MAJESTY THE KING and from Sir ALFRED YARROW, expressing approval of the Guild's objects.

Lord ASKWITH, in the course of his speech, said the distribution of knowledge was, perhaps, the phase of the subject at which that Guild particularly desired to work. Discovery had been endowed by such munificent gifts as those of the Rockefeller Institution and Sir Alfred Yarrow, and in other ways. At present scientific discoveries were going forward with giant strides, and it was all the more important that this country and Empire should have the knowledge quickly and be able to apply it and get it distributed.

Sir RONALD ROSS, in seconding the motion, said one of their main objects should be to promote in the public the spirit of science. The man of science had a big spirit, which remained in a state of doubt until proofs were forthcoming on one side or the other sufficient to turn the scale. That spirit was now being diffused by the British Science Guild, the Schoolmasters' Association and many of the newspapers. A great deal of pecuniary encouragement was now being given by Government to research. In all, the Empire was spending about a quarter of a million a year on the investigation of science, about a third or a fourth of the amount spent in the United States on similar work; but the laboratories upon which this money was spent were engaged upon direct operations, as disguished from inverse operations.

Sir JOSEPH COOK, High Commissioner for Australia, and Lord BLEDISLOE supported the resolution, which was carried unanimously.

N.A.S.E. Annual Meeting.

Inventions Committee Set Up.

The annual meeting of the NATIONAL ASSOCIATION OF SUPERVISING ELECTRICIANS was held on February 13th. Mr. T. H. WINDIBANK occupied the chair, and in his address complimented the members on the continued success of the Association as shown in the increasing membership.

The general secretary, Mr. A. BRAMMER, in presenting the annual report and accounts, said he was pleased to be able to present such a satisfactory statement, both from a financial and organisation point of view. The past year had seen many developments. District representatives had been appointed in various parts of the country, and a new district centre had been formed in Manchester, while new offices had been secured at 82, Victoria Street, S.W.1, to accommodate the increasing activities of the Association. The educational work had increased in volume and value, and was recognised as of great importance to the members and the industry. The Employment Bureau had been most useful, and had assisted many members during the slack periods.

The meeting decided to set up an Inventions Committee to assist members having inventions relating to the industry, and instructed the Board of Control to consider the question of a Special Benefit Section.

Electric Cranes.

Mr. C. H. Woodfield on Modern Hoisting Practice.

A paper was read before the Chelmsford Engineering Society on February 15th, on "Modern Hoisting Practice," by Mr. C. H. Woodfield. Mr. H. B. Tilley occupied the chair.

Mr. Woodfield said that cranes were one of the most useful pieces of machinery and one of the most frequently abused. The user knew that his crane had been tested with a greater load than that which it was designed to carry normally, therefore when he had an occasional big load, he took the risk and hoped for the best.

Mr. Woodfield described a portable joist of a very interesting type, to raise 15 cwt., to a height of 25 ft. It consisted of a tower-like structure up and down one side of which ran a projecting platform. The platform was raised and lowered by a small electric motor and could be made to throw off the load at any desired height. The top of the tower-like structure could be hinged down to allow the apparatus to pass through doorways.

The lecturer described various types of runways and cranes, starting with an old Dutch crane in which the load was lifted by a man climbing round in a tread wheel. Mr. Woodfield confined his remarks to electrically-driven cranes. In the discussion which followed the paper, he seemed to prefer the hydraulic crane from an engineering point of view, but said that the running expenses were twice as much as for an electric crane.

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North Western Centre Annual Dinner.

Dr. Ferranti on Trade Prospects.

The annual dinner of the NORTH WESTERN CENTRE of the INSTITUTION OF ELECTRICAL ENGINEERS was held on Friday last at the Midland Hotel, Manchester, a large company being present.

Dr. S. Z. DE FERRANTI, proposing the toast of the "City and Trade of Manchester," said that Manchester was now a very large engineering centre and was especially associated with electrical engineering, a fact of which the city should be proud. Taking as his text the fact that Manchester's electrical products went all over the world, he said that for trade to be successful, markets must be considered, and it was important that there should be a ready sale of products in order that Manchester might support its teeming population. In Manchester's own particular industry the market had failed owing to post war conditions, and they had therefore had to turn in other directions, and naturally looked to the British Empire to consume their products. Unfortunately some of the Dominion laws which were framed to favour the products of this country in reality gave preference to foreign countries, and as the colonies were likely more and more to manufacture their own goods he was not altogether optimistic about the future.

Mr. W. CLARE LEES, president of the Manchester Chamber of Commerce, in reply, said that the disturbed state of Europe was having a serious effect upon the cotton trade, not only through the breakdown of the direct market but indirectly through India. India used to pay for part of what she bought from this country by her exports to the Continent, and these exports had fallen to one quarter of their 1914 figures. The general effect of the changed conditions in the Indian trade could be expressed as a loss of two days a week in every mill in Lancashire.

The Universities and Electrical Engineering.

Sir HENRY MIERS, in proposing the toast of the "Institution of Electrical Engineers," said that Prof. Kapp had remarked that no profession had advanced so rapidly as electrical engineering because its theory was far advanced before it was put into practice. Practical electrical engineering was closely associated with theory and could be helped in the Universities by study of fundamental principles and by research. Sir Henry illustrated his contention that the harmony between theorists and practicians could not be too close by referring to the work of Osborne Reynolds, whose theoretical investigations had proved of such practical importance. He also pleaded for greater simplification in the published explanations of electrical matters, as laymen were puzzled by technical language. This simplification might be helped by the broadcasting of University lectures so that more use could be made of them. This would be specially useful in Manchester.

Mr. F. GILL, in reply, said that the Institution owed its thanks to Universities all over the country for their hospitality and encouragement. Referring to the growth of the Institution, he said that the increase in the number of members was causing problems with which the Council would have to deal adequately and wisely. It was obvious that as the Institution grew its activities could not be controlled from a central point. Already more than half the membership belonged to the local centres which had done excellent work, and this decentralisation was one of the ways of dealing with the growth. In the meantime all members must be as active as possible in helping the Institution.

E.P.E.A.

North Eastern Division Dinner in Newcastle.

The annual dinner of the North Eastern Division of the E.P.E.A. was held in Newcastle on February 23rd. The president of the division, Mr. A. W. Crompton, presided. The guest of the evening was Mr. W. J. Oswald, National President of the Association, who, in responding to the toast of "The Association," proposed by Mr. C. Turnbull (Chief Engineer, Tynemouth) referred to the fact that electricity was making inroads into every phase of life, surgery and science, commerce and industry alike, and was also speedily gaining ground in the domain of domestic life. It was, he said, the form of energy which was of the greatest use to mankind, and it was therefore essential that it should be produced at the lowest possible cost. The responsibility for this production rested largely upon the members of the Association.

The health of "The Industry" was proposed by Mr. G. L. Porter, and was replied to by Mr. J. Edgar (Chief Engineer, South Shields).

E.D.A.

General Meeting and Luncheon.

The annual general meeting of the BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION will be held at the Hotel Cecil, London, W.C., on March 16th, at 12 noon. It will be followed by the third annual luncheon at 1 p.m. Tickets for the luncheon, price 12s. 6d., may be obtained from the offices of the Association, 15, Savoy Street, London, W.C.2.

The annual dinner of the EX-BRITISH WESTINGHOUSE ASSOCIATION will take place on March 9th at the Holborn Restaurant, London, W.C. Mr. A. R. Dyer, chief officer, London Fire Brigade, will preside. Those who have not yet obtained tickets should write to Mr. L. S. Richardson, 14, Sydney Road, Richmond, Surrey.

Legal Intelligence.

B.T.-H. Patent Litigation.

Mr. JUSTICE ROMER, in the Chancery Division last week granted injunctions restraining the Brachelloyd Supply Co., of Worcester Street, Birmingham, from infringing patents owned by the British Thomson-Houston Co. for improvements relating to incandescent electric lamps and to improvements relating to evacuated vitreous containers having sealed-in conductors.

Unsuccessful Home Office Prosecution.

At Bath, on February 22nd, the Bath Electric Tramways Co. were summoned for having allowed a workman to use a portable electric lamp, of a pressure above 150 V, which was liable to become charged, and therefore contrary to the Home Office regulation.

Mr. JOSEPH OWNER, H.M. Inspector of Factories, of Bristol, explained the apparatus to the Bench, and a comparison was made with a standard safety hand lamp, the whole of the metal work of which was shrouded by a vulcanite covering.

HENRY WHITMORE, an electrician in the company's repair shop, said that the voltage of the mains in the repair shop was 550, and he described the method of getting a portable light.

CHARLES SHEPPARD, machinist in the company's employ, said when the inspector called he was working a shaping machine and had in use a portable lamp similar to the one described as being of the non-safety type.

Mr. W. F. LONG (for the company): You and the last witness appear against the company on subpœna?—Yes.

Have you ever made any complaints?—No.

The Inspector, Mr. Owner, giving evidence, described his visit to the repair shop, where he found the witness using a hand lamp devoid of any earthing arrangements. He also found that four 135 V lamps were in series and that it was possible for Sheppard to have received a severe shock if the metal work had become charged.

Mr. GILBERT SCOTT RAM, H.M. principal electrical inspector of factories at the Home Office, also gave evidence. The portable lamp in question, he said, did not comply with the regulations because the metal parts were not earthed. There was very grave danger to the person using it getting a shock if the metal work got charged. The lamp could be sufficiently earthed. He had had considerable experience during the last 18 years in dealing with electrical accidents and had investigated a number of fatal and non-fatal accidents dealing with lamps of a voltage parallel with this one. He had personally brought the requirements of the regulations before the notice of the general manager, Mr. Hardy.

Mr. LONG informed the Bench that for the past 12 months Mr. Hardy had been trying to find a lamp which would be satisfactory for his work and in accordance with the requirements of the Home Office. There had been no wilful intention on his part to sweep aside the regulation for the safety of his workmen. He asked for the summons to be dismissed because there was no evidence to show that the inspector saw Sheppard using the lamp and no evidence that the lamp was used at a pressure above 150 V.

The CHAIRMAN informed the inspector that what he had to prove was that the particular lamp which was in use was carrying a pressure above 150 V. Had he any witness he could call to prove it?—Mr. Owner went on to argue in respect of the circuit, but the Chairman said that in the opinion of the magistrates the summons referred to the lamp and not to the circuit.

After further contention on the point, the Chairman said that on the evidence given the case would be dismissed.

The inspector was given permission to appeal if necessary on the interpretation of the Home Office regulation named.

Municipal Contracts Going Abroad.

Deputation to the Board of Trade.

A deputation organised by the British Empire Producers' Organisation and including representatives of the principal manufacturing and producing associations of the Dominions and Colonies, National Union of Manufacturers, British Engineers' Association, British Electrical Allied Manufacturers' Association, and the Trade and Industry Committee of the Royal Colonial Institute, was received at the Board of Trade on Friday.

The deputation, which was introduced by Mr. Ben H. Morgan, chairman of the British Empire Producers' Organisation, urged the vital necessity of giving preference to British Empire firms and materials in all Government and public body contracts.

Sir WILLIAM JOYNSON-HICKS stated in reply that both the President of the Board of Trade and himself were in full sympathy with the object which the deputation had in view, and that the matter had for a considerable time received the careful attention of the Government, and particularly of the Cabinet Committee on Unemployment. A distinction must be drawn between the contracts placed by Government Departments or by local authorities in respect of works for which they received financial assistance from the State and contracts placed by local authorities or public utility undertakings not so assisted. In the former group of cases, the Government could lay down such conditions as they thought proper; as to the other cases, they could only make recommendations to the local authorities or companies concerned. The matter was undoubtedly one of great and immediate importance, and the representations made by the deputation would be given full weight.

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Imperial Notes.

AUSTRALIA.

Progress of the Electrical Federation.

The report submitted at the annual general meeting of the ELECTRICAL FEDERATION (VICTORIA) in December stated that marked progress had been made in the development of trade on sound commercial lines. The number of members of the contractors section had doubled during the past year, and the nominations in hand augured well for the success of the Federation. Prices for work were levelling themselves up. Mr. T. Malcolm Ritchie was elected president, Mr. L. G. Henwood, hon. treasurer of the Federation, chairman of the wholesale section committee, and J. L. Newbigin, chairman of the retail section committee.

Commonwealth Engineering Standards.

At the first meeting of the Main Committee of the AUSTRALIAN COMMONWEALTH ENGINEERING STANDARDS ASSOCIATION in December, the Chairman, Mr. G. H. Knibbs, said the demand of labour for a higher standard of living, the desire to reduce hours of work, and the policy generally accepted in Australia of stimulating industrial energy were factors which made it urgent that the engineering industries of Australia should introduce system into their methods of production. The Commonwealth was politically divided into six States, and conditions appertaining to any one State had developed without reference to those in other States. Specifications showed diversity as to quality of materials and the dimensions and preparations of manufactured goods. In order to compete with imported manufactures, every available means should be adopted to secure excellence and cheapness. Mutual concessions and the sinking of sectional interests were essential to the success of the movement. The Committee was particularly suited to undertake the conduct of the work, as its members were in constant touch with Australian engineering developments. Advantage should be taken of the experience gained and the results attained in other countries, particularly by the British Engineering Standards Association, some of whose standards might be adopted with little or no modification. Mr. Knibbs concluded by giving some particulars of the work done by the British Engineering Standards Association, the International Association for Testing Materials, and the American Society for Testing Materials.

INDIA.

Telephone Developments.

The Government of India have in hand an extensive scheme for connecting by telephone all the principal cities and commercial centres in India. The details of the scheme are not yet known. In this connection the progress already made in the Bombay Presidency by the Provincial Government may be mentioned. Bombay possesses TRUNK TELEPHONE LINES between Bombay, Broach, Surat and Ahmedabad, and between Bombay and Poona and Mahableshwar. Further extensions will shortly be made to the cotton-growing centres of Nagpur Dhulia, Akola, Amraoti and Indore. The line between Bombay and Ahmedabad (315 miles) has proved a complete success. The proposal is just put forward to extend the trunk line from Ahmedabad to Rajkot, so that there will be telephone communication between Bombay and the Kathiawar States.

NEW ZEALAND.

Extraordinary Fatal Accident.

An extraordinary fatal accident is reported from New Zealand which illustrates again how essential it is in handling high pressures to OBSERVE THE SAFETY PRECAUTIONS in absolute detail. A fuse had blown on an 11 000 V pole transformer station at Te Aroha and the lineman and his mate went out to replace it. The transformer is supplied by means of a throw-over switch from either of two 11 000 V circuits running across at the top of the pole station. The throw-over switch has a central dead position with a break of 9 in. from either set of jaws. The lineman unlocked the quadrant and opened the air-break switch, according to the evidence, to a distance of only about 4 in. instead of the full 9-in. break, and proceeded to climb from the platform to the fuses making contact with the dead 11 000 V leads. His mate beneath the platform then heard a discharge, and the lineman fell dead on to the platform. On removal of the corpse, the dead body of a sparrow was found beneath it quite warm, and with the beak and legs burned off. When examined, the connections below the throw-over switch were all dead and safe, and the deceased had not gone up within several feet of the live leads. Evidently the sparrow was killed simultaneously with the man, and the accident was apparently due to the sparrow having made connection across the half-opened air-break switch, the momentary arc through the sparrow's body being sufficient to cause the death of the lineman. Of course, there is a regulation that all h.t. conductors should be earthed before being touched, but like so many good regulations, it was not observed in this particular case.

Newcastle-on-Tyne Chamber of Commerce has submitted to the Lord Mayor a suggestion that on the occasion of his visit to Newcastle for the Royal Show in July the PRINCE OF WALES should be invited to inspect the electrical industries of Tyneside.

Foreign Notes.

EUROPE.

Siemens' Profits.

The net profits of the SIEMENS AND HALSKE COMPANY for last year are stated to be 158 000 000 marks, against 37 000 000 marks for the previous year, while the dividend paid was 80 per cent., against 20 per cent. The net profit of the Siemens Schuckert Company is 103 000 000 against 22 000 000 marks, the dividend being 80 per cent. against 16 per cent.

Swiss Railway Electrification.

The electrification of the SWISS STATE RAILWAYS will, it is believed, be finished by 1928—that is, five years earlier than was estimated in the scheme which was drafted in 1918. The electric system, which will cover 950 miles, involves the use of 400 electric locomotives. If the traffic reaches pre-war figures, over half a million tons of coal will have to be imported yearly.

The "George Montefiore" Prize.

A prize will be awarded this year by the Belgian "Association des Ingénieurs Electriciens Sortes de l'Institut Electrotechnique Montefiore" under the scheme instituted in memory of George Montefiore, the founder. The prize is awarded every three years for "the BEST ORIGINAL WORK presented on the scientific advancement of electricity and the progress in its technical applications in all fields." The competition is international in character, but manuscripts should be in English or French, and should be sent to the offices of the Association, 31, rue Saint-Gilles, Liége, not later than April 30th. The prize is awarded by a jury consisting of ten electrical engineers, five Belgian and five of other nationalities, and the jury may award the whole or part of the funds available. No competition was held in 1920, and the sum now available amounts to 21 000 francs. Full particulars may be obtained from Monsieur L. Calmeau, at the above address.

THE FAR EAST.

Chinese Electricity Schemes.

The SOUTH MANCHURIAN RAILWAY CO. have allocated various sums for expenditure during the year 1923–4 upon railways, harbour, mines, electrical work, iron and steel works, gas works, etc., amounting to 265 000 000 yen (£2 712 109). Of this sum 2 000 000 yen (£204 687) is to be spent on the extension of an electric power station, the construction of a power transmission line from Anshan to Liaoyang and the double tracking of about 11 miles of suburban railways in the vicinity of Dairen.

U.S.A.

General Electric Dividend.

A quarterly dividend of 2 per cent. has been declared by the GENERAL ELECTRIC CO. of America.

Parliamentary Intelligence.

Private Bills.

In the House of Commons on February 21st, the following private bills were read a second time:—Metropolitan Railway (Various Powers); Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board; Wimbledon and Sutton Railway.

The following were read a second time on February 22nd:—Birkenhead Corporation; Chesterfield Corporation; City and South London Railway; London County Council (General Powers); London Electric Railway; Maidstone Corporation; Nottingham Corporation; Potteries and North Staffordshire Tramways and Light Railways; Torquay Corporation.

Staff at the National Physical Laboratory.

In reply to Sir P. Newson on February 21st, Mr. E. Wood stated that in 1913-14 the Royal Society was responsible for the maintenance of the National Physical Laboratory, and received the following Treasury grants:—General grants, maintenance £7 000, buildings £5 000; aeronautics grants, maintenance £5 650, equipment £3 500; total, £21 150. The staff numbered 202, and cost £27 323. The sums received for services rendered, including payments by Government Departments, was £32 546. On April 1st, 1918, financial responsibility for the laboratory was transferred to the Department of Scientific and Industrial Research. In 1919-20, the staff numbered 544 and cost £132 744. The sum received for services rendered was £38 281, and the laboratory cost the Department of Scientific and Industrial Research £114 156. The estimated figures for 1922-23 were: staff 490, cost £145 500; cost of laboratory to department, £75 000.

Automatic Telephones.

Mr. Hurd asked the Postmaster-General, on February 20th, what progress he can report in the development of the automatic telephone system; and what is the anticipated saving in administrative costs?

Mr. N. Chamberlain: Sixteen automatic telephone exchanges are actually in operation. Six more are in course of construction and between 30 and 40 others have been authorised and will be installed when the necessary buildings have been provided for them. The savings to be anticipated depend on the proportion of local calls and other traffic conditions, and no general statement on this point is practicable.

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Electricity Supply.

Extensions and Developments.

TORQUAY Town Council has applied for a loan of £1 000 for mains extensions, etc., from time to time.

BARNSLEY Town Council has received the sanction of the Electricity Commissioners to loans of £5 000 for mains and services, £8 637 for plant and £1 500 for meters.

WINDSOR Town Council has accepted the offer of the Windsor Electrical Installation Co. for lighting 31 public lamps, each with two gasfilled lamps of 200 c.p., at £384 for one year.

LIVERPOOL'S electrical engineer, in a report to the Electricity Committee, states that as the Lister Drive power station is now practically complete it will be necessary to consider the question of providing for further extensions and possibly a new power station, but no provision for this is made in the estimates which have just been presented to the City Council.

The Cleaning and Lighting Committee of EDINBURGH Town Council has approved a scheme by the Lighting Inspector whereby increased lighting facilities will be afforded in Annandale Street during the periods exhibitions are being held in the new Industrial Hall. The Committee also agreed to light Dryden Street, Pilrig, with four 300 gasfilled electric lamps in place of the existing gas lamps, in view of the tramway depot line which is being laid down there.

Alterations in Charges, Proposed and Actual.

ST. PANCRAS Electricity Committee proposes to reduce the charge for power and heating from 1½d. to 1d. per kWh.

CHELSEA Electricity Supply Co. is to reduce the charge for lighting to 7½d. per kWh from the date of the meter readings for the March quarter.

BATTERSEA Electricity Committee recommend that lighting charges be reduced from 5½d. to 4½d. per kWh and for power (including heating and cooking) from 1½d. to 1¼d. per kWh.

As from the March quarter's meter readings, the following reductions are to be made:—HAMPSTEAD Corporation, Lighting from 7d. to 5d. per kWh; other domestic uses, including power, from 2d. to 1½d. per kWh.

STOKE NEWINGTON Borough Council is reducing electricity charges by ½d. per kWh as from the March quarter readings. This will make the lighting charge 5½d. per kWh and the flat rate for domestic uses 1d. per kWh.

A reduction of a halfpenny per kWh in the electricity charges has been decided upon by the BIRKENHEAD Electricity Committee. The present charge is 6d. for lighting in the borough on the flat rate system and 7½d. in the out-districts. This will make the charges the lowest in Merseyside boroughs, Wallasey being 6d., Liverpool 5·95d. for the first 3 000 kWh and 5·1d. beyond that consumption, and Bootle 5¾d. The pre-war charge at Birkenhead was 3d. per unit.

Charges have been reduced by the CITY OF LONDON Electric Lighting Co. as under:—Lighting: In each of the winter quarters 8d. per kWh for the first seven kWh per 30 W connected, and in each of the summer quarters 8d. per kWh for the first three kWh per 30 W connected, and 2½d. per kWh (instead of 4d. previously charged) for all energy consumed per quarter in excess of such quantities. Power: 1½d. per kWh consumed, and, in addition thereto, a fixed charge calculated at the rate of 10s. per quarter per kW of connected demand. Heating: 2½d. net per kWh.

CROYDON Town Council has reduced the charge for electricity for lighting on the flat rate from 10½d. to 7d. per kWh, and for heating from 2d. to 1¾d. For business premises, the fixed annual charge of £16 per kW has been reduced to £14 8s., plus 1½d. per kW, instead of 1¾d. For cinemas, the reduction is from 5d. to 4d. per kWh, and for power the running charge is lowered from 1½d. to 1¼d. There are also reductions for electricity supplied through one meter for lighting and heating, both as to the annual charge on rateable value and for electricity consumed. The latter charge is 1¼d. instead of 1½d.

Tapping New Areas.

A scheme to cost £12 000 has been approved locally for supplying electric light to MAESTEG and CAERAN.

LYDNEY Rural Council has consented to the West Gloucestershire Electric Power Co. extending their cables into the rural area.

CLITHEROE Town Council, on February 21st, decided to expend £100 to secure expert and technical advice regarding an electricity supply for the district.

Application has been made by the Derby and Notts Power Co. for a special order covering the supply of electricity for all purposes in Matlock and district.

A small local company, with a capital of £1 000, is being formed at MORETON-IN-MARSH for the purposes of installing a system of electric light for the town.

The West GLOUCESTERSHIRE Power Co. has asked the County Council to approve an order for authorising the distribution of electricity within the boundaries of the county.

WALLINGFORD Town Council has decided to offer no opposition, but to facilitate a private company, viz., the Crowmarch Mill Syndicate, in their application to instal electric light and power in the town and district.

Miscellaneous Supply Items.

RUGBY Urban Council has decided by seven votes to six to open a showroom and offices in connection with the electricity department in North Street. The proposal was opposed on the ground of municipal trading by the Builders' Association and the Chamber of Commerce.

An application by the STROUD Electricity Co. for powers to supply current throughout the rural district has resulted in a demand for a public inquiry at which certain objections by the local governing authorities might be heard. The desire is to safeguard the governing authorities' interest and to make sure that the company would supply the electricity required at a reasonable rate. The objectors are being generally supported by traders and others.

The LONDON County Council has agreed to a recommendation by the Special Committee on Electricity Supply that they be authorised to take action to secure amendments in the Draft Order of the Electricity Commissioners. This Order established the London and Home Counties Electricity Authority. The recommendation added:—"That the Council is not prepared to give any consent to the suspension of its existing purchase powers in regard to the undertakings of the London Electricity Supply Companies unless a satisfactory sliding scale of prices and dividends is first arrived at, and unless the Order is so amended as to vest in the Joint Electricity Authority, as distinguished from the local authority and company committees thereof respectively, more ample powers of control."

Obituary.

Arthur Martin.

The death is announced of Mr. ARTHUR MARTIN, who from 1892 to 1899 was the district manager at Liverpool for the National Telephone Co.

Percy Walkland Lambert.

After only two days' illness, Mr. PERCY W. LAMBERT died at Sheffield last week, aged 27 years. He was an engineering assistant in the Corporation Tramways Department, and local hon. treasurer of the E.P.E.A.

George Rigby.

The death took place on February 21 of Mr. GEORGE RIGBY, of Wigan. He was 44 years of age, and was a director of Hayes and Co., Ltd., electrical engineers. During the war he served in France and Italy with the Hon. Artillery Co. He was a prominent member of the Lindsay Lodge of Freemasons.

Henry Trowbridge.

In the death of Mr. HENRY TROWBRIDGE, which occurred at his home at East Ham, London, E.6, last week, after a somewhat lengthy illness, the India Rubber, Gutta Percha and Telegraph Works Co. lose another old member of their staff at Silvertown Mr. Trowbridge, who was born in 1863, was, during his 43 years' service with the company, connected chiefly with the electrical side of the firm's activities.

Personal Items.

Mr. HORACE BOOT has been elected president of the Institute of Arbitrators for the ensuing year.

The "South Wales News" states that Cardiff Wages Committee has recommended an increase of £250 a year in the salary of the electrical engineer, Mr. C. MORLEY NEW.

Mr. A. W. BLAKE, electrical engineer to Willesden District Council, has been granted five weeks' leave of absence. He is taking a complete rest owing to nervous exhaustion caused by overstrain.

Mr. W. J. LEEMING, formerly electrical engineer to the Buxton U.D.C., and latterly connected with Prangnell Partners, Newcastle-on-Tyne, has been appointed engineer at Stowe College, the new Public School.

Mr. THOMAS CLIMIE has been appointed chief electrical engineer at Falkirk, in succession to Mr. A. S. HUGHES, who has resigned on account of ill-health. The salary attaching to the appointment is £550 per annum.

Mr. WILLIAM S. JOHNSTON has been appointed engineer and manager of the Dumfries electricity undertaking, which the Town Council recently acquired. Mr. Johnston has for some time been manager of the electrical section of the Gretna factory.

Mr. H. LINCOLN, who is leaving Sheffield Corporation Tramways Department to take up the position of general manager of the Wallasey Corporation Tramways, has been presented by the Sheffield staff with a gold watch, and pieces of plate for Mrs. Lincoln.

Mr. C. H. YEAMAN, Stoke-on-Trent borough electrical engineer, is among the officers whose salaries have been revised by the Town Council. A minimum has been fixed of £800, rising to a maximum of £1 200 for the higher officers of the Corporation, with the proviso that the present salaries should be £1 000.

Mr. W. E. HARDY, manager and engineer of the Bath Electric Tramways, Ltd., took a prominent part in the effort made by the local Rotary Club to raise £1 000 for the unemployed. He arranged for an illuminated tram to tour the town each evening, and collections were taken by the tramway staff in carvival costume. The sum of £230 was raised as a result.

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Tenders Invited and Accepted.

UNITED KINGDOM.

DUNDEE CORPORATION.—Six tons of steel fishplates for tramway rails. Specification from the City Engineer, 91, Commercial Street, Dundee.

LEIGH AND ATHERTON JOINT SEWERAGE BOARD.—Motor-driven pump of 2 500 gal. per min. capacity. Specification from Mr. R. F. Greenhalgh, 30, Bolton Road, Atherton.

MERTHYR TYDFIL GUARDIANS. March 5th.—Electric fittings for six months. Tender forms from the Clerk, Mr. F. T. James, High Street, Merthyr Tydfil.

THRASHBUSH HOME, AIRDREE, March 5th.—Western Electric washer and wringer, wiring, etc.

BATTERSEA (LONDON) BOROUGH COUNCIL, March 8th.—1 800 kW rotary converter and switchgear. Specifications from the Borough Electrical Engineer, Lombard Road, S.W.11.

ISLINGTON (LONDON) GUARDIANS, March 8th.—Washing machine, belt-driven glad-iron, mangle, gas-iron and 15 H.P. Century (Swedish G.E.C.) motor, with starter, etc. Particulars from the Steward of the Infirmary, Highgate Hill, N., up to 11.30 a.m.

DOVER HARBOUR BOARD. March 8th.—Electrical sundries and cables for one year. Forms of tender from Mr. Rutley Mowll, Registrar of the Board, Castle Street, Dover.

STOCKTON-ON-TEES CORPORATION, March 10th.—Six months' supply of stores for Electricity Department. Forms of tender from the Borough Electrical Engineer.

SEVENOAKS RURAL COUNCIL. March 12th.—Wiring and fitting Council's new offices. Particulars from Mr. J. Prior, 1, The Paddock, Westerham.

SALFORD CORPORATION, March 12th.—Five low-type tramcars. Particulars from General Manager, Tramways Department, 32, Blackfriars Street, Salford.

PENSHAW (DURHAM) PARISH COUNCIL, March 12th.—Alterations and extensions of electric street-lighting. Particulars from Mr. J. H. Laws, Hodgson House, New Penshaw.

AYLESBURY CORPORATION, March 12th.—One year's supply of electric lamps, etc. Specifications from the Borough Engineer.

MANCHESTER TRAMWAYS COMMITTEE. March 13th.—Steel girder tramway rails. Specification from General Manager, Corporation Tramways, 55, Piccadilly, Manchester.

EDINBURGH CORPORATION, March 13th.—Two 4 500 kW three-phase (or single phase) transformers, to step up from 6 700 to 33 000 V. Specification (No. 46) from the Engineer and Manager, Electricity Department, Dewar Place, Edinburgh.

BIRMINGHAM CORPORATION, March 14th.—Construction of 600 yards of solid and 6 000 yards of double wooden sleeper track tramway. Specification from the City Engineer.

BRADFORD CORPORATION, March 17th.—800 tons of steel girder tramrails. Specifications, etc., from the City Engineer.

AUSTRALIA.

VICTORIAN ELECTRICITY COMMISSION.—Water-screening plant in connection with Morwell power scheme. Specification (No. 23/28) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2.

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, March 13th.*—305 000 dry cells (Schedule V 109).

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, March 27th.*—Underground and submarine cables (Schedule V 113).

COMMONWEALTH OF AUSTRALIA. April 10th.—Telephones and hand sets and switchboard cable. Specification from the Supply Officer, 101, Australia House, Strand, London, W.C.2.

POSTMASTER-GENERAL'S DEPT., MELBOURNE. April 24th.*—Switchboard cable (schedule V, 114).

NEW SOUTH WALES GOVERNMENT RAILWAYS AND TRAMWAYS DEPARTMENT. June 13th.—Two 20 000 kW turbo-alternators, with condensing plant and accessories, for White Bay power house, Sydney.

BELGIUM.

SCHAERBEEK MUNICIPALITY, March 13th.*—(1) Erection and equipment of h.t. distributor and transformer station; (2) electricity meters; (3) three automatic circuit breakers.

SOUTH AFRICA.

UNION OF SOUTH AFRICA POSTS AND TELEGRAPHS DEPARTMENT, March 21st.*—Dry cells.

JOHANNESBURG MUNICIPAL COUNCIL, March 27th.*—250 31-ft. steel tramway poles.

IRELAND.

POSTMASTER-GENERAL, IRISH FREE STATE, March 12th.—14 tons of bronze wire. Forms of tender from Mr. M. Dalton, Controller of Stores, G.P.O., Aldborough House, Dublin.

RUGBY URBAN COUNCIL have accepted the tender of the English Electric Co. for a set of liners for a Diesel engine, £154 10s.

The tender of Bertram Thomas for cable and switchgear for SHEFFIELD HEALTH COMMITTEE, at £551, has been accepted.

*Particulars from the Department of Overseas Trade.

BARKING DISTRICT COUNCIL have accepted the tender of the Union Electric Co. for cable for public lighting, at £188 12s.

For electric light and bell wiring and fitting at the natural baths, for BUXTON CORPORATION, the tender of Frank Craft, Ltd., has been accepted.

The tender of Babcock and Wilcox for water softening plant for ROTHERHAM CORPORATION Electricity Department, at £847, has been accepted.

The tender of Callender's Cable and Construction Co. for twelve months' supply of cables to WALSALL ELECTRICITY DEPARTMENT has been accepted.

The tender of D. Gamble and Co. for electric wiring and fitting of the infectious hospital extension at £220 has been accepted by BELFAST CORPORATION.

The tender of Gwynne's Engineering Co., £293, has been accepted by CROYDON CORPORATION for electric pumps in connection with water supply at Addington.

The BUSH TERMINAL CO. have accepted the tender of the Synchronome Co. for the installation of Synchronome electric clocks in Bush House, Strand, London.

The tenders of the Brush Electrical Engineering Co. for a turbo-generator, £11 400, and a frequency changer, £3 487, have been accepted by YARMOUTH CORPORATION.

SWADLINCOTE CORPORATION are recommended to accept the tender of Mather and Platt for an electric turbine-pump for Melton waterworks, at £764 2s., exclusive of cable.

The tender of the Sussex Electric Supply Co. for the electric lighting of the bandstand and shelter hall, at £178, has been accepted by LITTLEHAMPTON URBAN DISTRICT COUNCIL.

The UNDERGROUND ELECTRIC RAILWAYS CO. OF LONDON have placed with the Horsley Bridge and Engineering Co., contracts for two bridges at Golder's Green, amounting to £6 687.

British Insulated and Helsby Cables' tender (£7 395 15s.) for supply of four-core paper insulated lead-covered wire-armoured cable has been accepted by STOCKTON-ON-TEES CORPORATION.

Tenders accepted by SOUTHEND-ON-SEA CORPORATION include the following: Smith and Sons, electric crane, £1 100; F. T. Richard and Co., repairing and rearranging electric fittings, wires, etc., at the Cliffs Bandstand, £474.

Tenders accepted by BELFAST CORPORATION include those of the following firms, each for one converter: Metropolitan-Vickers Electrical Co., £8 195; English Electric Co., £8 091; British Thomson-Houston Co., £8 078.

The VICTORIAN ELECTRICITY COMMISSION have placed the contract for the first portion of the coal handling plant at Morwell with Gibson and Battle, of Melbourne. The plant comprised in the contact will be wholly Australian.

The following tenders are recommended for acceptance by EAST HAM CORPORATION: British Thomson-Houston Co., 10 tramcar equipments and spare parts, £5 213; Babcock and Wilcox, four chain-grate stokers for generating station, £2 340.

SALFORD CORPORATION have been recommended to accept the following tenders: Ferranti, Ltd., 100 kVA transformer, £153 19s. 6d. W. T. Glover and Co., e.h.t. and l.t. cable, £2 361 1s. 8d.; Metropolitan-Vickers Electrical Co., meter testing equipment, £485.

WIMBLEDON CORPORATION are recommended to accept the following tenders:—Metropolitan-Vickers Electical Co., switchgear in connection with 3 000 kW turbo-alternator, £512 10s.; J. Stone and Co., motor for sewage pumping station, £127.

The tender of Dean and Co. (lowest tender received) for electric light wiring and fitting at 20 Nottingham Place, and 19, Marylebone Road, £367 6s. 6d., is recommended for acceptance by the METROPOLITAN WATER BOARD. There were two other tenders, £397 and £468.

YARMOUTH CORPORATION have accepted the tender of the Equipment and Engineering Co. for 525 tons of rails at £9 8s. per ton, and 18¾ tons of fishplates at £11 per ton; that of Hadfields, Ltd., for 9 tons of tiebars at £16 per ton; and that of C. Richards for 3 tons of fishplates at £17 per ton.

The Foundation Co., New York, have the contract for the first of the three underground railways which are to be constructed in TOKYO at a total cost of £8 000 000. The contract, which has been placed with the Foundation Co. is on a cost plus profit basis and will amount to about £3 000 000.

Tenders accepted by GLASGOW CORPORATION include the following:—Pirelli General Cable Works, telephone and text cable; British Insulated and Helsby Cables, Ltd., globe strain insulators; Stewarts and Lloyds, trolley poles; F. Smith and Co., trolley wire; A. Herbert, hexagon turret lathe.

The following tenders have been accepted by BOLTON CORPORATION:—Drysdale and Co., electric pumps; British Insulated and Helsby Cables, Ltd., 12 months' supply of cables; British Mannesmann Tube Co., 220 tramway poles; Cargo Fleet Iron Co., 220 tons of tramway rails and 6 tons of fishplates.

GLASGOW TRAMWAYS COMMITTEE recommend the acceptance of the following tenders: North British Lifting and Moving Appliance Co., lifting gear for condensers; British Insulated and Helsby Cables, trolly bushes; Steel Company of Scotland, steel tyres; Western Electric Co., telephone cable; English Electric and Siemens Works Co., extra high pressure cable.

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Electric Traction.

Tramway Extensions and Developments.

Seven motions as to the advisability of extending EDINBURGH Corporation tramways came before the Committee last week. In view of the fact that the Corporation will not be promoting a Provisional Order until next November, it was decided to delay consideration of all the proposed extensions until September.

BELFAST Tramways Committee has appointed a sub-committee to deal with all matters arising in connection with the second section of the permanent way reconstruction. At the last meeting of the committee it was reported that grants under the unemployment relief scheme would cease on March 31st, 1924, and, in view of this, the chairman asked the committee to consider the question of taking in hand another section of the reconstruction work, which could be proceeded with concurrently with the present section, but by another contractor. The general manager was instructed to report upon this suggestion at the next meeting.

SALFORD Tramways Committee has introduced a new type of covered car into its service. It is designed for use on certain routes that are crossed by arches too low for the passage of an ordinary "double decker." The first car of the new type has proved quite satisfactory, and the Committee has been authorised to order five more cars of the new design for the same route. In appearance the new cars are not strikingly different from the old two-deck type. A special underframe allows the floor to be brought five inches nearer the ground than the floors of other Salford cars. The over-all height has been reduced without unduly limiting the headroom available for 70 passengers. The platform is, however, retained at the usual height, thus enabling existing gear to be used. The reduction of the wheels to a diameter of 25 in. is another factor in the design. Easier riding is promised by the inclusion of pendulum gears, which allow curves to be taken with a longer wheel base than is usually possible.

Fares, Receipts and Passengers.

Since April 1st, 1922, receipts on BRIGHTON Corporation tramways have totalled £109 024, as compared with £110 238 for the corresponding period twelve months previously.

The Mayor of HUDDERSFIELD has stated that it would be impossible to reintroduce the penny fare on the Corporation trams at present without making the undertaking a charge on the rates.

WOLVERHAMPTON Tramways Committee proposes to reduce fares, commencing at Easter. The 2½d. fares are to be reduced, it is stated, to 2d., and some of the workmen's fares are to be reduced.

The Tramways Committee proposes that the penny stages on the various BIRMINGHAM tramway routes be considerably lengthened, as from April 1st. In effect all the three-halfpenny stages will become penny stages.

During the past year the LEICESTER Corporation tramways undertaking made a profit of £42 000, and the Tramways Committee has decided to recommend the Council to allow the whole surplus being added to the reserve fund, which stands at £29 000.

BARROW Corporation electric tramways made a loss last year equivalent to a rate of 10d. in the £. It is estimated that the total deficit to be provided out of the rates will be £24 337, the estimated loss for the year being £19 672, to which has to be added the balance from last year of £4 665. The cost of working the undertaking for the year ended March, 1922, was £59 803, and the cost this year is approximately £49 458, a decrease of £10 345. There was a decrease in receipts this year of £12 571. The Committee are asking the Finance Committee of the Corporation to provide £15 000 for next year as there does not appear much prospect at present of reducing the loss owing to the large amount of unemployment in the town.

The total income of the NEWCASTLE Corporation tramways for the coming year is estimated at £550 400, compared with £551 400 estimated a year ago. It is anticipated that the present year's income (the year ends on March 31st) will fall short by £12 400 of the amount estimated. Working expenses for the coming year are estimated at £403 751, although this is a substantial reduction on the year now closing, for which £422 000 is set out as the total probable cost. The gross surplus is anticipated to be £146 649, as compared with £108 600 estimated a year ago, while after meeting various charges a net surplus of £49 767 is shown, as against £7 007 estimated twelve months ago, and £24 175 now "probable." A sum of £51 860 is expected to be spent out of reserve and renewals fund during the ensuing year, while that fund is shown to have a balance of £32 350.

Good Results from Electric Vehicles.

In the course of his annual report, Mr. William Kelso, chief sanitary inspector at PAISLEY, says that after having had a complete year's working experience of the two 2-ton electric vehicles, it can be stated with every confidence that they have given excellent results. Out of 306 working days, one of the vehicles worked 299 days and the other one 284 days. The time they were out of service was due to wear or breakage of certain working parts, and but for the delay in getting renewals of the parts required, the time lost need not have been more than half what it was. In any case it compares favourably with the time lost by horses from various causes. The most recent calculation shows that, allowing for all capital charges and working costs, they are collecting the refuse 2s. 1d. per ton cheaper than by horse haulage. As they collected 4 984 tons during the year, this is equal to a saving of £519 3s. 4d.

Electric Railway Items.

The South-Eastern and Chatham Railway Co. has reduced its estimate of the cost of ELECTRIFYING THE LINES within a 15-mile radius from £6 500 000 to £5 500 000. The higher sum included an estimate for the erection of a power station, which has been cut out by the committee in charge of the Trades Facilities Act, it being the opinion of that committee that it would be better to entrust the generation of power to the London Electric Supply Corporation, which has been done.

Speaking last week at the annual general meeting of the MERSEY RAILWAY Co., Mr. James Falconer said that in order to meet concentration of traffic, the signalling arrangements had been remodelled, so as to permit of a more frequent service of trains, and a system of automatic signalling was being gradually installed, similar to that in use on the London Underground Railways. The primary object of those new signalling arrangements was to increase the number of trains which could be run per hour, and when they were completed it was hoped the railway would be capable of dealing efficiently and safely with 35 trains per hour in each direction instead of 20 trains per hour under the old signalling arrangements

Wireless News.

The First "No Licence" Prosecution.

Action has commenced on behalf of the Post Office authorities against owners of wireless sets who fail to obtain licences for them. At OLDHAM last week, a defendant was fined 40s. and costs for this offence, his defence being ignorance as to the necessity of having a licence. It was explained that Post Office workmen were sent to his house to correct a fault in the telephone, and discovered a wireless earth wire attached to the telephone earth wire.

With regard to licences for home-made sets, it appears probable that the licensing fee for these will be raised to a guinea in order to compensate the British Broadcasting Co. for loss of revenue.

Moving Sets from Place to Place.

Wireless licensees have reason to be grateful to Captain WEDGWOOD BENN, who, in the House of Commons last week elicited the statement from the Postmaster-General that wireless sets may be moved temporarily from one address to another. The exact terms of Mr. CHAMBERLAIN's reply were as follows:—"A broadcast licence only covers the use of receiving apparatus at the address specified on the licence. I have no intention of prohibiting the removal of apparatus from one address to another, but, if the removal is other than temporary, the local post office from which the licence was obtained should be notified in order that the records may be amended."

The following is another interesting point embodied in a reply by Mr. CHAMBERLAIN last week:—"The issue of experimental licences, for which applications are being received in very large numbers from persons who do not appear to be *bona-fide* experimenters, is at present subject to some delay, but I hope to make arrangements which will obviate it."

Installation on Fishing Steamer.

The first of Fleetwood's fleet of 180 FISHING STEAMERS to have wireless telegraphy installed left port this week. The apparatus has a radius of 250 miles, which covers the distance to the fishing grounds, from which the steamer will report her catch to Fleetwood. The steamer carries a wireless operator, but eventually one of the crew will operate the instruments. The experiment is being closely watched by other fishing steamers.

Canada-Japan-Australia Station.

The Government has granted permission to the CANADIAN MARCONI Co. to establish a wireless station at Vancouver with a range of 7000 miles for the purpose of maintaining communication between Australia and Japan and Montreal.

Miscellaneous Wireless Items.

The National Government of the ARGENTINE REPUBLIC have authorised Senor Antonio Volpe to erect a wireless telegraph station at Laprida (Buenos Aires Province).

In the House of Commons on February 22nd, in reply to Captain Terrell, the Postmaster-General stated that the WIRELESS STATIONS at LEAFIELD and NORTHOLT were both now earning sufficient revenue to cover the cost of running the stations and meeting depreciation and interest charges.

An elementary lecture, intended for the Associates, has been arranged by the RADIO SOCIETY OF GREAT BRITAIN, and will be held at the Institution of Electrical Engineers, Savoy Place, London, W.C., on March 16th, at 6.30 p.m. The lecturer will be Mr. L. F. Fogarty, who will take as his subject "Accumulators, Dry Cells, and the Currents used in the Reception of Radio Telephony, illustrated by experiments."

Pantomime was broadcasted on Friday last for the first time. The occasion was the performance of "Cinderella" at the London Hippodrome by children, and the broadcasting was arranged by the British Broadcasting Co. in aid of the Variety Artists' Benevolent Fund. The GENERAL ELECTRIC Co. helped the Fund by inviting members of the public to listen-in at their offices. Appeals on behalf of the Fund were made from the stage of the Hippodrome.

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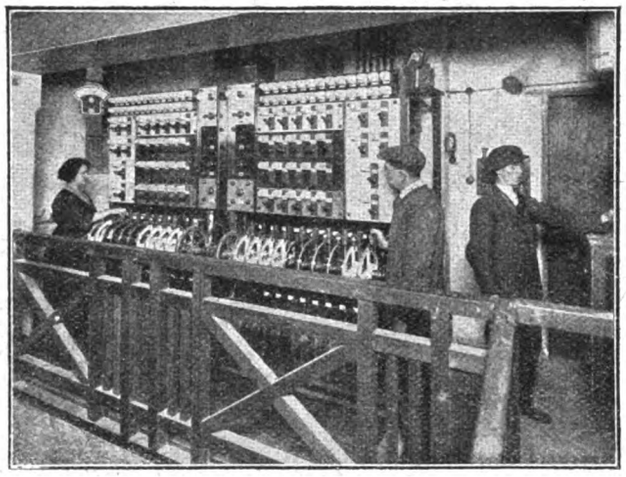
Stage Lighting.

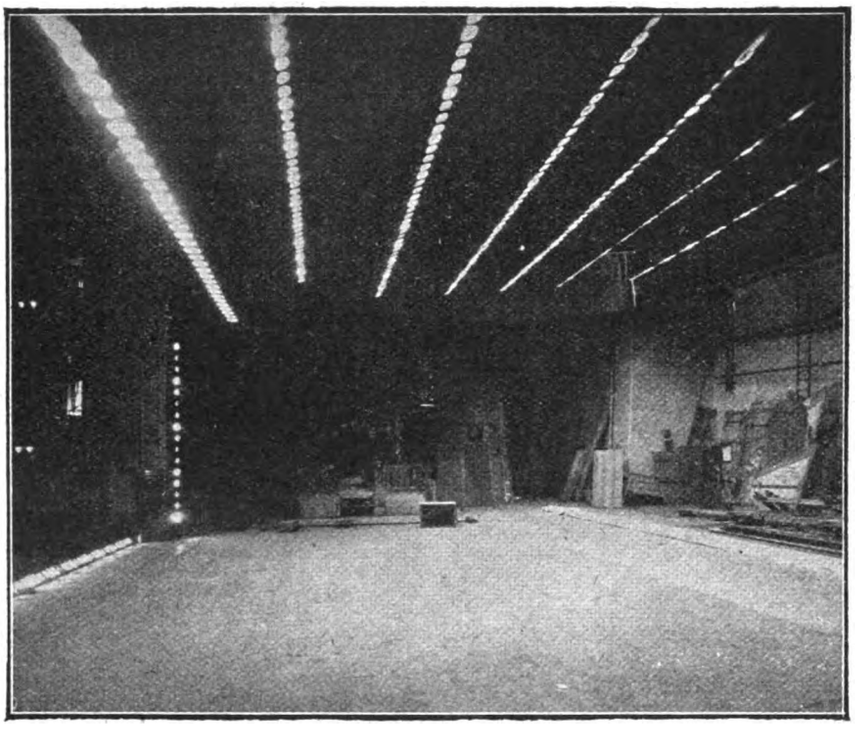
Blackburn-Starling System Installed at Edinburgh.

Some months before the recent visit of the British National Opera Company to the King's Theatre, Edinburgh, the management decided to re-organise the stage lighting, and the new system was ready in time for the first operatic performance. The lighting effects secured were audibly commented upon by the audience, and referred to with considerable awe and mystification by the newspapers. The new installation is on the "Blackburn-Starling" system.

Briefly described, the new equipment is a combination of three elements—the X-Ray mirror reflector, the Mazda gasfilled lamp and a metal framework to hold coloured gelatine slides. The required number of units, each consisting of a lamp, reflector and colour slide, are assembled in a specially-designed metal trough. The equipment is supplied in four different patterns, viz., concentrating battens, distributing battens, floats, and proscenium strips. The concentrating battens are intended for the intense illumination of particular sections of the stage. They are equipped with "Jupiter" X-Ray reflectors and with 100, 200, or 300 W Mazda gasfilled lamps. Using 100 W lamps, this form of batten gives a downward illumination of 1 000 c.p. per lamp. That is, a batten containing thirty 100 W lamps would project a light of 30 000 c.p. to the stage. For the general illumination of the stage, distributing battens, equipped with "Scoop" X-Ray reflectors and 100 or 60 W Mazda gasfilled lamps are recommended. Special "E.60" X-Ray reflectors and 60 W gasfilled lamps are used in the float and proscenium strip.



THE SWITCHBOARD.



SHORT EXPOSURE PHOTOGRAPH, SHOWING INDIVIDUAL UNITS.

STAGE LIGHTING AT THE KING'S THEATRE, EDINBURGH.

With the Blackburn-Starling system it is not necessary for the lamps themselves to be coloured in order to produce colour effects. These are obtained by the use of gelatine slides. Over the mouth of each reflector is fitted a sliding frame, in to which the gelatine is slipped, and it is an easy matter to change the colours about as desired. The footlight equipment consists of sixty-four 60 W Mazda gasfilled lamps, in "Scoop" X-Ray reflectors. The reflectors are fitted with removable colour mediums of four different colours—16 white, 16 red, 16 blue and 16 amber. A similar arrangement is fitted to the proscenium length, the small battens and the "Jupiter" batten.

Each of the four different colours in each unit is on a separate circuit running back to the switchboard and all lights can be "dimmed." The switchboard is arranged for simple and fool-proof control. The circuits for the different coloured lights are identified on the board by means of coloured slates. A collapsible iron gate (with lock) is fitted at each end of the gangway in front of the board and there is also a gate in the middle to prevent persons from handling both poles simultaneously. The tracker wires at the back of the board are, in the event of breakage, prevented from touching any live terminals by sliding grill doors running on ball bearings.

Further information on the subject of this system of stage lighting may be obtained from Blackburn, Starling and Co., Nottingham, who carried out the installation. The X-Ray reflectors, Mazda lamps and colour equipment used were supplied by the British Thomson-Houston Co.

Communism and Business.

A Lesson to be Learnt from last week's Debate.

Since the debate last week between Sir Ernest Benn and Mr. Newbold on Communism, we do at least know what Communism is. The Communist M.P. was driven to a confession which at the same time did him credit and exposed his case. He admitted that Communism as practised in Russia was undiluted despotism. The Kingsway Hall, with its 2 000 seats, was filled for the most part with followers of Mr. Newbold, and it was extremely interesting to the students of psychology to notice the grip which the leader had on his partisans. He told them in the bluntest manner that he would insist on "iron discipline," and his admissions of the failure of the representative principles in Communism were received by them with acclamation.

Communism was thus boiled down to the purest form of individualism—half a dozen strong wills in absolute control of the great Russian Empire and hoping to secure a still wider power. Private trade is declared to be a thing of the "accursed past," and is abolished. When as a result of this absurd procedure millions die, the private trader is reinstated, and the Communists are strong enough to enable them to take credit for this new development.

The business man must have come away thinking how fine it would be if there were more of the spirit of Lenin or of Newbold in business, the spirit which forces things through in face of opposition, and in face of difficulties, the spirit which determines at all costs to succeed, the spirit which is impervious to criticism and adverse opinions. If only, for instance, Lenin or, Trotsky, or Newbold had set up on their own account in the housing business, why, the world would be half full of houses to-day. Most of us, half-hearted creatures that we are, start our little schemes, meet with preliminary criticism, and then quietly drop them just as they are on the eve of success. We have not the courage to push things through—our hearts fail us at the critical moment. We are bound to feel rather ashamed of ourselves at the spectacle of half a dozen ruffians with the mad idea that they will boss the earth, men who have every conceivable opposition to meet, and still remain determined; men who will, no doubt, in due course, pay the penalty of their own criminal follies, and yet who do not flinch. If only those of us who are blessed with constructive tendencies had half the energy of the advocates of destruction, how fast the world would go ahead! But we must take a leaf out of the book of the Communists, and work on strictly individual lines.

It is now definitely known that the PRINCE OF WALES, on the occasion of his forthcoming visit to Birmingham and the Midlands, will formally inaugurate the new power station at Nechells.

The following are among the new guarantees under the TRADE FACILITIES ACT which the Treasury have stated their willingness to give up to December 31st last in respect of principal and interest: London Electric Supply Corporation (extension of power station at Deptford), £650 000 (25 years); Tata Power Co. (hydro-electric scheme in India), £850 000 (20 years); Oxford Electric Co. (extension of plant and mains), £25 000 (two years).

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Companies' Meetings, Reports, etc.

HALIFAX AND BERMUDAS CABLE CO.—Interim dividend declared on the ordinary shares of 6 per cent. per annum.

DIRECT WEST INDIA CABLE CO.—Dividend declared on the ordinary shares of 10 per cent. per annum, less tax.

BIRMINGHAM ELECTRIC SUPPLY CO.—Final dividend of 5 per cent., making 10 per cent., free of tax. Balance of £421 carried forward.

CLYDE VALLEY ELECTRICAL POWER CO.—Final dividend on the ordinary shares of 5½ per cent. actual, making 8 per cent. for the year.

SCOTTISH POWER CO.—Dividend recommended on the ordinary shares at the rate of 6 per cent., less tax, placing £4 000 to reserve, and carrying forward £2 498.

BROMPTON AND KENSINGTON ELECTRICITY SUPPLY CO.—Dividend on the ordinary shares for the half-year ending December 31st, 1922, at the rate of 1s. 6d. per share, less tax.

BRUCE PEEBLES AND CO.—Further dividend recommended of 2½ per cent. on the preference shares; dividend for the year on the ordinary shares at the rate of 10 per cent., plus bonus of 5 per cent., both less tax.

VICKERS, LTD.—Final dividends as under recommended for the half-year ended December 31st, 1922: 2½ per cent. on the preferred 5 per cent. stock, less tax; 2½ per cent. on the 5 per cent. preference shares, less tax; 2½ per cent. on the cumulative preference shares, free of tax up to 6s. in the £.

SMITHFIELD MARKETS ELECTRIC SUPPLY CO.—The net profit for 1922, after placing £4 500 to depreciation fund account and £2 000 to debenture stock redemption fund, was £8 900. To this is added £1 549 brought forward. It is proposed to pay a dividend on the ordinary shares for the year of 6 per cent., to place £2 000 to reserve fund, £3 000 to staff provident fund, and to carry forward £1 849.

ELECTRICAL DISTRIBUTION OF YORKSHIRE, LTD.—Net profits for 1922 were £14 419, compared with £8 086 for 1921, and £5 426 for 1920, and £2 724 was brought forward. A final dividend of 3½ per cent. is proposed on the ordinary shares, making 7 per cent., free of tax, for the year, adding £4 000 to the reserve (increasing that fund to £14 000), writing £258 off plant, and carrying forward £4 066. Authority to increase the capital is sought.

W. T. HENLEY'S TELEGRAPH WORKS CO.—As already announced, the dividend declared is 2s. per share, less tax, making 3s. per share for the year. The profit for 1922 was £249 352. Deductions for debenture interest, depreciation, etc., totalled £43 012, leaving £206 339, to which is added £260 244 brought forward, and £7 525 profit from realisation on investments. Income tax absorbs £18 620, £25 000 is placed to reserve, and £323 988 carried forward.

DAVIS AND TIMMINS.—Balance dividend proposed at the rate of 10 per cent. on the ordinary shares, making 8 per cent. for the year, free of tax, plus bonus of 17 per cent., free of tax. The total sum available is £54 573, made up as follows:—Profit for 1922, £12 860; brought in, £17 741; recovered in respect of E.P.D. and income tax, £23 971. £4 000 is transferred to general reserve, £4 541 to income tax, and £30 682 is carried forward, subject to Corporation tax.

MATHER AND PLATT, LTD.—Following the dividend announcement (10 per cent. for the year, plus bonus of 5 per cent., all tax free), it is announced that the net profit for 1922 was £365 535 (against £379 481), from which £53 694 (against £40 910) has been transferred to income-tax equalisation account. With £287 662 brought forward, there is an available total of £599 502. After transferring £200 000 (against nil) to reserve, a balance of £174 953 is carried forward.

The STOCK EXCHANGE COMMITTEE have granted official quotations to 224 135 £1 fully paid shares of Allen-Liversidge; £458 000 4½ per cent. redeemable debenture stock of the Central London Railway Co.; £2 750 000 4½ per cent. redeemable second debenture stock of the City & South London Railway Co.; 74 220 £1 fully paid ordinary, and 75 000 £1 fully paid 6 per cent. cumulative preference shares of the County of London Electric Supply Co.; £3 250 000 4½ per cent. redeemable second debenture stock of the London Electric Railway Co.; $2 000 000 common stock of the Manila Electric Corporation.

Electric Traction Companies' Results.

FIFE TRAMWAY, LIGHT & POWER CO.—Dividend on the ordinary shares at the rate of 8 per cent. per annum, less tax.

ABERDEEN SUBURBAN TRAMWAYS CO.—Profit for the year ended January 31st was £1 371, to which is added £2 028 brought forward.

TYNESIDE TRAMWAYS AND TRAMROADS CO.—Dividend for the past half-year at the rate of 2 per cent. per annum, less tax; £175 carried forward.

PAISLEY DISTRICT TRAMWAYS CO.—Dividend of 4 per cent. on the ordinary shares for 1922, and of 5 per cent on the cumulative preference shares. £8 610 carried forward.

MANSFIELD AND DISTRICT TRAMWAYS, LTD.—There is a credit balance for 1922, including £1 763 brought forward, of £17 694. Appropriated to contingency and investment reserve £1 255, and directors recommend dividend of 6 per cent. on ordinary shares, making 9 per cent. for year, less tax, carrying forward £1 362.

YORKSHIRE (WEST RIDING) ELECTRIC TRAMWAYS CO.—Net income for 1922, after providing for debenture interest, plus £4 230 brought in, was £52 953. Of this, dividend on preference shares took £10 235, purchase of funded preferential dividend certificates £14 958, renewals depreciation and reserve fund in lieu of accident insurance £23 537, leaving carried forward £4 222.

LIVERPOOL OVERHEAD RAILWAY CO.—There is a surplus on the year's working, after placing £5 000 to renewal fund and £400 to the contingent fund, of £4 385, leaving deficiency, after payment of debenture interest, of £2 639. Balance brought forward was £5 577, and £10 300 was received under Railways Act, thus enabling directors to pay 5 per cent. on preference shares, carrying £5 577 forward.

Midland Counties Supply Co.'s Capital Scheme.

To deal with current commitments, including the purchase of a large power station at Spondon, Derby, and to provide funds for the development pending in their undertakings, the directors of the MIDLAND COUNTIES ELECTRIC SUPPLY CO. propose an early issue of new capital. At the ordinary general meeting, held on Thursday, resolutions were submitted to increase the capital from £1 000 000 to £2 000 000, and to extend the borrowing powers of the company.

The net profit of the undertakings owned and operated by the company for 1922 amounted to £107 730. Of this £11 500 was appropriated to reserve in accounts of undertakings, and £96 158 has been received by company as interest, dividends and management fees. Balance at credit of profit and loss, including £2 440 brought in, was £93 689, of which loan and debenture interest, less tax, took £35 747, transferred to debenture redemption £11 278 and to general reserve £15 000, leaving £31 663. Directors propose dividend on ordinary shares for year at 5 per cent. per annum, less tax, carrying forward £4 007.

New Companies.

STEVENAGE ELECTRIC LIGHT AND POWER CO., LTD.—Private. Reg. Feb. 21st. Cap. £12 000 in £100 shares. To carry on the business as indicated by the title. Solicitors: W. Times, Stevenage.

CENTRAL ELECTRICAL ENGINEERS' ACCESSORIES SUPPLY, LTD.—Private. Reg. Feb. 22nd. Cap. £100 in £1 shares. To carry on the business as indicated by the title. Reg. office: 190, Bishopsgate, London, E.C.

PICKERING HART LIFT CO.—Private. Reg. Feb. 12th. Cap. £100 in £1 shares. General engineers, makers of electrical or any form of lift or lifting gear, and lift conversion sets, etc. Reg. office: Wenlock Road, City Road, London, N.

PRINCE'S ELECTRICAL CLOCKS, Ltd.—Private. Reg. Feb. 19th. Cap. £3 000 in £1 shares. Manufacturers of and wholesale and retail vendors of electric clocks, makers of scientific instruments and electric appliances, etc. Reg. office: 173, New Bond Street, London, W.

SHERBORNE ELECTRIC SUPPLY CO., LTD.—Reg. Feb. 5th. Cap., £15 000 in £1 shares. To carry on at Sherborne and elsewhere in Dorset the business of an electric supply company, and to adopt an agreement with Edmundsons Electricity Corporation. Reg. office: Greenhill, Sherborne, Dorset.

RADIAX, LTD.—Private. Reg. Feb. 9th. Cap. £500 in £1 shares. Electrical, general and motor engineers, manufacturers of and dealers in wireless and radio apparatus and components, electrical plant and machinery, etc. Reg. offices: 4, Percy Street, Tottenham Court Road, London, W.1.

CONDOR LAMPS (GREAT BRITAIN), LTD.—Private. Reg. Feb. 21st. Cap. £2 500 in £1 shares. Electricians, electrical engineers, manufacturers of, agents for and dealers in electric lamps, including metal filament, arc and half-watt lamps, dynamos, electroliers, etc. Reg. office: 60, Wilson Street, Finsbury Square, London, E.C.

E. H. MAISNER AND CO., LTD.—Private. Reg. Feb. 15th. Cap. £1 000 in £1 shares. To acquire the business of a manufacturer's agent carried on by E. H. Maisner, of 4, New Oxford Street, W., and to carry on the same and the business of gas, electric, lighting and heating engineers, etc. Reg. office: 4, New Oxford Street, London, W.C.1.

AUTOMATIC BURGLAR ALARM CO., LTD.—Private. Reg. Feb. 10th. Cap. £1 000 in £1 shares. To take over the business of an electrical, constructional, fire and burglars alarm engineer, contractor and dealer in machinery carried on by G. B. Carpenter, at 7, Finsbury Square, London, E.C. Reg. office: 7, Finsbury Square, London, E.C.

SOUTHERN REPAIRS, LTD.—Private. Reg. Feb. 6th. Cap. £100 in £1 shares. Manufacturers, inventors, designers and repairers of and dealers in internal combustion engines, hot air engines, steam engines, electrical and automobile accessories, batteries, dynamos, magnetos, etc. Reg. office: 115, Queen Victoria Street, London, E.C.

H.P. ELECTRICAL CO., LTD.—Private. Reg. Feb. 9th. Cap. £1 000 in £1 shares. To acquire the business of electrical, radio' and telephone engineers, suppliers and contractors carried on by F. Clayton, H. Partington, and H. J. Partington, at 25, Eccles New Road, Salford, as "Clayton and Partington." Reg. office: 25, Eccles New Road, Salford.

WIRELESS LIGHTS SYNDICATE, LTD.—Private. Reg. Feb. 5th. Cap., £10 500 in 10 000 ordinary shares of £1 each and 10 000 deferred shares of 1s. each. To acquire from Eugene V. Hayes-Gratze, certain inventions relating to wireless lights and signs, etc. E. V. Hayes-Gratze, 1, Gledhow Gardens, South Kensington, London, S.W., is managing director.

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INTERNATIONAL RADIO MANUFACTURERS, LTD.—Private. Reg. Feb. 16th. Cap. £5 000 in 30 000 preference shares of 2s. 6d. each and 50 000 ordinary shares of 6d. each. Radio and electrical engineers and manufacturers, makers of and dealers in all kinds of electrical apparatus, machines, accessories and goods, etc. Reg. office: 119, High Street, Merton, Surrey.

ELECTRO CHEMICAL MANUFACTURING CO., LTD.—Private. Reg. Feb. 6th. Cap., £400 in £1 shares. To carry on in the United Kingdom and elsewhere the business indicated by the title, and that of manufacturers of and dealers in wireless apparatus, electrical appliances generally for wireless sets, etc. Reg. office: 26-31, Eyre Street Hill, Clerkenwell, London, E.C.

INTERNATIONAL EXAPHONE CO., LTD.—Private. Reg. Feb. 20th. Cap. £1 000 in £1 shares. To acquire and take over all letters patent, rights and protections granted or to be granted to F. W. Hampshire in respect of exaphones, and to carry on the business of importers, exporters and manufacturers of, agents for and dealers in electrical instruments, etc. Reg. office: 24, The Strand, Derby.

LACLAND ELECTRIC MANUFACTURING CO., LTD.—Private. Reg. Feb. 8th. Capital, £1 000 in £1 shares. To adopt an agreement with J. E. Manes and D. Douët and to develop and turn to account the business of electrical engineers and manufacturers of wireless receiving sets and electrical equipment referred to in the said agreement. Reg. office: 429B, King's Road, Chelsea, London, S.W.

PRIOR'S TELEVISION (PARENT COMPANY), LTD.—Private. Reg. Feb. 5th. Cap., £100 in £1 shares. To acquire the interest of W. Prior and/or Mrs. Riley in all their discoveries, inventions and patents (when granted) relating to Selenium cells and to electrical matters, and particularly to telegraphy; to promote subsidiary companies, etc. Sec., W. Wrentmore, 108, Victoria Street, S.W.1, engineer.

ROBSON PALING AND CO., LTD.—Private. Reg. Feb. 21st. Cap. £2 000 in £1 shares. To acquire the business of electrical engineers carried on by H. Robson, trading as H. Robson and Co., at 16A, Oxford Road, Manchester, and the business of scenic artists carried on by H. Robson and C. A. Paling as C. A. Paling and Co., at 16, Oxford Road, Manchester, and to carry on the business of electricians, electrical and general engineers, scenic artists and contractors, etc. Reg. office: 16A, Oxford Road, Manchester.

SHAW ELECTRICAL TRANSMISSION CO., LTD.—Private. Reg. Feb. 7th. Cap., £1 050 in 1 000 15 per cent. cumulative preference shares of £1 and 1 000 ordinary shares of 1s. To acquire the letters patent in respect of an invention entitled "an improved arrangement of apparatus for the electrical transmission of power," to adopt an agreement with K. R. D. Shaw and to carry on the business of electricians, mechanical engineers, etc. Dr. K. R. D. Shaw is permanent director. Reg. office: 22, Frith Street, Soho, London, W.1.

BAYLISS, MARCH AND NEWEY, LTD.—Private. Reg. Feb. 21st. Cap. £2 500 in £1 shares. To adopt an agreement with H. March and W. Newey, trading as March and Newey, at 217, Holliday Street, Birmingham, electrical manufacturers, of the first part, F. C. Russon-Bayliss and J. B. Duddleston, trading as Bayliss Duddleston Electrical Supplies, at 24, Weaman Street, Birmingham, of the second part, F. W. Bayliss, of Russell Road, Moseley, Birmingham, of the third part, and V. Smith, of Primrose Cottage, Hampton-in-Arden, Warwick of the fourth part, and to carry on the business of manufacturing electrical engineers, etc. Reg. office: 217, Holliday Street, Birmingham.

Business Items.

Mr. R. J. RUSSELL has commenced business as an electrician at 12, Manor Road, Yeovil.

Mr. E. L. PALMER, of the Electrical Supply Stores, has opened new showrooms principally for wireless apparatus at 11, Fountain Street, Halifax.

The London office of the BRUSH ELECTRICAL ENGINEERING CO. is now at 88, Kingsway, W.C.2. This is also the registered office of the Company. The telephone number is Holborn 1220, and the telegraphic address is "Magneto, West Cent."

Manufacturers open to purchase quantities of pressed metal parts are invited to get into touch with the MIDLAND PRESSWORK CO., Far Gosford Street, Coventry. The firm has facilities for larger production than they are at present undertaking, and will be glad to quote for metal, fibre, etc., pressings for the electrical trade. They are at present engaged on large quantities of pressed parts for wireless apparatus.

The BRITISH ENGINEERING STANDARDS ASSOCIATION has issued a standard glossary of aeronautical terms. It can be obtained from the offices of the Association, 28, Victoria Street, London, S.W., price 1s. 5d., post free.

We have received from the RELAY AUTOMATIC TELEPHONE CO. a handsomely illustrated pamphlet dealing with the Fleetwood Exchange which we recently described in THE ELECTRICIAN. It should be in the hands of all those who are interested in this branch of electrical communication.

The ANNUAL REUNION DINNER of No. 4 Company, London Electrical Engineers, will be held at the Florence Restaurant, Rupert Street, London, W., on March 10th, at 7 p.m. Any member of the Company who have not received a notice are requested to communicate with Mr. Arthur E. Beach, Metal Works, Shawfield Street, London, S.W.3.

Europe's New Economic Centre.

British Manufacturers and Continental Trade.

When the "European Commercial" was established some months ago—an early herald of the better days already beginning to dawn on Europe—Vienna was chosen as it publishing headquarters in the belief that the process of European recovery would begin in Austria and gradually spread outwards. It was an act of faith and foresight which needed courage at the moment, but which already is being vindicated by the course of events. If it were only a coincidence, it would, indeed, be a happy coincidence that the stabilisation of the Austrian krone, one of the first signs of hope, should date from the first issue of the "European Commercial." Just as it used to be said that what Manchester thinks to-day, England thinks to-morrow, so it may be said now that what the publishers of the "European Commercial" saw six months ago, Europe—and the more far-sighted minds of America—see with ever-increasing clearness to-day. Austria, in a word, is to be the economic rallying point for Europe. If Austria marked the depth of the fall in European fortunes, it seems surely destined also to mark the starting point towards recovery. The geographical centre of Europe, it is the natural point to which the reconstructive forces in Europe are turning their sympathies, their hopes, and most of all their practical efforts. In years to come Vienna will have added to its brilliant past the fresh glory of being the foundation stone on which Europe's new future began to be rebuilt.

If the doubter should think this too romantic or premature, he may be directed to the most solid piece of evidence that could be required—the invitation this week by the Bank of England "at the request of the League of Nations, and of His Majesty's Government," for subscriptions to an issue of £1 800 000 of Austrian Government Guaranteed Treasury Bills. This sum represents Great Britain's portion of a total of £3 500 000 which is being raised this week in six European countries to meet Austria's more immediate financial needs. Arrangements have been or are in course of being made for similar issues in various continental countries—namely, £800 000 in France, £500 000 in Holland, £100 000 in Belgium, £200 000 in Switzerland, and £100 000 in Sweden. These amounts, together with the British issue, will make a total of £3 500 000, which is the amount of temporary accommodation that Austria needs, pending the flotation of a long-term loan of 650 million gold kronen (£27 000 000) as provided for in the League of Nations scheme for the rehabilitation of Austria. Not the least impressive feature of this plan is that the central banks of six European countries are co-operating in securing its success—the first occasion in history on which such institutions have joined in a collective effort. Nor are the participating nations limited to allies or belligerents. They include several neutrals, who, viewing the situation more calmly, see European salvation to be dependent on the re-establishment of international credit and commerce. Here, indeed, is a League of Nations of the most potent and practical order.

With such a spectacle before us nothing could be more tragic than that, while the far-sighted minds of Europe are fixed on the new future, our own leaders of industry should be blind to the high duties and the great opportunities awaiting them. Europe which needs our money to-day will need our goods to-morrow, is needing them indeed, even now. The crying need is for the British manufacturer to get busy in Europe, making Vienna his centre, and the "European Commercial" his medium. Years hence it will be our satisfaction to have pointed the way to success, still more to have helped the British trader to secure his share in it.

Institution Notes.

Under the auspices of the SCOTTISH ENGINEERS' ASSOCIATION, Mr. Robert B. Mitchell, electrical engineer to Glasgow Corporation, will deliver an address on the "Dalmarnock Power Station" in the hall of the Royal Philosophical Society, Glasgow, on March 8th. All interested are cordially invited.

The second annual Costing Conference arranged by the INSTITUTE OF COST AND WORKS ACCOUNTANTS will take place on March 9th, at the Connaught Rooms, Great Queen Street, London, W.C. Morning and afternoon sessions will be presided over by Sir Herbert Austin and Sir Max Muspratt, respectively.

The annual dinner of the NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS was held in Newcastle on February 23rd. Sir Archibald C. Ross, who presided, referred particularly to the importance of the Graduates Section and the investigations which were being carried out by the Institution as a whole. Amongst those present were:—Sir Archibald Ross, Sir Alexander Kennedy, Sir George Renwick, Sir George Hunter, Sir Alexander Leith, Prof. J. J. Welch, Mr. R. F. Hindmarsh, Mr. E. R. Newbiggin, and Mr. R. Archer Coulson. A conversazione and dance were held after the dinner, over 500 guests being present.

JOHN BARTHOLOMEW AND SON have issued a railway map of the British Isles showing the new grouping system, the lines of the four principal companies being indicated in different colours. It will be some time before the public become perfectly familiar with all the changes brought about by the new system, but this clearly printed map should help in their education. Its price on paper folded is 2s. 6d. net, on cloth folded 5s. net, and mounted as a wall map 10s. net.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

DAWSON, W. AND CO., 50, St. George's Road, Golders Green, electrical engineers. £28 19s. 6d. January 16th.

CLIFFORD, HOLLINGS AND CO., Market Place, Pontefract, electrical engineers. £29 2s. 2d. January 19th.

Deed of Arrangement.

SIMPSON, John William Edward, Glenathoil, Worcester Street, and Beavington Christopher George SMITH, The Cot, Pepper Hill, Worcester Street, trading at 112, High Street and Green Street, all Stourbridge, as SIMPSON AND SMITH, electrical engineers. Filed February 24th. Trustees, P. D. Folkes, 101, High Street, Stourbridge, C.A., and another. Secured creditors, £35; liabilities unsecured, £1 370; assets, less secured claims, £752.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

BERKELEY AND YOUNG, LTD. (late BERGTHEIL AND YOUNG, LTD.), London, E.C., dealers in electric machinery. Registered February 14th, debenture to bank; general charge. *Nil. December 31st, 1921.

CHIPPENHAM ELECTRIC SUPPLY CO., LTD.—Registered February 16th, £5 000 debentures (secured by Trust Deed dated January 29th, 1923), present issue £1 100; general charge. *£300. June 26th, 1922.

ELECTRIC WELDERS (LEEDS), LTD.—Registered February 19th, £400 debenture, to P. McC. Wilson, 22, Thornfield Road, West Park, Leeds, C.A.; general charge.

MELBOURNE ELECTRIC SUPPLY CO., LTD., London. E.C.—Registered February 16th, Trust Deed dated February 5th, 1923 (supplemental to Trust Deed dated January 31st, 1922), securing £300 000 debenture stock; charged on company's freehold properties in Australia, also general charge (subject to first and second debenture stocks). *£702 178. February 21st, 1921.

NEW BRITISH ELECTRIC SUPPLY CO., LTD., London, E.C.—Registered February 14th, charge to bank; general charge. *Nil. August 9th, 1921.

WHITSTABLE ELECTRIC CO., LTD.—Registered February 14th, £1 490 debentures part of £10 000; general charge. *£5 366 13s. 4d. December 23rd, 1918.

Satisfaction.

TEIGNMOUTH ELECTRIC LIGHTING CO., LTD.—Satisfaction registered February 21st, £3 500, registered July 14th, 1922.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-up.

STANDARD ELECTRIC SIGN CO., LTD. Order made February 20th.

Bankruptcy Information.

LETHERBARROW, Percy Charles, carrying on business as LETHERBARROW BROTHERS, 1, Church Lane, Banbury, in the county of Oxford, electrical contractor. Receiving order, February 21st. Debtor's petition.

Notice of Dividend.

ROLLINSON, Joseph Ernest, trading at Tavistock Chambers, Beastmarket Hill, Nottingham, electrical engineer. First and final dividend of 2s. 7d. per £, payable, March 5th, Bentinck Buildings, Wheeler Gate, Nottingham.

Bankruptcy Proceedings.

CONNOLLY BROS., LTD., insulated cable manufacturers and electricians, Vale Mills, Blackley, Manchester. Meetings of creditors and shareholders were held on February 21st, at the Board of Trade Offices, 33, Carey Street, W.C., in this compulsory liquidation for the appointment of a new liquidator in the place of Mr. J. M. Henderson, who has died since he was certified. The company was ordered to be wound up in July, 1919, and the statement of affairs filed in the liquidation showed ranking liabilities £17 906, and estimated net assets £17 442, after deducting £25 121 in respect of loans on debenture bonds, and £24 889 in respect of receiver's liabilities. The failure of the company was attributed by Mr. H. Connolly chiefly to severe competition, both at home and abroad. At the creditors' meeting Mr. Ian Henderson, son of the late liquidator and a partner in the same firm, was nominated to fill the vacancy, while the shareholders proposed that the Official Receiver should act as liquidator. It was announced that the difference of opinion must be referred to the Court which would make the appointment in due course.

STUART, Arthur Curtis, and PERRIER, Cyril, trading as the STEWART WIRELESS TELEPHONE CO., 109, Kingsway, W.C. The statutory first meeting of creditors under this failure was held on February 26th at Bankruptcy Buildings, Carey Street, W.C. The receiving order was made on February 12th on the petition of the Fellows Magneto Co., Ltd. The Official Receiver said that the debtor Stuart had failed to attend under the proceedings. The debtor Perrier had, however, stated that he was a British subject born in this country and came out of the army shortly after the armistice. For a time he was part proprietor of a night club in Shaftesbury Avenue, W.C., in connection with which he had a claim against a former partner for £1 200 which, however, he regarded as irrecoverable. Last year he became a partner with the debtor Stuart in the business of wireless dealers carried on at 109, Kingsway, and put into it capital to the amount of £200. The business was then financially in a bad way but he had promises of financial help from friends which he said constituted the inducement for him to join Stuart. The money was, however, not forthcoming and in November a private meeting of the creditors was held when a statement of the firm's affairs was submitted showing liabilities £4 000 and assets £350. Stuart did not attend that meeting but his uncle's representative was present and intimated that he was willing to provide £1 500 if the creditors would hold their hands. But it was found that Stuart had under-estimated the amount of the firm's liabilities with the result that the offer was not put to the meeting, while at an adjourned meeting it was resolved that the estate should go into bankruptcy. The meeting decided to leave the estate in the hands of the Official Receiver.

THOMAS, Frederick Harold, and EVANS, Walter Ernest, trading as THOMAS AND EVANS, Salubrious Chambers, Salubrious Place, Swansea, electrical engineers. The public examination of these debtors was held on Friday at the Town Hall, Swansea. According to the statement of affairs the gross liabilities amounted to £3 700 against assets of £466. Debtor Evans was questioned by the Official Receiver with reference to certain contracts, but he said they did not know whether a profit or loss had been made on these transactions. Takings declined in 1920 and they had recourse to moneylenders. No record was made in the books of borrowed money. Debtor stated that they continued trading in the hope that matters would improve. After further questions, the case was adjourned, the Official Receiver stating that the trustee wished to investigate certain matters.

Prices of Metals, Chemicals, etc.

TUESDAY, February 27.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£74 10 0	£2	—
Electro Wirebars ..	,,	£80 0 0	£4	—
H.C. Wire, basis ..	per lb.	11½d.	1/16d.	—
Sheet	,,	1s. 0¾d.	2d.	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 3½d.	1/16d.	—
Brass 60/40—				
Rod, basis	,,	7½d.	¼d.	—
Sheet, basis	,,	10d.	¼d.	—
Wire, basis	,,	10⅜d.	⅜d.	—
Pig Iron—				
Cleveland Warrants	per ton	£6 0 0	7s. 6d.	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 0 0	10s.	—
Lead Pig—				
English	,,	£30 10 0	£1	—
Foreign or Colonial	,,	£29 7 6	£1 2s. 6d.	—
Tin—				
Ingot	,,	£199 15 0	£6 10s.	—
Wire, basis	per lb.	2s 7½d.	⅛d.	—
Aluminium Ingots ..	per ton	£100 0 0	—	—
Spelter	,,	£36 10 0	15s.	—
Mercury	per bottle	£10 5 0	2s. 6d.	—

Sulphur (Flowers)—Ton £8 10s. *Sodium Chlorate*—Per lb. 2⅞d.
,, (Roll-Brimstone)—,, £8 *Sulphuric Acid* (Pyrites, 168°).
Copper Sulphate.— ,, £26 per ton, £7 10s.
Boric Acid (Crystals). ,, £55 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 4⅜d.; plantation 1st latex, 1s. 5⅛d. to 1s. 5⅜d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

188 855 QUASI-ARC Co. and A. P. STROHMENGER. Electric welding or fusion deposition of metals. (23/9/21.)
188 880 F. CHABLOZ. Adjustable electric lamp support. (6/10/21.)
188 881 IGRANIC ELECTRIC Co. (CUTLER-HAMMER MANUFACTURING Co.) Electromagnetic brakes. (7/10/21.)
188 884 E. H. CARDWELL. Electric ignition apparatus. (10/10/21.)
188 891 A. H. RAILING, C. C. GARRARD, P. H. COALES and S. DARBY. Supports for busbars. (12/10/21.)
188 893 BRITISH LIGHTING AND IGNITION Co., E. O. TURNER and E. B. TUPPEN. Switches. (12/10/21.)
188 895 A. H. RAILING, R. ORSETTICH, and A. E. ANGOLD. Brushholders for electrical machines. (14/10/21.)
171 678 AUTOMATIC TELEPHONE MANUFACTURING Co. Relay circuit arrangements (17/10/20.) (Addition to 123 053.)
188 907 H. A. THOMAS. Electric fly and insect killer. (22/10/21.)
188 918 T. S. TURNBULL. Electric-light ceiling fixtures. (26/10/21.)
188 924 H. G. SOUTHARD and V. W. MEAGER. Assembling and protecting electric wires for connecting commutator and ignition coils. (29/10/21.)
188 939 A. REYROLLE AND Co. and W. D. OWEN. Lightning or surge arresters. (7/11/21.)
188 943 POLLAK, J. E. (SIEMENS AND HALSKE A.-G.). Telephone instruments. (10/11/21.)
172 291 WESTERN ELECTRIC Co. Telephone receiver. (2/12/20.)
188 957 V. H. CRUICKSHANK. Electrodes or anodes in systems for the prevention of corrosion and scale formation in boilers, etc. (21/10/21.)
172 623 METROPOLITAN-VICKERS ELECTRICAL Co. Electrical measuring-instruments (7/12/20.)
188 970 W. G. MOORE. Instrument for treatment of the throat with rays from an arc. (30/11/21.)
188 975 R. AMBERTON. Electric control systems and switch mechanism therefor. (2/12/21.)
188 979 FERRANTI, LTD., and S. Z. DE FERRANTI. Supporting-devices for transformers, etc. (6/12/21.)
188 985 CABLE ACCESSORIES Co., F. H. REEVES, and A. CRAWFORD. Fuse boards. (9/12/21.)
188 996 WESTERN ELECTRIC Co. Telephone systems. (20/12/21.)
188 998 E. C. STRONG. Switches. (21/12/21.)
189 004 D. M. OSWALD. Lamp bulb fitting. (28/12/21.)
174 365 SIEMENS AND HALSKE A.-G. Telephone systems. (21/1/21.)

APPLICATIONS FOR PATENTS.

February 12, 1923.

4 066 E. S. WILDING. Wallplugs.
4 071 EFANDEM Co. and J. EATON. Batteries.
4 082 R. F. SPILLER. Keyboard for transmitting Morse code.
4 094 GRIERSON BROS. Electric junction boxes.
4 101 W. H. DERRIMAN and J. ROBINSON. Wireless systems and apparatus.
4 102 TELEPHONE MANUFACTURING Co. and R. L. MURRAY. Horns for sound projection, etc.
4 103 TELEPHONE MANUFACTURING Co. and R. L. MURRAY. Telephone receivers.
4 104 POPE'S METAALDRAADLAMPENFABR. Small glow lamps. (8/3/22 Holland.)
4 105 JUST-FILE IZZOLAMPA ES VILLAMASSAGI GYAR RESVENYTARSASAG. Electric lamps. (27/2/22 Hungary.)
4 106 H. L. HANNAFORD. Re-magnetising flywheel magnets of automobiles.
4 108 N. H. FLEMING. Electric signalling device for automobiles.
4 113 G. LATEUR. Motor starters. (16/6/22 France.)
4 121 W. G. MOORE. Electrodes.
4 123 BRITISH THOMSON-HOUSTON Co. Attachments for oil switches. (25/3/22 U.S.)
4 131 W. BARTEL and O. Happel. Cooling turbine-driven electrical machines. (20/12/20 Germany.)
4 139 W. DUBILIER. Connecting devices for radio receiving systems.
4 142 E. PFIFFNER. Electric condenser (10/2/22 Germany).
4 143 E. PFIFFNER. Prevention of marginal discharge in condensers. (11/2/22 Germany.)

February 13, 1923.

4 167 E. R. and J. H. HAZZARD. Wireless telephony.
4 173 BROOK, HIRST AND Co. and J. A. HIRST. Motor starters.
4 174 BROOKHIRST SWITCHGEAR, LTD., and A. C. LIVESEY. Automatic motor starters and controllers.
4 181 W. W. HACKETT. Masts for wireless aerials, etc.
4 185 ACCLES AND POLLOCK. Masts for wireless aerials, etc.
4 190 J. W. HANSON. Traction motor armature winding.
4 191 H. P. GIRLING. Electric stoves, radiators, etc.
4 197 J. E. SIDWELL, J. APPLEBY and A. CHARLES. Insulating electric fittings.
4 200 T. COOPER. Electric radiator.
4 202 E. C. FORSTER. Switches, cut-outs, etc.
4 231 H. F. TREWMAN. Telephone exchange apparatus.
4 243 SIEMENS BROS. AND Co., F. BAKER and E. A. PETITHORY. Telephones.
4 260 HIMMELSBACH GEB. AKT. GES. Parts for electric conductors. (10/7/22 Germany.)
4 265 L. C. PARTINGTON. Trolley wire suspension.
4 272 I. KAJINO. Micro-relays.
4 283 A. E. RICHARDS. Lock for electric globe and holder.

February 14, 1923.

4 297 S. A. FOX and C. H. OFFORD. Electro-mechanical apparatus for transmission of information, etc.
4 307 E. J. ATKINSON. Ionic valves.
4 333 A. E. THRESH. Electric semaphore signalling.
4 345 J. ERSKINE-MURRAY and C. SEYMOUR. Receiving apparatus for wireless telegraphy, etc.
4 347 H. C. TURNER, A. E. ANGOLD and A. H. RAILING. Automatic trip mechanism for circuit breakers.
4 354 METROPOLITAN-VICKERS ELECTRICAL Co. and T. W. ROSS. Protective apparatus for electric circuits.
4 355 E. Y. ROBINSON. Vacuum electric tubes.
4 357 BRITISH THOMSON-HOUSTON Co. Electron discharge devices. (28/2/22 U.S.)
4 363 C. H. F. MULLER. Röntgen tube apparatus. (22/1/23 Germany.)
4 371 RELAY AUTOMATIC TELEPHONE Co. Telephone systems. (22/2/22 Sweden.)
4 388 & 4 389 M. L. D. MCFARLANE and H. G. BARTHOLOMEW. Telegraphy, photography, etc.
4 393 IGRANIC ELECTRIC Co. (CUTLER-HAMMER MANUFACTURING Co.). Circuit controlling devices.

February 15, 1923.

4 430 R. A. MACAULAY. Switches.
4 440 H. B. SIKES. Loud-speaking gramophones for wireless telegraphy, etc.
4 462 M. ZEILER. Portable electric lamps.
4 474 METROPOLITAN-VICKERS ELECTRICAL Co. and D. R. DAVIES. Switches.
4 481 S. O. COWPER-COLES. Electrodeposition of metals.
4 482 H. ST. GANSON. Rendering weak currents effective to influence electrical apparatus.
4 493 ELLIOTT BROS. (LONDON) and W. PHILLIPS. Electric indicators and recorders.
4 502 C. FIRPO. Portable electric therapeutic apparatus. (24/7/22 Italy.)
4 506 W. E. GOMER and S. M. GREENING. Telephone receivers.
4 508 C. M. BOYCE. Terminals for electric conductors.
4 517 A. S. SALAS and I. HALL. Therapeutic devices for controlling electric circuits.

February 16, 1923.

4 518 F. A. PEREIRA. Wireless receiving apparatus.
4 524 IPSWICH INDUSTRIAL CO-OPERATIVE SOCIETY and A. GAMBLIN. Magneto conversion set.
4 540 J. A. GETTY. Adaptable electric fire.
4 545 T. F. WALL. Introduction of capacity effects in a.c. systems.
4 553 T. GREENWOOD. Incandescent lamps.
4 562 E. I. DAVID. Control of motor generators.
4 570 C. A. VANDERVELL AND Co. and P. J. BEDDONS. Electric starter for engines.
4 579 J. R. D. NORIE, G. DERHAM, C. B. MILLETT and C. H. T. PELMEAR. Electric lamplock.
4 584 A. C. MARK and J. W. GAYLOR. Transformers for wireless receivers.
4 586 J. B. BOLITHO. Electric contacts.
4 604 A. H. HUNT. Safety device for protecting valve filaments.
4 606 PHILIPS GLOEILAMPENFABR. Electric lamps. (17/2/22 Holland.)
4 610 J. WASS. Aerials for wireless telegraphy, etc.
4 613 M. BILLINGTON. Wireless apparatus.
4 617 J. W. BARBER. Wireless receiving apparatus.
4 629 GENERAL ELECTRIC Co., LTD. (TREUHAND GES. FUR ELEK. GLUHLAMPEN). Operation of luminous discharge tubes.
4 630 GENERAL ELECTRIC Co., LTD. (TREUHAND GES. FUR ELEK. GLUHLAMPEN). Electrodes for electric discharge devices.

February 17, 1923.

4 636 T. D. TAYLOR. Electric commutators for internal combustion engines, etc.
4 647 L. ETHERIDGE, J. A. BAKER and W. EDWARDS. Motor control.
4 667 G. E. MALLETT. Crystal holder for wireless telephony.
4 680 B. E. D. KILBURN (NEDERLANDSCHE THERMO TELEPHOON MAATSCHAPPIJ). Multi-core cables for high frequency telephony, etc.
4 682 G. M. BLACKSTONE and E. and F. CARTER. Impulse starter for magnetos.
4 683 A. N. PENMAN and D. SMITH. Plug and socket connections.
4 694 H. GARDE. Switches.
4 697 P. E. WELLS. Condenser of variable capacity.
4 704 GENERAL ELECTRIC Co., LTD. (TREUHAND GES. FUR ELEK. GLUHLAMPEN). Electrodes for electric discharge devices.
4 708 G. C. BARCLAY and H. T. CRIPPS. Radio telephone receiving apparatus.
4 713 A. C. DAY. Switch mechanism.

Arrangements for the Week.

FRIDAY, MARCH 2nd (To-day).

ELECTRICAL POWER ENGINEERS' ASSOCIATION (SOUTHERN DIVISION).
7 *p.m.* At the Institution of Electrical Engineers, Victoria Embankment, London. Lecture on "High Power Mercury Arc Rectifiers, with special reference to Traction Service," by Mr. R. L. Morrison.

JUNIOR INSTITUTION OF ENGINEERS.
7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette entitled "Glass-forming Machines," by Mr. C. Saxton.

BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION.
7.30 *p.m.* At Caxton Hall, Caxton Street, London, S.W.1. Salesmanship Conferences. Lecture on "The Industry, the Press and the Public," by Mr. A. Gowans Whyte.

SATURDAY, MARCH 3rd.

INSTITUTION OF CIVIL ENGINEERS.
Students' Visit to Marconi House.

MONDAY, MARCH 5th.

INSTITUTE OF TRANSPORT.
5.30 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Lecture on "The Operation of a Railway-owned Port," by Mr. G. S. Szlumper.

INSTITUTION OF ELECTRICAL ENGINEERS. (WESTERN LOCAL CENTRE.)
6 *p.m.* At Merchant Venturers' Technical College, Unity Street, Bristol. Joint Meeting with I.P.O.E. Lecture on "Long Distance Installations," by Mr. E. H. Shaughnessey.

INSTITUTION OF ELECTRICAL ENGINEERS.
7 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London. Discussion on "Control in Industry" opened by Mr. J. H. Parker.

BRADFORD ENGINEERING SOCIETY.
7.30 *p.m.* At the Technical College, Bradford. Lecture on "Recent Developments in Connection with Waste Heat Recovery for Steam Raising Purposes," by Mr. W. Gregson.

TUESDAY, MARCH 6th.

ELECTRICAL SOCIETY OF GLASGOW.
7.30 *p.m.* Lecture on "Electric House (Practical Results)," by Mr. R. Hardie.

WEDNESDAY, MARCH 7th.

INSTITUTION OF ELECTRICAL ENGINEERS. (WIRELESS SECTION.)
6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London. Lecture on "Development of High Power Valves," by Mr. H. Morris-Airey.

INDUSTRIAL LEAGUE AND COUNCIL.
7.30 *p.m.* At Caxton Hall, Caxton Street, London, S.W.1. Lecture on "Control of Industry," by Mr. A. Dalgleish.

THURSDAY, MARCH 8th.

ROYAL INSTITUTION OF GREAT BRITAIN.
3 *p.m.* At Albemarle Street, London, W.1. Lecture on "Water Power of the Empire" (Lecture II), by Mr. Theodore Stevens.

INSTITUTION OF ELECTRICAL ENGINEERS. (SCOTTISH CENTRE.)
7.30 *p.m.* At University College, Dundee. Lecture on "Hydro Electrical Schemes," by Mr. H. Richardson.

FRIDAY, MARCH 9th

INSTITUTE OF COSTS AND WORKS ACCOUNTANTS.
At the Connaught Rooms, Great Queen Street, London, W.C. Second Annual Costing Conference. Subject: "Standardisation in Costing."

INSTITUTION OF ELECTRICAL ENGINEERS. (SOUTH MIDLAND CENTRE.) (STUDENTS' SECTION.)
Radio Demonstration and Discussion.

INSTITUTION OF ELECTRICAL ENGINEERS. (LONDON STUDENTS' SECTION.)
7 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London. Address by the President, Mr. F. Gill.

INSTITUTION OF HEATING AND VENTILATING ENGINEERS.
7 *p.m.* At the Engineers' Club, Coventry Street, London. Lecture on "Gas as a Fuel," by Mr. J. G. Clark.

JUNIOR INSTITUTION OF ENGINEERS.
7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Paper on "Rolling Mill Machinery," by Mr. R. C. D. Fell.

EDINBURGH ELECTRICAL SOCIETY.
8 *p.m.* At Philosophical Institute, 4, Queen Street, Edinburgh. Lecture on "Colliery Plant," by Mr. E. Cunningham.

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THE ELECTRICIAN

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CONTENTS.

Notes of the Week	243	The Electrical Operation of Railway Points	261
Rating of Paper Cables	245	The Wholesalers' Dinner	261
Notes on Wireless Matters. By Prof. G. W. O. Howe	246	Imperial Notes	262
The Control of the Speed and Power Factor of Induction Motors. Lecture II. By Prof. Miles Walker. Illustrated	247	Foreign Notes	262
		I.E.E. Western Centre	262
Standard Dynamos and Motors	250	Wage Reductions in North Midland Area	262
The Electric Lighting of the "Faraday"	250	Electricity Supply	263
The Measurement of the Electric Intensity of Received Radio Signals. By J. Hollingworth. Illustrated.	251	Halifax Electricity Works Dispute	263
		Personal Items	263
Permissible Current Loading of British Standard Impregnated Paper-Insulated Electric Cables. By S. W. Melsom and F. Fawssett. Illustrated.	253	Tenders Invited and Accepted	264
		Electric Traction	265
Electricity Supply in Unoccupied Areas	254	Parliamentary Intelligence	265
Institution of Electrical Engineers	255	Wireless News	265
Electricity in the Ideal Home	256	W. T. Henley's Telegraph Works Co.	266
Salesmanship in the Electrical Industry	257	Companies' Meetings, Reports, etc.	267
Merchandise to Sell and Profit By. Illustrated	258	New Companies	267
Legal Intelligence	260	Business Items	267
The Institute of Chemistry	261	Reference Index to Wireless Publications	268
British Electrical and Allied Industries Research Association	261	Commercial Intelligence	269
		Prices of Metals, Chemicals, etc.	269
		Patent Record	270
		Arrangements for the Week	270

Notes of the Week.

Imperial Wireless—A Likely Settlement.

THE answer given by the PRIME MINISTER in the House of Commons on Monday should do much to clear up existing doubts and fears on the subject of the future of Imperial Wireless and should allow the work, which has for one reason or another been too long delayed, to be at last proceeded with. In effect the PRIME MINISTER said that in the interests of national security the Government will both erect and operate one station in this country which will be capable of communicating with any part of the Empire and will be available for public and private messages. This carries out the recommendations made in various reports by various Commissions. On the other hand, private enterprise is to be permitted to erect high power stations subject to British control, and suitable traffic arrangements. By this policy the best is made of two possible arrangements. We should not like to see Imperial radio communication entirely in private hands, but for commercial work there is a great deal to be said for allowing private enterprise to operate as freely as possible.

Marconi Enterprise.

WITH commendable promptitude the Marconi Co. have already determined to build five high power stations at a cost of £2 000 000, by which it will be possible to establish a wireless service with all parts of the Empire and with South America, China and Japan, and also to erect a group of lower power stations for communicating with European countries. Doubtless the other companies who can perform such services will also put forward schemes with the result, we hope before long, that a regrettable gap in our system of communication will be closed. We have always held that the more freedom there is in these matters the better for wireless progress. We hope that the Government, having gone so far, will recognise this and that a most unsatisfactory chapter in political and scientific history will be finally closed.

The Projection of Light.

THE discussion on "The Projection of Light," which took place before the Illuminating Engineering Society recently showed how much remains to be done with the design of apparatus for this purpose. Most of us were aware that the loss of light in optical lanterns is considerable, but probably few people realised that it may amount to as much as 95 per cent. In the kinema projector, where the film projected occupies a smaller area than a lantern slide, and where further light is absorbed by the shutter, the percentage usefully employed on the screen is even less than 5 per cent. Hitherto we have been dependent on the use of the arc to obtain effective pictures, but the results of the experiments of Messrs. W. J. JONES and E. A. MARX suggest that gasfilled lamps with concentrated filaments have now been developed to a stage useful for optical lanterns. We believe, however, that as yet relatively little use has been made of such lamps for kinema work, except in the smaller portable sizes. Evidently mere increase of candlepower is not of great assistance. It was found that 1 000 W lamps gave results little better than those obtained with the 400 W type. On the other hand the higher brightness of the filaments in low voltage lamps gives them a distinct advantage as compared with those for 200 to 260 V. There are, of course, many other problems involving light projection. The ingenious colour-projector shown by Mr. ADRIAN KLEIN, in which pure spectrum colours are obtained by transmitting light from a Beck arc through a number of

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prisms, is an interesting instance. It is also common knowledge that advertisers are now making much more extensive use of placards illuminated by concealed lamps. In some cases the results are good, but in others a patchy effect shows that the scientific projection of light has not been sufficiently studied.

Clinging to the Eternal Verities.

In an address which he recently delivered to the London Students' Section of the Institution of Electrical Engineers, Mr. C. H. Wordingham had some truths and some encouragement to give to the hot youth of our profession and industry. "One of the greatest temptations which besets those who study science," he said, "is a tendency to cocksureness," to formulate theories, test them at a few points, and then to speak of them as truths. The young student is impressed with these triumphs of intellect and intolerant of those who prefer to cling to the eternal verities. But to blame the student for this is, we feel, to blame him for being young, a thing which he cannot help and out of which he will grow. In the meantime if he neglects the eternal verities and follows strange gods he will only give himself a good deal of trouble and gain some useful experience.

A Note of Optimism.

Having thus cast the spell of his pessimism over scientific thought, invention, the printing press, industrial conditions and the reduction of man to a machine, and having perhaps, as he himself supposes, led the student to consider him a dotard, Mr. Wordingham concludes on a note of optimism. "It behoves each one," he says, "to find out for himself what work he is best suited to perform, and then to find means to make it his vocation." One of the most important objects in life is the formation of character and in that formation the engineer's work and the way he does it play the most important parts. Above all the accomplishment of duty is the real way to happiness and duty, "stern daughter of the voice of God," is the one thing worth doing. The electrical student of the present day is working under great difficulties, and these difficulties increase many fold when his course of training is over. But the future is brighter than it has ever been before. In the hand of the student lies the realisation of that future. The hard times through which he is now passing will help to make that realisation sure.

The Electrical Press—Is It Perfect?

Mr. A. G. Whyte's Paper on "The Industry, the Press, and the Public" at the Salesmanship Conference last Friday only attracted a small audience and as those who spoke in the discussion were mainly connected with the second of the three classes mentioned in the title we are drawn to propound the question placed above this note. Of course there may be another explanation: that the Press is so bad and inefficient that no amount of criticism can improve it, and the only thing to do is to go on starting more and more electrical journals. The trend of such "outside" discussion as there was went to show that this is not the explanation; and the main point to determine is how the electrical press can be made a sharper instrument for carving out the path of the industry to greater usefulness. It is obvious that it cannot do this of itself. It requires the assistance of the industry. That assistance should be given freely, and obstacles, both direct and indirect, which are now in the way should be removed. As Mr. Whyte truly said, the Press is a most potent factor in salesmanship. It should be the duty of all to see that that potentiality is kept at the highest pitch.

More Supply Results.

The reports of the electricity companies supplying in the outer London area show results as satisfactory as those upon which we commented last week in dealing with the inner metropolitan undertakings. The South Metropolitan Electric Light and Power Co. report a satisfactory increase in connections and revenue and a satisfactory decrease in expenditure. The first increased from 32 387 H.P. to 34 088 H.P. and the second from £216 808 to £227 899, while the last fell from £116 493 to £85 173. The kilowatt hours sold increased from 18 697 606 to 20 705 387, and the total cost per kWh was 0·99d. compared with 1·49d. in 1921. The old two-phase system has now almost entirely been changed over to three-phase at the standard pressure of 10 000 V. Equally satisfactory are the results of the West Kent Electric Co., which is doing useful pioneer work in extending electricity supply into the more rural districts of the county. It is work which should be amply repaid.

Extending the Electric Idea.

At the other end of London the North Metropolitan Electric Power Supply Co. have had a satisfactory year. The kilowatt hours sold exceeded 65 000 000, which is a substantial increase on the previous year's output. The net revenue for 1922 was £172 800 as against £131 700 in 1921. The area served by the company, as pointed out by Mr. Garcke at the annual meeting, provides a considerable diversity of demand and is now growing, even in its extreme outskirts, as a residential area. There is, therefore, an excellent chance of inculcating the electric idea from the very beginning, and from the imposing list of new areas served during the year, or about to be served, it is evidently the company realise this. Bulk supply is about to be given to Luton from St. Albans, is being given to Tottenham, Cheshunt and Ware, and will shortly be available in Hoddesdon, Broxbourne and Hatfield. The area that includes Chingford, Woodford, Wanstead and Loughton, which is a good residential part, but which for more than one reason has so far remained without an electricity supply is also to be exploited.

Politicians and Business Men.

Mr. Lloyd George has been discoursing on the hard lot of the politician. Unlike the business man, he has to work in the fierce light of publicity, his transactions and his words are subject to close examination, and if he makes a mistake it is blazoned to the world, accompanied by abuse or laughter. But in spite of Mr. Lloyd George's apologia we remain unimpressed. For we remember that while nearly everyone has to earn their living, no one need be a politician unless they want to. We remember that a politician makes experiments with the public's money, not with his own, and if the experiments turn out a failure he generally wriggles out of the natural consequences with a perfectly wonderful ingenuity. We remember that notoriety is more precious to some people than the reward of solid constructive work. So there are two sides to the question, and will remain two sides until the politician is held personally responsible for the results of his actions—like the happy and care free (*pace* Mr. Lloyd George) business man.

Supplying Hot Water Electrically.

The note we published last week upon our second competition, which will become effective as soon as that dealing with the "All Electric House" closes on March 29th, has given rise to a little misapprehension. In these competitions we want to deal rather with generalities than with details, and therefore we shall in the second of the series ask the question, How can an electric hot-water supply be best given in a certain house? and—pause for the replies we feel sure will be forthcoming in bulk. The certain house will be our well-known model occupied by Mr. and Mrs. Ordinaire and a smaller or larger family to taste. They will want hot water for baths and washing up and scrubbing the floors and so on and so forth, and they will want to get it with the least expenditure of time and trouble. They are going to do it electrically. How? Well, that is the question.

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Rating of Paper Cables.

WHEN an engineer is faced with the problem of spending to the best advantage a sum of money entrusted to him by council or company on the purchase of new plant he is in the same position as all other investors. He has to weigh, one against the other, those two important factors the probable return on the capital invested and the risks run. Which of these factors is dominant in deciding his course of action will depend on the character of the engineer. On the one hand he may keep his risks of failure down to the minimum and be satisfied with a small return on capital or, on the other, he may take risks for the sake of the big profit.

Speculation in Engineering Unnecessary.

The engineer's course, however, as distinct from that of the ordinary investor is more susceptible to scientific treatment and intelligent anticipation: effect follows cause with greater certainty. In engineering science, as distinct from the world of finance, rarely are the phenomena affecting the future operation of the investment so little understood, or data, available from previous similar operations, so meagre, as to justify anything in the nature of speculation with the taxpayers' or shareholders' money. Yet there is one branch of electrical engineering where the purchase of plant is not always free from embarrassing problems. We refer to the selection of dimensions for cables. In this field it is by no means an easy matter to obtain perfect security and at the same time maximum return for capital invested.

A Masterly Attack.

Owing chiefly to the enterprise of the large firms of cable makers in compiling lists of current carrying capacity, we have certain standards which have helped us along in the past; but during recent years this problem has been attacked in a really masterly manner by the Electrical Research Association. Elsewhere in this issue we give an account of the presentation to the Institution of Electrical Engineers, by Messrs. S. W. MELSOM and E. FAWSSETT, of a report on the loading of paper cables, which is the outcome of two years experimental work carried out since the preliminary report was published in December, 1921.

The document is voluminous, but we commend every page of it to the careful attention of engineers who have at any time to design and lay out cable systems. It is a veritable *vade mecum* on the rating of impregnated paper cables, and as such is going to fill a long-felt want.

Meat Easily Extracted.

The busy man may lose interest at the sight of this long report: it is truly monumental, but the "meat" in it is easily extracted by those who cannot spare the time to read the whole of the paper. What the practical man wants most of all is contained in the twenty-seven tables giving the currents for standard sizes of cables, and the brief description which enables him to use the tables intelligently. We anticipate that such will be the demand for the tables that they will have to be issued at an early date in a more convenient form for quick reference than as part of the Institution Journal.

Reliable Results.

One of the criticisms levelled at the preliminary report, the precursor of the present one, was the absence of an ordered treatment which would enable the results to be applied. Whatever were the justifications for such criticism two years ago, they no longer apply, for the final report is laid out in such a way that the reason for any deduction is clearly evident and with very little trouble the reader can trace back the whole of the standardised data to the supporting experimental evidence.

Approximations have, of course, had to be made owing to the difficulties of formulating theories exactly to fit the practical conditions, but these must have been introduced with considerable discretion, for, whereas cross checking of the tables one with another would be expected to reveal any discrepancies, we find that they check remarkably well. Anyone who has had experience in compiling series of tables so closely interconnected as these are by dimensions, types and voltages will appreciate what an important factor this is and how it reveals the careful scrutiny to which the results have been subjected before publication.

Relieving the Manufacturers.

The appearance of the data in this report, in addition to helping the cable user to select the size for a given load and set of conditions is going to relieve the manufacturer of a duty which at times may become rather delicate. Some engineers, when inviting quotations for cables, ask for guaranteed figures for current and temperature. Such a course is not altogether desirable as, obviously, the fact that one manufacturer offers higher values than another is no indication that he will provide a better cable. On the contrary it is more than probable that the smaller manufacturer, either because of his having a lesser reputation to guard or because of actual ignorance of the thermal properties, puts forward a higher figure than that which the larger firm, as a result of having carried out extended research, can recommend. In the light of this information now given, the purchaser with his knowledge of the local conditions can decide the point himself. At the same time, as was pointed out by more than one speaker in the discussion, the ratings given in the tables are based entirely on considerations of heating, and it does not follow that these will be the most economical ratings to adopt. In some cases the cost of providing additional cables, beyond those required to comply with the requirements of the tables in the report, might easily be covered by the saving in copper losses accompanying their installation.

Heating of Grouped Cables.

With so much matter it is difficult to know which points to note, and which to skip, but we do feel that too much emphasis cannot be placed on the work which the Association has carried out on the heating of cables where several are grouped together. It has caused us surprise on more than one occasion to find how some station engineers underestimate the diminishing effect of cable grouping on the current carrying capacity. Cases may be found where the load capacity of a feeder a mile long is reduced 20 per cent. and more by the conditions holding for the first few yards at the station end. Of course, it is usually very difficult to give the desirable spacing where so many cables converge; but when engineers have studied this part of the report, we imagine that some of them will be casting around for a remedy for the existing state of affairs.

A Triumph of British Research.

In one or two points of detail the report is open to criticism. The work on the effect of depth of laying would probably have been more easily interpretable if the temperature at the surface of the ground could be controlled over long periods. Test conditions are often the reverse of those required to give the true explanation of working phenomena and artificially controlled conditions often reveal the truth. But the general impression left on our minds from a careful study is that its appearance is not only an event of outstanding importance in the progress of the electrical industry of this country, but also constitutes a brilliant triumph for British industrial research. The Electrical Research Association, in thus helping to employ that large amount of capital invested in underground cables with security combined with a maximum return, is contributing enormously to the cheapening of electric supply, and, therefore, in a very direct way to the rapid advance and development of the whole industry. We hope that the piece of work which they have just brought to such a satisfactory conclusion will bring the claims of the Association to the notice of many of those bodies which, while enjoying the benefits of the Association's work are not at present contributing to its support.

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Notes on Wireless Matters.

Some Problems in Telephony.

By Prof. G. W. O. HOWE.

In the simplest form of ordinary line telephony a battery maintains a steady current through the microphone, along one of the lines, around the coils of the receiver, and back along the other line; the outgoing current being at a higher potential than the returning current, there is a steady flow of energy from the transmitting to the receiving station, the energy being represented *en route* by the magnetic and electric fields around and between the two wires. By speaking into the transmitter one controls or modulates the flow of energy from the battery to the line and thus to the receiver.

The steady flow of energy is not fundamentally essential, it is all dissipated in the resistance of the lines and receiver coils; so long as the diaphragm of the receiver is at rest, no further supply of energy would be necessary, however large the current and the force of magnetic attraction, were it not for the resistance of the coils. If the lines and coils could be made of some perfect conductor, there would be no P.D. between the lines and no energy transmitted, although the current would be flowing and modifying the attractive force of the magnet on the diaphragm. A decrease in the resistance of the microphone would cause an increase in the current and a consequent increase in the magnetic field of the receiver; on account of the self-inductance of the lines and receiver this would necessitate a P.D. between the lines and a transmission of energy so long as the current was increasing.

If the current were caused to decrease the P.D. would be reversed and the receiver would act as a generator and transmit some of the energy of its magnetic field back along the line to the transmitter. Hence in this simple case the steady transmission of energy is not essential to the telephony, but is only necessary because of the imperfections of the system. The introduction of a transformer—or induction coil, as the telephone engineer prefers to call it—between the transmitter and the line gives the same result as the ideal line of zero resistance so far as the steady conditions are concerned.

A Radio Telephonic Analogy.

The ordinary system of radio telephony resembles the ordinary line system in that a flow of energy is maintained, the rate of flow being controlled or modulated by the transmitter. It is hardly correct to say that the flow of energy is steady because, being radiated from the aerial by means of an alternating current with a frequency in the case of broadcasting of about a million, the energy is really transmitted in pulses at the rate of about 2 million pulses per second. By speaking into the transmitter one varies the amplitude of the aerial current and with it the magnitude of the radiated pulses of energy. The currents set up in the receiver will follow the same variations of amplitude, and if rectified will cause corresponding variations in the attractive force on the telephone diaphragm.

Recent Transatlantic Tests.

In the recent transatlantic tests, however, the modulated high frequency current was passed through a filter before passing to the transmitting aerial. This removed from it all components having frequencies above a certain value. If the radio frequency is fr and the telephonic frequency impressed upon it is ft, it can be shown that the resultant wave of constant frequency and variable amplitude can be analysed into three waves, each of constant amplitude, but of different frequencies, viz., one of the original radio frequency fr, one of a lower frequency $fr-ft$ and one of a higher frequency $fr+ft$. Every constituent of a speech sound will be represented by three such components, each with its proper ft depending on the frequency of the constituent. If one simply filtered out the fr constituent and transmitted the upper and lower frequency components $fr+ft$ and $fr-ft$, these would recombine to form a resultant very similar to the original, viz., of constant frequency fr and of an amplitude varying with a frequency ft, the constituent thus filtered out being due to the modulation not being complete. In the recent tests, however, the components fr and ft were also filtered out and only the other so called side bands containing the lower frequency components of the type $fr-ft$ were sent into the transmitting aerial and radiated out.

Local Heterodyne Necessary.

At the receiving station it is therefore necessary to add something to the received currents before they can give the speech sounds. If one could add the complementary components of the other side band one would obviously obtain the original wave form, but this is hardly possible. If a steady oscillation of the frequency fr is added by means of a local heterodyne, a resultant high frequency oscillation of frequency midway between fr and $fr-ft$, varying in amplitude at a rate equal to half of ft is obtained. This will be true of all the component frequencies, hence if the telephonic currents thus obtained can by some device have their frequencies exactly doubled the result will be a replica of the variations originally impressed upon the transmitting microphone.

Screening Frame or Coil Aerials.

In last month's wireless notes we dealt with the question as to whether there was any justification for the view that in the case of the elevated antenna the e.m.f. was induced by the electric component of the wave, whereas in the case of the coil or frame aerial it was due to the magnetic component, and it was shown that this view was untenable. It does not follow, however, that it is not sometimes convenient to regard the induction from one point of view and at other times from the other point of view. It sometimes happens that a phenomenon which is difficult to explain if one thinks only of the electric field, is relatively simple as soon as one thinks of the action of the magnetic field. The following may serve as an example. Experiments have been made with metal tubes entirely enclosing the vertical sides of a frame aerial; now if one regards the e.m.f. as being induced in the coil by the vertical electric field of the wave acting successively on the vertical coil sides, one is tempted to assume that such metal tubes would screen the coil from the action of the field.

This is found not to be the case. If one entirely surrounds the four sides of the coil with metal tubing, except for a small gap in the top or bottom, it is difficult for one who thinks only in terms of the vertical electric field to understand why the screening action is very slight and the signals but little affected. If, however, we approach the question from the other point of view the explanation is simple. Owing to the passing of the waves there is an alternating magnetic flux through the rectangular coil and this induces an e.m.f. around the rectangular path whether the coil is there or not The presence of other conductors inside or outside the coil cannot affect this e.m.f. unless they produce magnetic fields which modify the flux through the coil due to the wave. If the coil is completely enclosed in a metal tube, the ends of which are joined, the magnetic flux due to the wave still passes through the coil, and were there no other magnetic field would still induce the same e.m.f. in it, but it will also induce an e.m.f. around the metal tube and set up currents around it, and these currents will produce magnetic fields which pass to some extent through the coil and tend to neutralise the effect of the flux due to the waves. Such a closed tube will therefore screen the coil, but the smallest break in the continuity of the tube whether at the top, bottom or sides will prevent the flow of the screening currents and the flux due to the wave will then be the only flux inducing e.m.f. in the coil, which will therefore be relatively unaffected by the almost complete enclosure.

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The Control of the Speed and Power Factor of Induction Motors.

In the second lecture of the course which he is delivering before the University of London Prof. Miles Walker continued his theoretical discussion of the characteristics of induction motors and then proceeded to deal with the various methods of speed control that are available. The advantages of the liquid controller, the application of the induction motor for ship propulsion and the uses of the new method were gone into and the Boucherot motor was described.

Lecture II.

If in Fig. 13 the admittance Y_L be taken parallel to the voltage vector the construction shown leads directly to the form of circle diagram of the induction motor as given by Behrend and Ossanna for the case where the power factor of the load is unity. This is the ordinary case where no phase advancer or choke coil is put in circuit with the rotor winding.

In this case we can set off OP_0 in Fig. 14 to represent Y_0 to

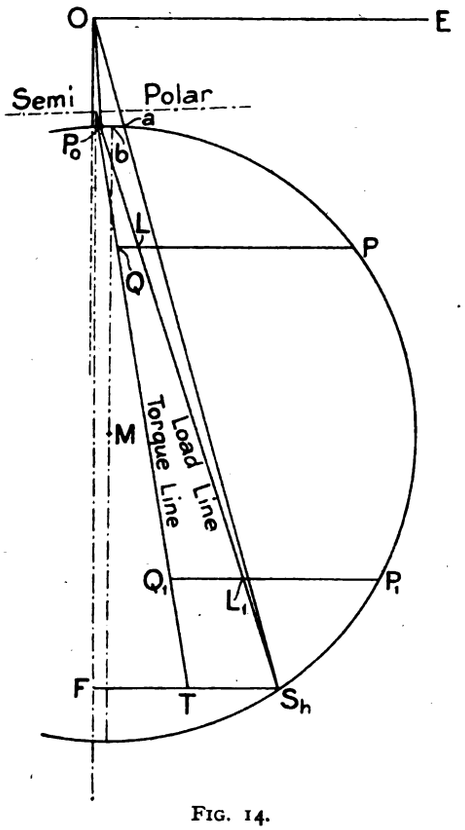

FIG. 14.

the admittance scale, making the angle φ_0 with the voltage OE. This is to say, to represent the no-load current to the current scale. The next step is to set off the vector OS_h to represent the admittance Y_h of the motor on short circuit and to represent the short circuit current to the current scale.

From the point P_0 draw the line P_0a parallel to OE cutting OS_h at the point a. Bisect P_0a at b and draw bM at right angles to OE. Join P_0S_h, bisect this in c and let the vertical at c cut bM at M. Taking M as the centre, describe the circle P_0PS_h. This is the same circle as we would have obtained if we had gone through the construction described with reference to Fig. 13. Note that the angle aMb is equal to the angle aS_hP_0. The latter is equal* to

$$\psi_1 + \psi_2 = \varphi_h - \varphi_{h0} = 2\psi \text{ nearly}$$

and 2ψ is the inclination which the vector Y_b makes with the voltage vector assuming that Y_L is parallel to the voltage vector (see Fig. 13).

* Observe that as $Y_a = C_1C_2Y_0$

$$\frac{P_2}{C_2}Y_a = C_1P_2Y_0 = P_1Y_0$$

Therefore, to set off Y_0 from the primary volts P_1, gives the same result as to set off Y_a from $\frac{P_2}{C_2}$ (see Fig. 12). Referring now to Fig. 13, if we take the vector difference between OS_h and OP_0 we get $Y_h - Y_0 = P_0S_h$ which makes a small angle with OS_h. This angle OS_hP_0 is equal to $\psi_1 + \psi_2$ because

The line P_0S_h is called the "load line" because a line parallel to OE drawn from any point P on the circle to it gives the in-phase current of the rotor output.

The Torque Line.

If we draw a line SF parallel to OE and divide it at T so that the ratio S_hT: TF is ratio of the rotor resistance to the stator resistance we obtained the torque line P_0T. Strictly speaking the torque line is drawn from the point where the semi-polar to the circle cuts the line OM. Any line P_1Q_1 parallel to OE is proportional to the torque and to obtain the torque in lbs. at a foot radius we multiply the number of amperes represented by P_1Q_1 by

$$\frac{\text{line volts} \times 1{\cdot}73 \times 33\,000}{746 \times \text{syn. r.p.m.} \times 2\pi}$$

If we increase the rotor resistance so that the rotor loss at standstill caused by the current P_0P_1 in the rotor resistance is equal to rotor input represented by the line P_1Q_1, then the motor will start with the torque represented by P_1Q_1.

Fig. 15 shows how the torque speed curve of an induction

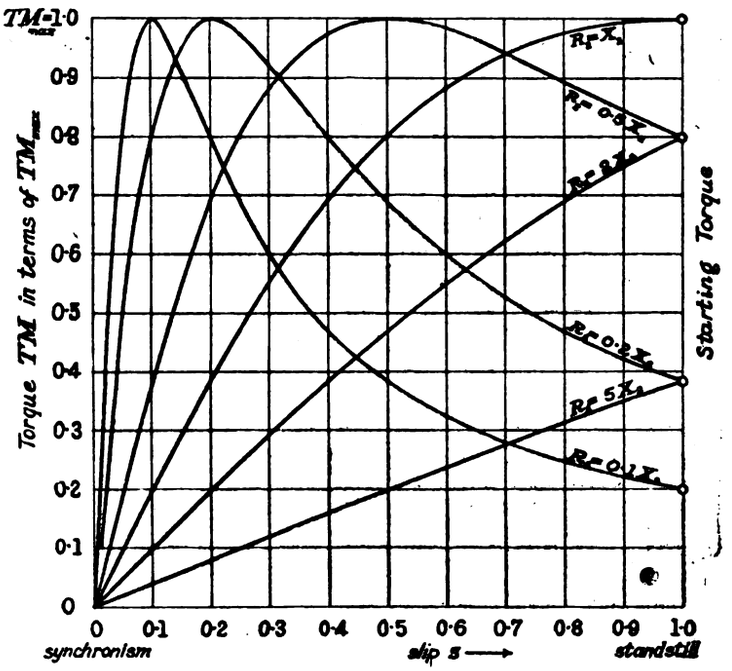

FIG. 15.—TORQUE SPEED CURVES OF AN INDUCTION MOTOR.

Reproduced from "Papers on the Design of A.C. Machinery," by Hawkins, Smith and Neville. (Pitman).

motor changes with the amount of resistance in the rotor circuit.

Characteristics of Ordinary Induction Motor.

The characteristics of the ordinary induction motor without any additional apparatus can be deduced from Fig. 14. We know that it is essentially an almost constant speed machine somewhat like a d.c. shunt motor in that speed can be reduced by putting resistance in circuit with the rotor but this is only done with a proportional loss of power and is very inefficient.

$$C_1C_2 = c_1c_2/\psi_1 + \psi_2$$

and

$$C_1C_2 = \frac{Y_h}{Y_h - Y_0}$$

Denoting by φ_{h-0} the angle of the vector P_0S_h we get

$$\frac{Y_h}{Y_h - Y_0} = \frac{OS_h}{P_0S_h}/\varphi_0 - \varphi_{h-0}$$

$$\therefore \quad \psi_1 + \psi_2 = \varphi_h - \varphi_{h-0}\ 2\psi_0 \text{ nearly.}$$

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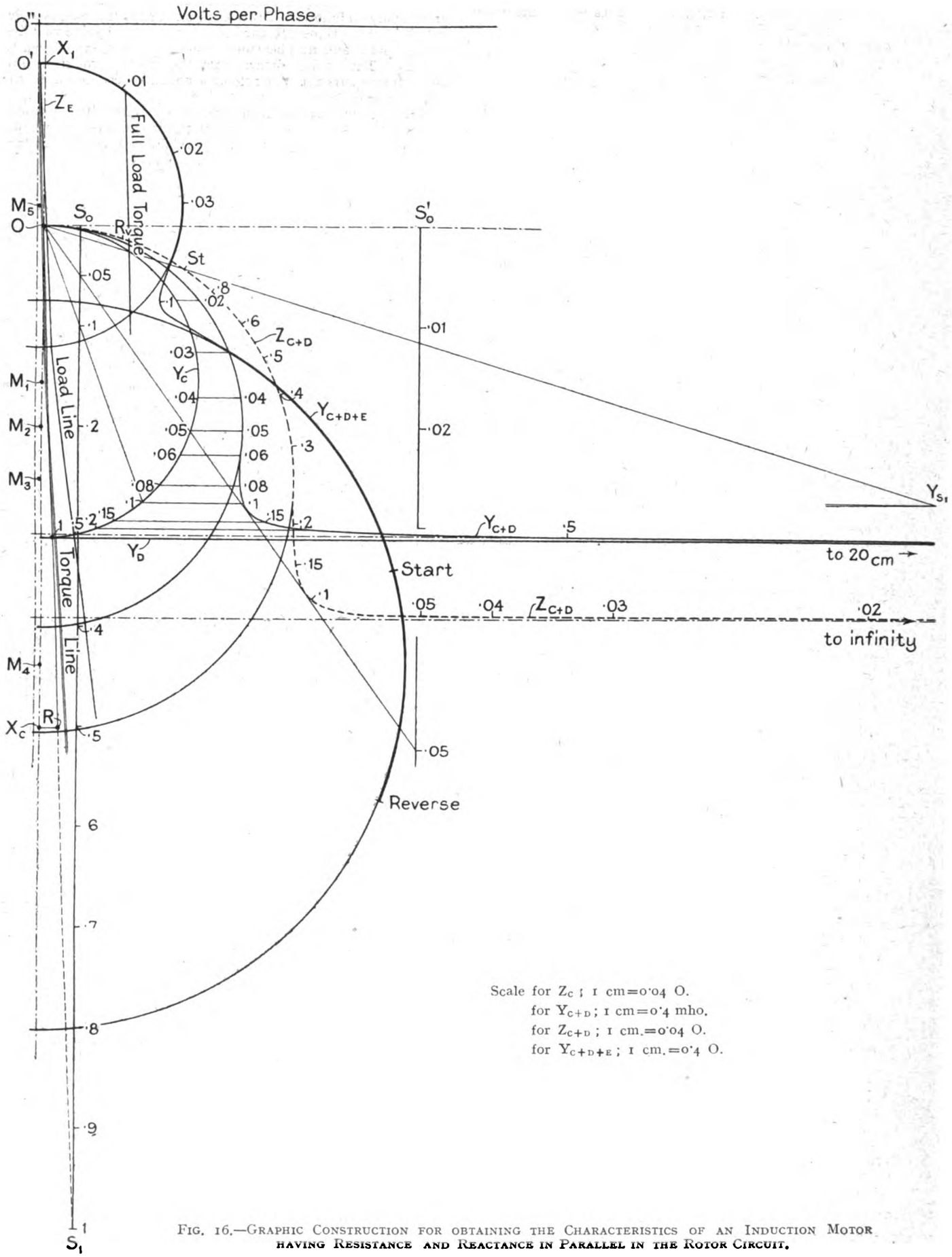

Scale for Z_C ; 1 cm=0·04 O.
for Y_{C+D}; 1 cm=0·4 mho.
for Z_{C+D} ; 1 cm.=0·04 O.
for Y_{C+D+E} ; 1 cm.=0·4 O.

FIG. 16.—GRAPHIC CONSTRUCTION FOR OBTAINING THE CHARACTERISTICS OF AN INDUCTION MOTOR HAVING RESISTANCE AND REACTANCE IN PARALLEL IN THE ROTOR CIRCUIT.

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The methods of controlling the speed of an induction motor may be considered under the following heads :—

I. Rheostatic control in the rotor circuit.
II. Resistance and reactance in parallel in the rotor circuit. Boucherot motor.
III. Change of frequency of supply.
IV. Pole changing devices.
V. Cascade connections.
VI. The Hunt motor and Creedy modifications.
VII. A rotary converter in circuit with rotor. Kraemer's method.
VIII. A frequency changer in circuit with rotor.
IX. Le Blanc exciter in circuit with rotor—sometimes called Scherbius method.

In his original lecture the author discusses these in detail. He also discusses certain problems of changing the speed of an induction motor used for driving a ship's propellors, especially pole changing and the two circuit rotor due to M. Boucherot:*

The Use of the Inversion Method.

The method of inversion is very useful in working out the characteristics of a motor provided with resistance and inductances in parallel. The other alternative is to use the symbolic method. One cannot see as well among a maze of r's and jx's what will be the effect of altering one of the constants as one can with a graphic construction which alters its shape in an intelligible manner with the augmentation or reduction of any of the resistances or reactances.

The graphs to be inverted in the investigation of a Boucherot motor are not simple circles and straight lines but parts of them so nearly approximate to circles and straight lines that one need not be hampered much in applying the method.

The procedure is illustrated in Fig. 16. A 2 500 H.P. three-phase induction motor is required for ship propulsion, full speed 186 revs. per min. It is to be provided with two circuits in parallel in each phase of the rotor z_c and r_D in Fig. 17. The open circuit voltage per phase of the rotor is to be 1 650 V across terminals or 955 V to the star point. We will consider all resistances and reactances as if referred to the stator and as if the stator voltage were 955 V per phase. For the sake of simplicity in this example we will suppose that the reactive drop caused by the magnetising current can be neglected in so far as its effect on the rotor current is concerned. Its effect can always be allowed for afterwards. Under these assumptions one phase of the machine can be shown diagrammatically as in Fig. 17.

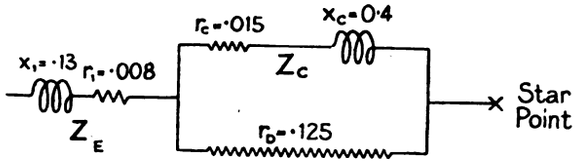

FIG. 17.

In this figure $\mathbf{Z}_E$ includes the reactance of both stator and rotor as in Fig. 12, but it includes the resistance of the stator only. $\mathbf{Z}_c$ includes the resistance of the coil whose reactance at primary frequency is 0·4 O and also the resistance of one phase of the rotor. The latter is almost negligible as compared with the resistance r_D=0·125.

Plotting the Locus of the Stator Current.

It is required to find the speed torque curve of this motor from full speed in the direction opposite to that of the revolving field (that is s=2) to full speed in the forward direction there being no switching operations in the rotor circuit.

We begin (see Fig. 16) by drawing the two chain dotted axes through the origin O. Mark off OX to represent 0·4 O. As the scale is 1 cm=0·04 O OX=10 cm, XR is then set off to represent r_c. The line XR if extended indefinitely would give us the locus of z_c (viewed from the stator) as s sinks to zero. This line inverted therefore gives us the admittance of circuit c. The circle $\mathbf{Y}_c$ gives us the admittance to the scale 1 cm=0·4 mho. The diameter of this circle is made $\frac{1}{0\cdot4}$=2·5 mhos, which is represented by 6·25 cm. The next step is to add the admittance of r_D. When s=1 this is $\frac{1}{\cdot125}$=8 mhos represented by 20 cm. As s decreases the apparent admittance of r_D decreases in the same ratio. In order to add the admittances for all values of s, we must find the points on the $\mathbf{Y}_c$ circle corresponding to various values of s. This can be done graphically as follows. Draw any convenient line S_0S_1 parallel to OX, and continue OR until it cuts it in S_1. Divide this line into 10 parts and number these s=0·1, 0·2, 0·3, etc., down to 1 at S_1. Then a line drawn from the origin through one of these points cuts the $\mathbf{Y}_c$ circle at a point corresponding to the slip in question.

Mark off a number of points on the circle to represent s=0·5, 0·2, 0·1, etc., etc. In order to get the small values of s accurately it is well to draw another slip line at S^1_0, say ten times further from OX, then the divisions in this line will be correspondingly bigger. Now take the 20 cm line representing 8 mho and multiply it by the fraction s. Set off horizontally 0·5×20 cm at the 0·5 point; 0·2×20 cm at the 0·2 point and so on as shown.

We thus get the curve $\mathbf{Y}_{c+D}$ representing the locus of the admittance of c and D in parallel as s changes from 1 to 0.

It will be seen that this curve consists of three parts, one part very closely approximates to a straight line whose inverse is part of the dotted circle marked $\mathbf{Z}_{c+D}$; another part very closely approximates to a circle whose inverse is the dotted line $\mathbf{Z}_{c+D}$; and another part is a curve which sweeps from the line to the circle and the inverse of this is a curve of similar shape which sweeps from the dotted circle to the dotted line. The exact position of the inverse can be seen at once by drawing a tangent to both curves from the origin. The points on the dotted curve corresponding to various values of s are obtained at once by inversion. The point for s=1 is marked S_t on the dotted curve to denote the starting point. To get the point for full speed in the reverse direction corresponding to s=2, we must produce the 20 cm admittance line to 40 cm and set it off from its correct point on the circle $\mathbf{Y}_c$. Then invert the far end (which is off the paper) on to the dotted circle. The point is marked R_v. The points for other values of s are also marked.

Effect of No-load Current.

If we had wished to take the effect of the no-load current into account, we could, before inverting $\mathbf{Y}_{c+D}$ add the admittance $\mathbf{Y}_a$ as was done in Fig. 13. This will give us a new origin as in Fig. 11 and the effect is to make the inverse of the circular part of $\mathbf{Y}_{c+D}$ come out as a circle of very large diameter instead of as a straight line. The result obtained is not substantially different from the result obtained by adding the admittance in the manner shown hereafter but the figure is not so simple. Moreover we have an extra step in the procedure because the reactance of the rotor winding must be dealt with separately.

Having obtained $\mathbf{Z}_{c+D}$ by inversion we can add $\mathbf{Z}_1$ by setting off OX_1=3·25 cm vertically upwards and X_1O'=0·2 cm to the left.

We now invert the dotted curve taking the new origin O' as the centre of inversion. This gives us the heavy line curve consisting mainly of parts of two circles whose diameters are found by inverting the circle and straight line of the dotted curve (see description of Fig. 11). This is the locus of the admittance $\mathbf{Y}_{c+D+E}$ of the whole combination $\mathbf{Z}_E$ $\mathbf{Z}_c$ and r_D as s changes from 0 to 2. The part of the curve which sweeps from one circle to the other can be drawn point by point by inverting corresponding points in the dotted curve or its position can be judged with sufficient accuracy by merely drawing a tangent to the sweep on the dotted curve from the origin O'.

The inverse of the points on the circular part of the dotted curve are found on the big circle of the full line curve and the inverse of the points on the straight part of the dotted line stretching to infinity are found on the small circle.

Admittance of the Stator.

The next step is to add the admittance of the stator at no load. Suppose this is 0·06+j·3. Then we set off $\frac{0\cdot3}{0\cdot4}$=·75 cm vertically upwards and 0·15 cm to the left. This gives a new origin O''. Vectors drawn from this origin to the curve $\mathbf{Y}_{c+D+E}$ give the stator current to the scale, 0·4×955=382 A per cm.

The torque line consists of two parts, each having a different inclination to the vertical. The easiest way to get it is to rule a base line through O' at right angles to the voltage line and then take any current for the small circle (say the current

* "General Electric Review," Vol. XXII, p. 224.

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represented by the vector drawn to the far end of its diameter). Square this current, multiply by the resistance per phase of the stator 0·008 and divide by 955. This gives the wattful current required to supply that stator loss. This wattful current is then set off at right angles to the base line at a point opposite the end of the current vector. The end of this little perpendicular lies on the torque line for the circle in question. It is only then necessary to draw a line through the point so obtained and the intersection of the semipolar of the circle with the base line. The same construction is carried out for the large circle, it being remembered that the torque line for that circle passed through the intersection of the semipolar of that circle with the base line. The torque line is shown in the figure with a double ruling. Taking the resistance of the rotor as equal to that of the stator, the load line can be set off in the same way.

The wattful output current is

$$\frac{2\,500\times 746}{3\times 955}=650 \text{ A per phase.}$$

This can now be set off above the load line parallel to the voltage and gives us the full load point. We see that the slip at full load is just a little over 1 per cent.

The torque reaches a maximum at a slip of 0·03 and then falls off until about $s=0{\cdot}1$. It is then only about 135 per cent. of full load torque. An increased slip then gives an increased torque until at standstill at the point marked "Start" (if the voltage is 955), the torque is four times full load torque. In practice one would not start up a motor of this kind at full voltage. In ship propulsion the voltage of the generator is under control. The rheostat of the generator field is brought up slowly so as to give the required torque to the propeller. Then, as the ship gains speed, the voltage is brought up to normal. If it is required to reverse the propellers when the ship is going at full speed ahead, the excitation is brought down and the generator is switched out. Two of the phases are reversed so as to reverse the direction of rotation of the magnetic field. The generator is switched on again and the excitation brought up again. The whole of these operations can be carried out automatically by simply moving a handle over from "full speed ahead" to "full speed astern," there being no switching operations required in the rotor circuit.

Standard Dynamos and Motors.

A standard specification for the electrical performance of industrial electric motors and generators with Class A insulation (No. 168/1923) has just been published by the British Engineering Standards Association.

This specification applies to industrial electric motors and generators of 1 B.H.P., kW, or kVA and upwards per 1 000 revs. per min., having windings insulated with Class A material (impregnated cotton, paper or silk) wound for voltages not exceeding 7 000 V, and having either a continuous or a short-time rating. This Specification is the first of a series designed to supersede the British Standardisation Rules for Electrical Machinery (Publication No. 72/1917).

New British Standard Rating.

Stated briefly, the new British Standard Rating is:—

Temperature rise (on rated load), 40° C. Temperature rise for totally enclosed machines and machines with short-time ratings, 50 C. Dielectric test 1000+2 rated V. Momentary overload: Short-time rated machines, 100 per cent. for 30 secs.; continuous rated machines, 50 per cent. for 15 secs. Sustained overloads: Short-time ratings and all totally enclosed machines, none; continuous rating, 25 per cent. for two hours, except for small machines. No provision is made for tests of temperature rise after the sustained overloads. The conditions of the cooling air and maximum temperatures permissible are given in a chapter entitled "Service Conditions," as they are not, strictly speaking, a part of the rating.

It will be noted that this specification marks an important departure from the rating laid down in B.E.S.A. Publication No. 72, which following the rules published by the International Electro-technical Commission, provided a rating with a 50° C. temperature rise without sustained overload for all classes of machine. It has been found, however, that this I.E.C. rating has only been used by the electrical industry to a very limited extent, and the revision has been made in response to urgent requests from the industry for home use. The I.E.C. are now considering the adoption of this overload rating for industrial machines as an additional international standard.

The "Faraday" Past and Present.

Some Details of the Original Electric Installation.

A short time ago we noted the imminent passing of the well-known cable ship the "Faraday." Besides being a pioneer in the work of cable laying, the "Faraday" was also notable as being one of the first ships to use electric lighting. The following notes by Mr. J. W. Long are an interesting historical record.

Mr. Long states that electric light was first used in the s.s. "Faraday" in 1879, for laying the French Atlantic cable from Brest to St. Pierre. Arc lights only were used on the three trips. Some disturbance of compass was evident, and experiments to remedy this trouble were made, first by twisting the main cables together, it being supposed that their proximity to the bridge was the cause, and then by attaching long loose cables to a dynamo. As the dynamo was dragged aft along the deck it was found that the disturbance was lessened; this resulted in the plant being fixed in a deck house extreme aft.

The deck lights were fixed on lamp posts which were screwed to the deck; two in "Oxford Street," and two in "Piccadilly," and two on the bridge (these two were soon removed on account of exposure to the wind). On the posts were lanterns somewhat of the then familiar street gas patterns. These were surmounted by reflectors and having screens, to confine the illumination to the ship's deck.

Carboning and Conjuring.

The carboning of the lamps was done by the help of a short ladder having foot spikes, the lamp (d.c.) had to be removed, trimmed in some convenient place and carried up the ladder in one hand and coaxed into position—a feat of legerdemain in rough weather.

The cable tanks were also lighted by arcs (a.c.), suspended from the "crinolines." Trimming was comparatively easy, although the trimmer was like a bird on a perch.

Occasionally a portable arc was used for throwing light on the water alongside the ship, during hauling in or other cable operations occurring in the night. Projected through a hawse hole in rough weather, this duty was a trying one, when each heave of the ship was accompanied by a stomachic heave of the human lamp post. Such was electric ship lighting in 1879.

The New "Faraday."

Following the passing of the old "Faraday," her new namesake was launched at Jarrow on February 16th. The new "Faraday" is of the following dimensions:—Length over bow sheaves, 415 ft.; beam, 48 ft. 3 in.; depth to upper deck, 29 ft. 3 in. She has been constructed of steel, under special survey, to class 100 A1 with Lloyd's Register of Shipping; with shelter deck type with freeboard, and has a clipper stem adapted for carrying three cable sheaves; a cruiser stern with two sheaves fitted on starboard side, and two masts, with schooner rig. A double bottom is fitted all fore and aft, adapted for carrying either water ballast or oil fuel, except in the way of the engine and boiler room, which will be used for feed or ballast water. Additional ballast capacity is provided by means of deep tanks to ensure ample immersion of the vessel when her cable is discharged. Oil fuel is also carried in the cross bunker at the fore and aft end of cable tanks, and separated from these by air spaces, the total storage of fuel oil being sufficient to provide for a steaming radius of 10 000 miles. The ship has four cable tanks, with a total coiling capacity of about 92 000 c. ft.

Cable Handling Appliances.

The cable handling appliances are of Siemens' latest and most approved pattern, and the main cable machinery is being constructed by Palmer's Shipbuilding and Iron Co.

Spacious accommodation is provided for the ship's officers, cable staff and crew, the total number of people being over 150.

On the lower deck forward, a large space is fitted up for workshops and cable stores. Refrigerated stores and fresh water storage are provided aft to serve the large complement.

The "Faraday," which is one of the largest and most modern of her type afloat, is to be fitted with twin screw triple expansion engines, having cylinders 21 in., 34 in., 57 in., by 39 in. stroke, steam being supplied by three boilers fitted with Howden's forced draught, having a working pressure of 180 lb., and burning oil fuel.

It may be noted that the old "Faraday" has laid some 50 000 miles of submarine cables in all parts of the world, including eight cables across the Atlantic, while she has also been employed for carrying out many repairs to cables in waters of varying depths up to 3 000 fathoms.

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The Measurement of the Electric Intensity of Received Radio Signals.*

By J. HOLLINGWORTH, M.A., B.Sc.

For measurements at very short distances, a direct method is practicable. This usually consists of the insertion of a delicate thermal instrument, into a tuned aerial or coil circuit the constants of which are known, the instrument being calibrated by direct current. In many cases practical considerations are of considerable weight, and from this point of view the following requirements must be borne in mind: (*a*) The actual operation should be as rapid and simple as possible; (*b*) special transmission should be reduced to a minimum; (*c*) the overall calibration should be effected as closely as possible under working conditions; (*d*) the set should be moderately portable and capable of adaptation to varying conditions.

Technical Considerations.

The following methods are in use: (*a*) Telephone methods; and (*b*) galvanometer methods.

Under the former heading may be included the shunted telephone method, in which comparative results are obtained by shunting the telephones until the signals just disappear: the accuracy is not high. An audible method is comparatively insensitive to small variations to intensity, whereas in using a galvanometer, it affords a greater sensitivity to small variations. The usual method of calibration is to disconnect the aerial system and to connect the receiving set to a non-radiating aerial which has the same constants as the receiving aerial, and contains a calibrated mutual inductance coupled to a calibrated local oscillating circuit: the latter is then adjusted until equality of signal strength is obtained.

This method involves the equalisation of the constants of the main and dummy aerials, and the accuracy of this adjustment will be one of the chief factors determining the accuracy of the result. In addition, on switching over to the dummy aerial, any jamming previously present will disappear, thus introducing another uncertain factor into the physiological balancing process.

The N.P.L. Apparatus.

At the National Physical Laboratory a galvanometer method is used. In general principle it follows standard lines, but it exhibits several important modifications. Its chief features are: (*a*) No heterodyne required; (*b*) no metallic screening necessary; (*c*) only one oscillating circuit in use at a time.

The signal from the tuned receiving circuit is applied to a multi-valve resistance-capacity amplifier. A galvanometer is connected in the anode lead of the last valve, and is made to give zero deflection for the normal anode current, a 2 V cell and adjustable resistance across the galvanometer being used for this purpose. The incoming signal polarizes the grid of the last valve, and in this way reduces its anode current, the reduction being indicated by the deflection of the galvanometer.

For calibration purposes, the tuned receiving circuit is broken and totally disconnected from the amplifier, which is then joined to the local oscillator through a calibrated aperiodic coupling coil. The oscillator is next adjusted until the same deflection is obtained as with the signal.

Application of the Method.

The method can be applied equally well to an ordinary aerial or a closed coil. For convenience and portability, a closed coil has been adopted. The coil now in use consists of a wooden box frame, 5 ft. square, wound with 79 turns of 7/26 S.W.G. copper wire spaced $\frac{1}{8}$ in. apart. This is sectionalised by a three-way switch, so that either 29, 50 or 79 turns can be used, the coils not in use being completely cut out. With suitable condensers, the wave length range is 3 000 to 25 000 m.

The amplifier is of the resistance-capacity coupling type having several special arrangements. Resistance-capacity coupling was adopted for three reasons: (*a*) Larger effective wavelength range. As the set is not designed to work below 3 500 m, the question of the inefficiency on short waves does not arise. (*b*) No screening is necessary. In measurements such as these it would be necessary to screen all coils and transformers. (*c*) Stability. The amplifier must be kept well away from regeneration, instead of, as is usual, working as near this point as possible.

* Abstract of a paper read before the Wireless Section of the Institution of Electrical Engineers.

The special circuits are confined to the last valve (Fig. 1). Instead of the usual telephones, a sensitive galvanometer and shunt are connected in the anode circuit, and across them is placed a 2 V accumulator with such an arrangement of resistances that the normal anode current can be balanced; the deflection is obtained by the departure from the normal, and the whole is shunted by a 5 mF condenser. Under these conditions, the effect of atmospherics appears to be small, and as a matter of fact, excellent results have been obtained during a thunderstorm. The last valve is also run off a separate battery in order to minimise the creep of the zero due to the gradual fall of accumulator voltage on load; and for the same

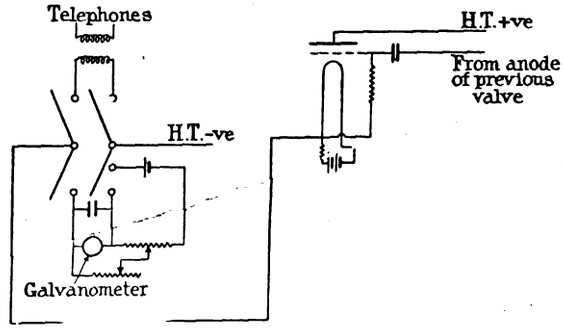

FIG. 1.—CONNECTIONS OF THE LAST VALVE.

reason, the filament resistance is a fixed one of the iron-in-hydrogen pattern. In order to obtain satisfactory results, it is essential to use an accumulator and not a primary battery.

The Calibrated Local Oscillator.

As mentioned above, the local source is connected to the amplifier by an untuned coupling circuit. In this way, it is possible to dispense entirely with metallic screening since there is never more than one oscillating circuit in action at a time.

On the other hand, this method involves the necessity of actually measuring the effective high-frequency resistance of the receiving system at each observation; but the set is arranged so that this can be done easily, and the great advantage results that a very severe check on the accuracy and correct working of the apparatus is provided.

The oscillator itself has several special features. In the ordinary construction of such oscillators a normal continuous-wave generator is used with a high-pressure supply of 50 to 60 V, so that the oscillating current is large enough to be

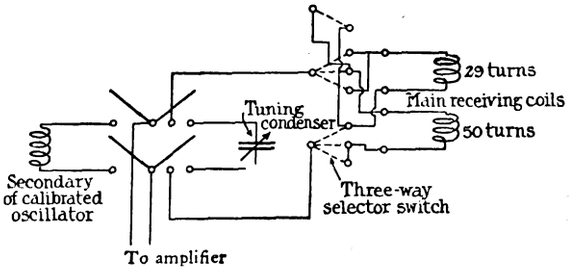

FIG. 2.—TUNING CONDENSER AND THROW-OVER SWITCH.

measured on a direct-reading instrument. A few turns of the oscillating circuit are led through the primary of a variable mutual inductance; but this arrangement involves the screening of the main part of the oscillator from the mutual inductance. Also it has been found that with the use of such comparatively high voltages there is a danger that an appreciable but indefinite amount of energy may reach the later valves of the amplifier owing to capacity coupling.

If, however, the whole of the oscillating inductance be used as the primary of the mutual, the secondary can be mounted some distance away from it, and this increase in distance and the reduction of the high-tension voltage minimise the risk of capacity coupling. This method involves actual measurement of the mutual inductance under working conditions; but this is practically essential in any case, and is not difficult, whilst,

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with the control which will be described shortly, it is not necessary to rotate the secondary.

Calibration of Receiving Set.

The formula for the results is derived as follows :—

From the second equation in Section I above, we see that the current in an oscillating circuit with potential gradient D

$$=\frac{D\times 2\pi an}{R\lambda}$$

Hence, the resonance volts on the condenser, i.e., the volts applied to amplifier

$$=\frac{D\times 2\pi an\sqrt{(R^2+\omega^2L^2)}}{R\lambda}$$

Under ordinary conditions $\sqrt{(R^2+\omega^2L^2)}$ may be replaced by ωL.

Therefore resonance volts $=\frac{2\pi anD\omega L}{R\lambda}$ ..... (1)

Since the local oscillator is then adjusted so as to give the same deflection as the incoming signal, we must have :—

resonance volts = volts applied to amplifier by local oscillator, $=\omega I_0M$, where I_0 is the current in the local oscillator, and M the mutual inductance between it and the coupling coil.

Hence $\frac{2\pi anD\omega L}{R\lambda}=\omega I_0M$ ..... (2)

Therefore $D=\frac{I_0MR\lambda}{2\pi anL}$

M being the appropriate value of the mutual inductance for the particular wave length and secondary coil employed.

The Determination of M.

As has been mentioned above, M is not necessarily the mutual inductance measured by low-frequency methods, but

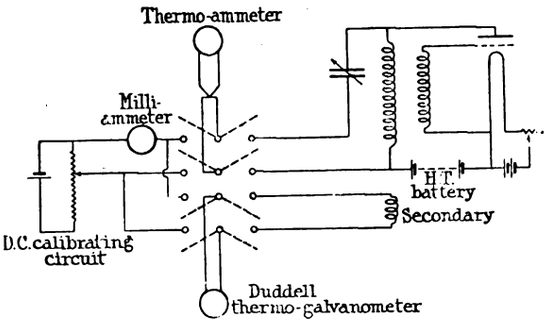

FIG. 3.—DIAGRAM SHOWING CALIBRATION OF OSCILLATOR.

the mutual inductance at working frequency referred to the current at a particular point on the oscillator. It is measured as follows :—

The oscillator is connected as in Fig. 3, the Duddell thermo-galvanometer with an appropriate heater being in the secondary circuit, and an ordinary thermo-junction and galvanometer in the oscillating circuit. The resistance and impedance of the secondary are measured by ordinary methods, since its natural frequency is so high compared with those under consideration as to have no measurable effect. In addition, the secondary is of a form in which the increase of resistance with frequency is small, and as a high-resistance heater is generally required in the thermo-galvanometer this variation can be neglected.

Test Details.

Owing to the use of the aperiodic coupling, it is necessary to measure the high-frequency resistance of the circuit for each observation. While this introduces an apparent complication into the process of taking a reading, it has several very definite advantages, these being :—(1) No assumptions of uncertain accuracy are made. (2) A very severe check on the correct working of the apparatus is provided for each reading. (3) Owing to there being no balancing circuit, the number of turns on the coil can be varied at will. This is of value if it is required to take observations of stations on widely different wave-lengths with only a short interval of time between them. In addition, it is sometimes advantageous to have control of the resistance.

The actual measurement of resistance is made as follows. The coil is fitted with a five-way switch by which resistances of 7·46, 18·3, 39·9, and 78·2 O can be inserted in the oscillating circuit. A signal, either from a local source or from outside, is tuned, and readings of the galvanometer are taken for all five positions of the switch. The voltages corresponding to these readings are then measured by the local calibrating circuit.

Very Important Information.

From these results very important information can be obtained. Of course, if the resistance of the circuit be unusually high or exceptionally low the extreme values of the inserted resistance may not give accurate results, but the group has been so chosen as to be suitable for average working. In a particular case the following results have actually been obtained. By using the five steps and working out the results of individual pairs, the following series of values for the high-frequency resistance of the circuit was found : 22·3, 22·9, 22·75, 22·35, 23·8, 23·2, 22·4, 22·3, 21·5, the average of these being 22·6 O ; the above values are as consistent as may be expected from measurements of this nature under ordinary conditions.

Their close agreement shows the truth of the following statements :—

(*a*) The effective resistance of the amplifier is independent of the signal strength.

(*b*) Since the calculation of these results involves the figures obtained for the various mutual inductances of the secondary coils, these figures must be accurate.

(*c*) Any direct electrostatic coupling to the amplifier is negligible, since the constants in (*b*) were obtained with a thermo-galvanometer, and not by means of the amplifier.

In order to verify the fact that the result was independent of the particular adjustment of amplifier, a local oscillator was set up and its intensity measured. The amplifier was then considerably altered, i.e., the number of valves, high pressure, and filament current were changed, and the local source was measured again. The results differed by less than 1 per cent.

It is hoped to obtain useful information by the incorporation of an Einthoven string galvanometer so as to obtain photographic records of signals, which will assist in deciding another very important question, namely, within what limits of intensity and frequency is an average transmission liable to vary.

MEASUREMENTS OF THE URSI SIGNALS FROM NANTES (UA) MADE AT THE NATIONAL PHYSICAL LABORATORY.

Date	Potential gradient μV/m	Effective *R* of set	Date	Potential gradient μV/m	Effective *R* of set
1922		O	1922		O
Oct. 25 ..	1 100	10·5	Dec. 1 ..	1 670	17·7
,, 26 ..	1 980	14·0	,, 4 ..	3 200	20·8
,, 27 ..	2 190	23·0	,, 6 {	2 310	} 21·0†
,, 31 ..	1 660	16·6		2 030	
Nov. 1 ..	2 100	9·8	,, 7 ..	2 050	19·4
,, 2 ..	4 260*	14·7	,, 11 ..	1 600	21·3
,, 10 ..	2 720	12·6	,, 12 ..	1 800	18·0
,, 14 ..	3 270	19·4	,, 14 ..	1 730	21·7
,, 15 ..	1 750	9·3	,, 18 ..	1 650	14·8
,, 16 ..	2 000	16·7	,, 20 ..	1 010	10·0
,, 17 ..	2 250	19·2	,, 21 ..	1 360	13·0
,, 20 ..	1 040	30·0	,, 22 ..	2 269	15·8
,, 21 ..	1 900	23·7	1923		
,, 22 ..	1 795	42·5	Jan. 3 ..	1 720	20·0
,, 27 ..	2 440	16·0	,, 4 ..	2 200	21·2
,, 28 ..	1 760	16·4	,, 5 ..	1 460	17·7
,, 29 ..	1 420	21·4	,, 8 ..	840	6·3
,, 30 ..	1 950	17·6	,, 10 ..	3 100	28·0

* Obviously an abnormal day. "MSK" (Moscow) was heard loudly on a small set on which it is normally inaudible during the day. Daylight variations of bearing were also reported as excessive.

† An abrupt change of intensity occurred in the middle of the signal.

NOTE.—These figures are the actual readings obtained, and are not corrected to the standard aerial current of 180 A for purposes of comparison. The variations are in most cases not more than 2 or 3 per cent.

On the basis of the Austin-Cohen formula, the theoretical value of the gradient at the N.P.L. with 180 A in the aerial should be 1 760 μV per metre.

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Permissible Current Loading of British Standard Impregnated Paper-Insulated Electric Cables.*

By S. W. MELSOM and E. FAWSSETT.

This Report, describing further investigations of the heating of buried cables, is of a very comprehensive character, and it is only possible to give a summary of its contents. It consists essentially of three portions, the presentation of current carrying tables, the account of theoretical and experimental work, and a series of appendices in which additional data bearing thereon are included. There is also a bibliography prepared by the Association.

The work has now reached a stage at which it is possible to issue tables of maximum permissible currents for all sizes and types of paper-insulated cables dealt with in the British Standard Specification and in general use. A series of twenty-six tables, calculated on the basis of experimental results obtained with a large number of cables, is given. The following constants relating to thermal resistivity are of interest :—

Dielectric †—Cables up to and including 2 200 V	750
Cables above 2 200 V and including 11 000 V.	550
Armouring and protective coverings	300

Current loading tables are given corresponding to various values of thermal resistivity and moisture content of soils. According to these data the thermal resistivity varies from about 340 for dry sandy loam and heavy clay with only 1 per cent. moisture to 90 with sandy loam having 15 per cent. moisture.

As representing average practice, depth of laying is taken as 18 in. for cables up to 2 200 V and 3 ft. for cables for pressures above 2 200 V up to 11 000 V. The normal maximum temperature of the soil is taken as 15° C., and the maximum temperature to which dielectric and conductor may be exposed as 65° C. for armoured cables laid direct in ground and 35° C. for plain lead-sheathed cables drawn into ducts. The temperature rises on which the tables are based are thus 50° C. and 35° C. respectively.

Theoretical and Experimental Work.

The account of the theoretical and experimental work covers a considerable amount of ground. The evaluation of the temperature rise of a conductor buried in the ground depends on the fundamental relation :—$H = t_1/(S+G)$ where H = heat developed in conductor per sec. ; t_1 = temperature rise of conductor ; S = thermal resistance between conductor and surface of cable ; G = thermal resistance of ground surrounding cable. These factors are conveniently reviewed in succession. H is expressed in watts. Dielectric loss is regarded as negligible within the limits of 65° C. and 11 000 V. Temperature rise, t_1, is an arbitrary value adopted as the result of available data. Information as to the temperature to which cables can be safely subjected for long periods is conflicting and experimental work on the subject incomplete. The temperature limits mentioned were, however, adopted after full consideration of all sides of the question.

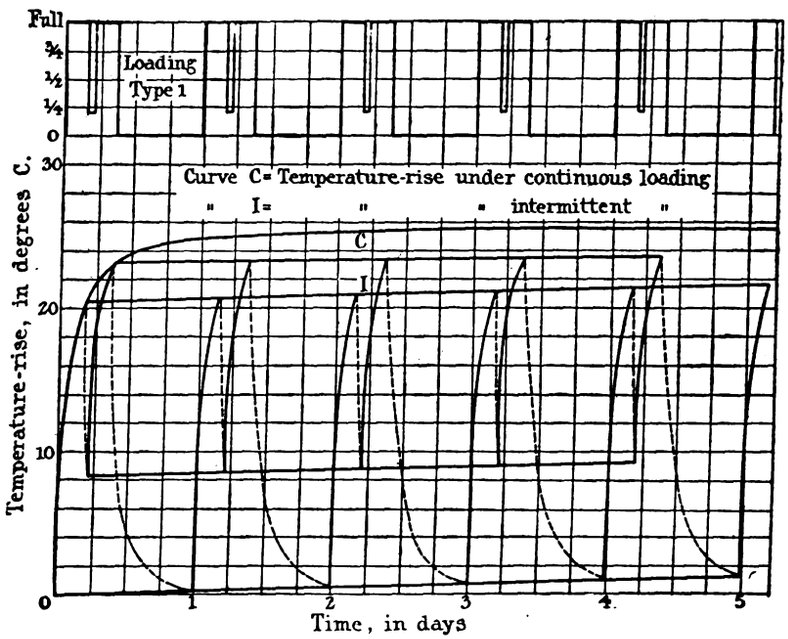

FIG. 2.—THREE-CORE 0·15 SQ. IN. 20 000 V ARMOURED CABLE LAID DIRECT IN GROUND; CURRENT = 200 A.

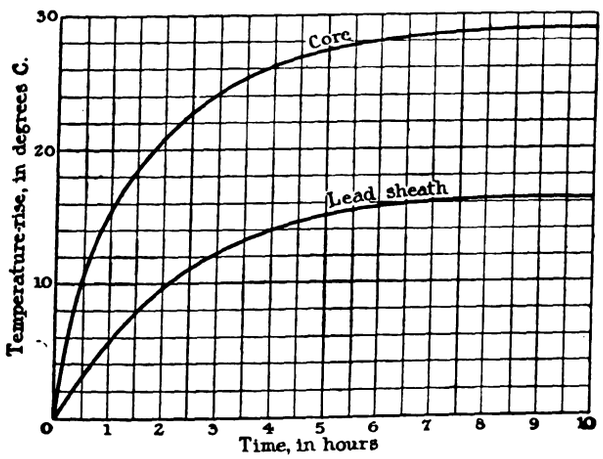

FIG. 1.—TEMPERATURE-RISE IN AIR OF THREE-CORE 0·15 SQ. IN. 20 000 V CABLE NO. 22 AT 200 A, THREE-PHASE 25 ~

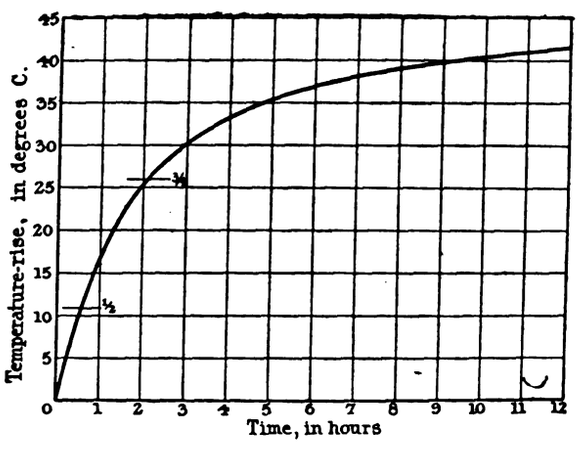

FIG. 3.—CHARACTERISTIC CURVE OF THREE-CORE 0·35 SQ. IN. 20 000 V LEAD-COVERED AND ARMOURED CABLE LAID DIRECT IN THE GROUND; ULTIMATE TEMPERATURE-RISE = 50 DEGREES C.

* Abstract of the Second Report presented, on behalf of the British Electrical and Allied Industries Research Association, to the Institution of Electrical Engineers.

† Higher values have been adopted for cables having sectional areas less than 0·06 sq. in. to allow for difficulty in manufacturing.

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Ground Temperature.

Curves showing ground temperature throughout the year, both in this and other countries, are presented. As might be expected, the maximum (20° C.) occurs in July and August; 15° C., the value adopted by the Association, is only exceeded in the period June-August, when cables are less heavily loaded, and hence seems an appropriate basis of calculation. The value of thermal resistance, on which tests supplementary to those summarised in the first report have been made,

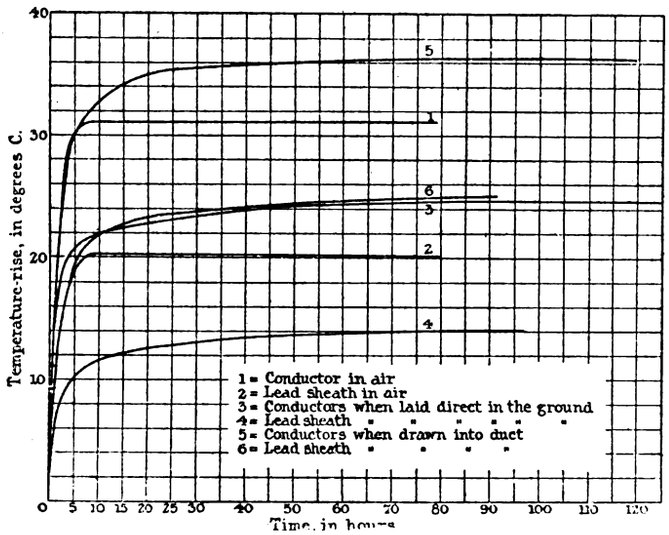
Temperature-rise, in degrees C.
Time, in hours
1 = Conductor in air
2 = Lead sheath in air
3 = Conductors when laid direct in the ground
4 = Lead sheath " " " "
5 = Conductors when drawn into duct
6 = Lead sheath " " " "

FIG. 14.—TEMPERATURE RISE OF THREE-CORE 0·15 SQ. IN. 11 000 V CABLE LAID UNDER DIFFERENT CONDITIONS; CURRENT = 220 A.

depends on lines of heat-flow through the dielectric. These become complicated in three-core cables, and special determinations have been made. Departures from Russell's formula range from 10 per cent. for a 20 000 V cable to 30 per cent. for a 660 V type. Thermal resistance of soil depends on its thermal resistivity and on the lines of heat flow from cable. Thermal resistivity is mainly a matter of the amount of moisture present, and curves giving values are presented in the report. It appeared that 10 per cent. moisture for sandy soil and 20 per cent. for clay would be a fair average. But in view of the varied conditions actually occurring tables corresponding with moisture contents of 0 to 15 per cent. for sandy loam and 1 to 20 per cent. for heavy clay are drawn up. The exact nature of heat transmission through the soil has been the subject of much discussion. The assumptions on which the conclusions of Kennelly, Teichmüller and others are based are not strictly confirmed by the isothermal diagrams obtained in practice. The Kennelly formula has been modified accordingly, and the tables are prepared on this new basis.

The Effect of Depth.

The effect of depth of laying of a cable on degree of heating can be calculated by an adaptation of this formula, and experimental results were in good accordance with values thus determined. The proportional values of currents required to produce a given temperature rise, with conditions otherwise similar, at depths of 1½, 2½ and 4½ ft. were 100, 97 and 92. However, account must be taken of the fact that during part of the year the moisture near the surface is likely to be less than that at a greater depth and the ground temperature correspondingly higher. The effect of proximity of other cables on rating was also considered. No general rule can be given, but in the case of two cables laid in the same horizontal plane in a trench the maximum permissible current would have to be reduced in the following ratio :—

Distance between axes of cables in inches.	Ratio of max. permissible currents for two cables.
4	0·76
8	0·82
12	0·86

At a distance apart of 4 to 6 ft. the difference becomes almost inappreciable. Somewhat similar variations are recorded for cables laid in the same trench and in the same vertical plane. Information on conditions in the case of cables drawn into ducts is meagre. Experiments were made both with still air and with air drawn into the duct. It appears that the greater part of the resistance to heat is in the thin layer of air in immediate proximity to the cable, and the relative size of duct and cable made little difference to the final result. It was decided to assume that the current required to produce the same temperature rise in a cable in a duct is 0·95 that for the same cable in still air. Some tests were made with six-way ducts to determine effect of grouping, but further experiments are needed in this direction.

Experimental Formula.

All cables were tested in air free from draughts, and a formula has been developed which is in good accord with results of experiments. On this formula are based the tables presented. Nature of the outer surface has some influence, but not very much; with a new lead sheath the value is, however, distinctly lower. The thermal time constant has not proved serviceable for calculation of short-time rating, since a buried cable behaves differently from one in air. In general increase of current loading for intermittent load conditions resembling those met with in practice does not exceed 3 to 10 per cent., hardly sufficient to justify a special recommendation for increased rating with intermittent currents. A considerable number of curves illustrating the effect of intermittent loading are presented in the report. Of these Fig. 3 is typical.

Two of the types of short-cycle loading were designed to give information on which to base a rating for one or two hours only, for use in emergency. The figures show considerable increase over maximum permissible continuous current, and are nearly independent of method of laying. However, the same limit is retained to obviate possible damage due to abnormal expansion.

A comparison was also made between the heating of a three-core cable with three-phase current and direct current. Tests were made with a 0.15 sq. in. three-core cable, lead-covered and wire armoured, at frequencies of 25 and 50 cycles. No measurable difference between results obtained respectively on d.c. and a.c. was observed, and it seems clear that for a cable of this size skin effect and eddy currents in sheath do not produce any appreciable additional heating effect.

In conclusion, a summary of work necessary to complete the investigation is given. This applies more particularly to cables for pressures above 11 000 V.

Electricity Supplies in Occupied Areas.

At a meeting of the CHELMSFORD ENGINEERING SOCIETY, on March 1st, a lecture on "Electricity Supply in Unoccupied Areas" was given by Mr. A. HUGH SEABROOK, a director of Sir Charles Bright and Partners, Ltd. The lecturer referred to the important areas in the East, West, and South of England, and large tracts of country interspersed among the industrial areas where there was no supply of electricity, and he advocated the formation of small local companies for the supply of electricity, controlled by central companies. Another and more promising method of affording electricity supply to scattered districts was where electricity works could be combined with a gas undertaking. In East Anglia, he believed, there were more of these "unoccupied areas" than anywhere else in the country. In Essex he mentioned Shenfield, Hutton, and Brentwood, Harwich, Dovercourt, and Parkeston. He had good reason to believe that in twelve months steps would be taken to develop these areas, which were likely to prove remunerative to carefully managed electricity companies.

A Successful Concert.

The County of London Electric Supply Co.'s Social Society recently held another successful concert at King George's Hall, Tottenham Court Road, London, W.C. Mr. A. R. BACON occupied the chair, supported by the general manager and secretary, Mr. F. C. MCQUOWN, and other heads of departments. Sir Harry and Lady Renwick were unable to be present owing to the indisposition of the latter. The first part of the programme consisted of items contributed by members of the Staff, concluding with a character impression by Hugh Howell and Dorothy Madgin, the former being an old member of the staff. This item contained many skits on electrical matters and was extremely amusing. The second half of the programme consisted of an excellent performance by the Motleys, "The Clesco" concert party.

The current issue of "Punch" contains an appeal from the ROYAL ACADEMY OF MUSIC—the oldest of all musical schools in this country—for funds to enable them to build and equip a small theatre for the study and performance of opera. Though the connection between electricity and music may seem remote, yet with the advent of broadcasting it is certainly becoming closer, and, moreover, many electrical men, as witness the Electro-Harmonic Society, take more than a passing interest in its development and the pleasure it can bring. We therefore support the appeal, and recommend this good cause to the charity of our readers.

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The Institution of Electrical Engineers.

The Second Report on the Heating of Buried Cables.

At the meeting of the Institution of Electrical Engineers on Thursday, March 2nd, the Second Report of the Committee on Heating of Buried Cables was presented by Messrs. S. W. Melsom and E. Fawssett. An abstract of the report is given on p. 253.

The Work of the Research Association.

Mr. Ll. B. Atkinson, in opening the discussion, paid a tribute to the manner in which the work dealt with in the report had been carried out, and then addressed himself to pointing an urgent moral. Great discoveries had been, and would no doubt continue to be, made by individuals in the electrical and other industries, but there was a vast field for mass attack on the problems which had first been initiated by Edison. The idea had spread largely during recent years that by putting enough trained people on to almost any problem it was soluble within a reasonable time, and he gave the opening of the General Electric Co.'s new laboratories at Wembley as an example. The work of the British Electrical and Allied Industries Research Association was of a similar nature, although it tackled problems which neither individuals nor firms could tackle. These were problems of the widest application in every branch of industry, and yet, so far the burden of finding the necessary funds had fallen upon a few shoulders and, in some cases, on the shoulders of those least interested. The research now before them aimed at diminishing the quantity of cables required for a given service. As a result of the present work, supply authorities would be able to determine whether their cables were underloaded or overloaded and the exact size of cable to use under the particular conditions. It was a conservative estimate to say that there were cables to the value of not less than £40 000 000 in use in public electricity distribution, and the tables in this report would enable the efficiency of these cables to be improved by 10 per cent. That fact represented something of the order of £3 000 000 or £4 000 000 to the industry. This at 10 per cent. meant between £200 000 and £300 000 per annum to the supply industry, and yet the funds for the Association were being largely found by a certain group of manufacturers. He could not help feeling that the supply industry should come in and help the Research Association financially and personally, and the same applied to other manufacturers and users of cable.

Cables and Napoleon.

Dr. Alexander Russell had noticed that in a three-core cable the authors found the same temperature differences between the cores and the sheath when the three cores were loaded and when only two cores were loaded. The only explanation he could give was that thermal resistivity had a temperature coefficient, the same as insulation resistance, and in that event the thermal resistivity got worse the higher the temperature. Thus cables used in hot places ought to have an appreciably different rating from cables used in cool places. The whole theory of heat on which this work was based was worked out by one of Napoleon's generals over one hundred years ago, and no doubt he would be much surprised if he could see the application of his theory.

A Permissible Load Problem.

Mr. H. Brazil pointed to the wide difference in temperature rise for cables made in different countries. The results might be foreseen if cables were being laid in sand or clay, but in London it was not possible to be certain what the soil was. He took it that the permissible loading was limited by the worst conditions.

Dielectric Losses in Single Phase Cables.

Prof. E. W. Marchant noticed a temperature rise of 50 deg. was allowed for cables laid direct in the ground and 35 deg. for cables laid in ducts. The only reason for this difference appeared to be the liability to abrasion in the former case. This was not a sufficient reason for such a difference, and people would therefore not be tempted to put their cables in ducts, because, in addition to their being more expensive in the first place, they would not be allowed such a large temperature rise. Some figures of dielectric loss in single-phase cables were needed, having regard to the suggestions that had been made in the last few months for the use of single-phase current for power supply at high voltages.

German Loadings.

Mr. T. N. Riley said the current loading of the German and British 11 000 V cable showed that the thickness of dielectric on the German cable was 0·24 in. as against 0·3 in. for the British, laid direct in the ground. The former would give a better cooling effect and enable the German cables to be run at a higher current density. He would like to know if the difference in thickness of insulation was sufficient to account for the increased rating of the German cables.

Some Detailed Criticisms.

Mr. P. Dunsheath, after expressing his satisfaction at the manner in which the report had been prepared, and recalling a certain dissatisfaction on certain matters at the time the preliminary report was issued two years ago, discussed a number of points of detail. For instance, he wanted to know why a figure of 750 had been adopted for the thermal resistivity in the case of cables up to 2 200 V and 550 for cables above that pressure. Taking the whole of the report and the previous one, he did not think the evidence was sufficient to justify this classification, which meant that the higher voltage cable had a more severe rating. With regard to the thermal resistance of the soil the figures in the report were worked out on the assumption that the further a cable was put into the ground the greater would be the thermal resistance of the soil, but if a cable was put lower down in the summer it was put into a cooler spot and therefore the reverse might hold. It was true that both the Japanese and the Americans were allowing a higher temperature rise than we did, but from a recent report on American cables the number of faults allowed per mile was ridiculous from the British standpoint. Thus, the fact that other nations allowed a higher temperature rise was no justification for our doing the same.

Allocating the Saving.

Mr. E. B. Wedmore (Director of the British Electrical and Allied Industries Research Association) supported the remarks already made as to the value to the supply industry of the work that had been done and suggested that if 10 per cent. of the amount which Mr. Atkinson had spoken of as being saved was allocated by the supply industry as a contribution to the funds of the Association, it would be an enormous help.

Mr. P. V. Hunter said it would be useful to have information as to distances greater than 12 in., as it was customary to lay cables 18 in. and 2 ft. apart. Whilst agreeing that all the lines of heat flow from a cable must eventually reach the surface and be dissipated in the atmosphere, there was the weakness in the assumption that the surface of the ground was isothermal, and it was for that reason it was necessary to make a rather large correction to the formula.

The Author's Reply.

Mr. Melsom, in the course of his reply, said he would like to join in the discussion on the financial end of the problem. As Mr. Wedmore had suggested, 10 per cent. of the savings which it was thought should follow the work in the report might be handed over as subscriptions to the Association, might he himself suggest that 1 per cent. could well be reserved to enable the research workers to keep above the bare subsistence level. The loading of two and three cores of a three-core cable, as mentioned by Dr. Russell, had puzzled them not a little, and it was a point which had yet to be cleared up. As to the higher loading of Japanese and American cables, the point was that he gave the information but did not recommend that that practice should be followed. He believed the British practice was best. Difficulties as to the type of ground had evidently been a snag for engineers; it certainly had been a snag for the experimenters and it was impossible to lay down one set of tables for all kinds of soil. A three-core cable with three equal size conductors had been taken because the information he had was that such cables were largely used on three-wire circuits. In reply to Mr. Dunsheath, he said that the figures of 750 and 550 referred to were arrived at after many experiments, and he believed they were all right from the safety point of view.

A Rush of Central Station Engineers!

The President, in moving a hearty vote of thanks to the authors, said he wished officially, as President of the Institution, to endorse the plea put forward by Mr. Atkinson. The thing that had struck him that evening was the rush of central station engineers to speak.

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Electricity in the Ideal Home.

True Labour-Saving Devices at Olympia.

The Seventh IDEAL HOME EXHIBITION was opened at Olympia on March 1st, and will remain open until March 24th. The most casual visitor cannot fail to conclude that electricity plays a large part in the home of to-day, and must play an ever increasing part in the home of the future. No exhibition is needed to prove that electricity is the only possible illuminant for an ideal home, in spite of the fulminations of Mr. Bawtree. Apart from lighting, however, the display at Olympia demonstrates effectively the many directions in which electricity can add to the comfort of the modern house, while saving much of the labour which renders many homes far from ideal.

The Need for Propaganda.

The enemies of electricity have used many and curious weapons in their time, but it is surprising how some of the old parrot-cries survive even to-day. On one of the stands at Olympia, where hand-power vacuum cleaners are shown, notices are displayed intimating that the users of these machines are not liable to suffer shocks. Most members of the public are well enough aware by this time that an electric vacuum cleaner will only give a shock to the user who deliberately asks for it, but innuendoes of this kind may still do some small amount of harm. This fact has evidently been realised by ELECTRICO, LTD., whose stand contains notices to the effect that "Electricity is safe." It may be argued that such propaganda is elementary and unnecessary; but where the public is concerned the truth cannot be told too often, however obvious it may seem. We have more to say about this stand below.

Excellent Display of Electric Vacuum Cleaners.

To return to the subject of vacuum cleaners, there is a really excellent display of these articles electrically driven. It would be tedious to enumerate all the exhibiting firms, but in almost every case the cleaners are shown in action. Their labour-saving properties are thus obvious. The same cannot be said of the hand-propelled variety. These are not for the most part shown in action. Where they are so shown the efforts of the demonstrator who works the bellows or pushes the whole apparatus bodily across the floor are hardly in consonance with modern labour-saving ideas. The electric vacuum cleaners are shown in a range large enough to satisfy every taste and every pocket. One is priced as low as six guineas, and the finish of all the varieties shown is excellent.

Lighting and Heating.

Electricity is well to the fore in the section of the Exhibition devoted to lighting and heating. Small generating sets for country houses are exhibited on several stands. LEO SUNDERLAND AND CO. are exhibiting their "Hundred Guinea" set, as well as the "Lister-Bruston" fully automatic plant. TAMPLIN AND MAKOVSKI, LTD., show electric plant for pumping and lighting in country houses, in conjunction with the HENLEY system of wiring. Another good exhibit in this connection is that of DRUMMOND BROTHERS, who claim that freedom from trouble more than compensates for their sets being non-automatic. With such sets at his disposal the country-house owner is hardly likely to fall back on petrol-gas or to remain content with oil lamps.

Alabaster fittings are prominent in the lighting section. The "Berkeley" fittings shown by GIRDLESTONE AND CO. are worthy of special note, some beautiful effects being obtained. L. G. HAWKINS AND CO. also have some notably good electric-light fittings on show, and their stand is generally one which commands attention. Their display of domestic appliances is particularly good. Practically everything is shown in actual operation, and a special feature is made of portable "Vio-Ray" high-frequency sets for home use.

It cannot be said, on the whole, that the electric heating appliances shown reach the same high standard as the lighting fittings. But some of the electric fires, such as those shown by BELLING AND CO. and the "Creda" models, are excellent in design and finish. The same applies, perhaps, in a greater degree to many of the gas-fire exhibits, and from these one or two lessons may well be learnt by makers of electric fires.

Cooking and the Hot-Water Problem.

The "TRICITY" stand is the scene of an active demonstration of the firm's electric cookers. These demonstrations are conducted daily, and are the means of attracting a great deal of attention to the stand. Cookers are also a feature of the stand of the HOTPOINT ELECTRIC APPLIANCE CO., and in general this branch of electrical activity is well represented.

A courageous attempt to tackle the hot-water problem electrically has been made by ELECTRICO, LTD. Electric geysers are shown in all sizes, and stress is laid on their absolute safety. The consumption is claimed to be very low, and the firm are to be congratulated on the way in which they have tackled this difficult subject. The visitor to their stand cannot fail to realise that an electric hot-water system is a practical proposition. In other cases where electric geysers are shown, they are not prominent, and therefore unlikely to receive much attention.

In general, the range of domestic electric appliances shown is excellent. The "Glow" electric cooker shown by CHARLES H. SMITH AND CO. is a small but useful article which should have no difficulty in displacing the much-used gas-ring. The same firm are showing the "Glow" electric toilet cup, as well as a variety of other useful articles. Good displays are also made by the DOWSING RADIANT HEAT CO., the TELEPHONE MANUFACTURING CO., HEWSON AND LOWN, CHARLES FER AND CO., and WAKELINS, ENGINEERS, LTD. There is a novelty on the stand of the last-named firm in the shape of the "Twelt" patent candle-tube for electric-light fittings. This is a real wax tube with a melting point of 170° F., and it is claimed that it will not chip or crack.

High-Efficiency Reflectors.

These are shown on the stand of ASTRO ELECTRIC, LTD., and it is claimed that their initial cost is repaid after 200 hours' use. An excellent and convincing demonstration is given on the stand in such a way that the advantages of the reflectors are apparent. "Astro" daylight units for colour matching are also shown.

The Labour-Saving Section.

An individual section of the Exhibition bearing this title is situated in the main hall gallery. It contains numerous electrical exhibits, although those which have already been dealt with certainly also come under the "labour-saving" category. Foremost among the exhibits are electric vacuum cleaners, to which reference has already been made, but there are one or two other stands also deserving of note. The exhibit of the HURLEY MACHINE CO. is attracting considerable attention from visitors. Electric washing machines have had part of the outside cover removed and glass has been substituted. The application of an ingenious lighting arrangement makes the whole action of the machine visible, and stress is laid on the fact that the most delicate fabrics cannot be harmed by its use. An electric ironer is also being efficiently demonstrated. ROGERS ELECTRIC SALES CO. are showing electro-medical appliances which are demonstrated on the stand by experts. This exhibit also includes numerous other labour-saving devices for the home.

While not being quite so numerous as the vacuum cleaners, electric washing machines make a good show in this section. The NORTHERN STEEL AND HARDWARE CO. have a particularly good display of these articles. Vacuum freezing machines are shown on one or two stands, and should command a ready sale during the coming months, provided last summer's weather conditions are not repeated.

The Wireless Section.

Some forty stands are occupied by manufacturers of wireless apparatus in the new hall gallery. Every type of receiving set is shown, but as demonstrations are not allowed, the visitor must perforce make his selection on the strength of appearances. The majority of the stands in this section are excellently appointed, and it seems a pity that the sumptuous armchairs provided should not be used by prospective customers while "listening-in." If exhibitors had been allowed to receive the evening programmes on their stands, for the benefit of visitors—loud speakers being barred—this section would undoubtedly have been one of the most popular in the Exhibition. As it is, however, the stands are not coming in for a great deal of attention, except from wireless enthusiasts. All credit is due, however, to the exhibiting firms for the excellent displays made under the circumstances.

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Salesmanship in the Electrical Industry.

The Function of the Press in Assisting Developments.

The last but one of the salesmanship conferences arranged for this session by the ELECTRICAL DEVELOPMENT ASSOCIATION was held at Caxton Hall, Westminster, on Friday, March 2nd, when Mr. ADAM GOWANS WHYTE, Editor, Electrical Press, gave a paper entitled " The Industry, the Press and the Public." The chair was taken by Mr. C. H. Wordingham.

Mr. WHYTE said the various combinations of the industry, the Press and the public were endless, and he had been forced to select a few that seemed most worthy of discussion from a business point of view. He classified these as (1) the use of the Press as a whole in spreading the electrical idea among the general public; (2) the use which can be made of the local Press by supply undertakings; (3) the use by manufacturers, factors, contractors and supply undertakings of the trade and technical Press.

The Most Potent Salesman.

Speaking on the first heading, he characterised the Press in general as the most potent salesman which the industry has, and laid stress upon the need for systematic and continued publicity, both as regards trade announcements by way of advertisement and of news items in the various papers. The public required educating in this matter of the electrical idea, and the campaign must be planned not merely for months but for years. If the Press were provided with suitably prepared matter relating to electricity it would be published, and a great deal was being done by the E.D.A. on these lines at present.

Coming to his second heading, the use of the local Press, he pointed out many obvious ways in which electricity supply companies and contractors should make much greater use of this medium of publicity than was the case at present, and advocated co-operative advertising, friendship with local editors, and generally at aiming to keep the local electricity supply authority and what was being done as regards electricity continually in the public view.

Not Too Many Electrical Journals.

Passing to the third heading, the trade and technical journals, Mr. Whyte disagreed with the view often heard that there were too many electrical journals. Such a view, he said, could not be sustained by the manufacturers because they now had a journal of their own; neither could it be sustained by the electrical contractors because they, too, had a journal, and individual manufacturers had at times swelled the throng with house journals, all of which imitated the genuine electrical journals by taking advertisements. Electrical trade unions swelled the subsidised competition; the Post Office was another conspicuous sinner and last, but not least, there was the Institution of Electrical Engineers preparing to scour the electrical industry for advertisements in the Journal of the Institution. Apart from these aspects, it might well be asked whether five journals could be described as too many for an industry of the range and magnitude of the electrical industry. Further, there was the test of survival; the youngest electrical journal was over 22 years old, and they had all continued to develop in spite of the fact that they had to face subsidised competition.

How to Obtain Better Service from the Electrical Journals.

It was surely remarkable that most electrical associations, which received ungrudging support from the independent journals, were now competing with them for the strictly limited publicity allocations of the manufacturers and traders. All this had a direct bearing upon the service which the genuine electrical journals could render the industry. The electrical journals did something more than provide so much advertisement space for so much money. The broader policy of trade and technical journalism was the development of the electrical industry, and he instanced many matters in which the journals had aided progressive movements right through the history of the industry. There were, however, two ways in which the electrical journals could render still better service in the future. One was by being granted a fuller recognition of the service they rendered as independent organs of opinion and distributors of information; and the other was by a more intelligent and energetic use of that service by the industry.

Advice to Salesmen.

He urged every salesman to keep closely in touch with the electrical Press, and all young members of the industry to study at least two electrical journals in order to get the advantage of different editorial points of view. Further, the large firms and supply authorities should subscribe for several copies of the electrical journals so that their staff had the opportunity of seeing them. The cost of this bulk subscription was trifling measured as a percentage of the total staff expenses, but its effect upon the recipients would make it a most remunerative investment. Probably the most valuable direct service rendered to the electrical salesmen by the electrical journals was their educative effect upon the central station engineer, who, as a class, was a fairly constant reader of the trade journals. It was due to the electrical journals having steadily pushed in the direction of commercial development during the past 15 years that the industry was doing so much more to-day on the sales side.

DISCUSSION.

There was a long discussion upon the paper in which the editors of all five electrical journals took part.

Mr. C. H. WORDINGHAM explained the action of the Council of the Institution of Electrical Engineers in seeking advertisements for their Journal. The object was to reduce the enormous cost of the Journal in the hope of being able either to lower subscriptions of members or give more reading matter. He added, facetiously, that the electrical Press was to blame because it had taught the Council the value of commercial methods.

In addition to the editors of the electrical journals, Mr. L. L. ROBINSON agreed with the condemnation of the policy of the Institution in the matter of advertisements in the Journal. He added that the Institution subscriptions had been increased largely because of the rise in the cost of paper and other commodities during the war, but there had been large decreases since, and it seemed necessary that there should be an " axeing enquiry " into that body's financial operations.

Some Differences of Opinion.

Such differences of opinion as there were with Mr. Whyte came from his confrères. For instance, Mr. R. W. HUGHMAN did not agree that there were not too many electrical journals, but at the same time he added that every issue of every electrical journal, however poor, gave information worth many times the amount paid for it.

Major F. H. MASTERS, referring to other journals than the genuine electrical journals as " spurious " publications—for want of a better term—said they were bad for the industry apart from the question of advertising. Some manufacturers who issued house journals prevented their staffs from contributing to the genuine journals, and thus they were not able to do that service to the industry as a whole which they could if the results of their work were published in the independent journals, whose circulation was larger and more influential. The electrical industry did not appreciate the potentialities for good which it possessed in its trade and technical Press.

Mr. A. H. ALLEN expressed the wish that the various firms in the industry would keep the Press more in touch with what is going on.

Mr. S. RENTELL and Mr. E. SLATER also spoke in similar terms.

The Author's Reply.

Mr. WHYTE, in the course of his reply, said his paper had indicated that there were some firms who were willing to give every possible help to the Press. He did not suppose anything he had said would induce any association or firm to forego its official organ or cut out the advertisements, but when such firms asked for more from the electrical journals, they should understand that the electrical journals were now giving to the full extent of their tether. If the electrical journals were to be handicapped in their proper development by these " spurious " electrical journals, then they could not give the same service to the industry as they otherwise could.

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Merchandise to Sell and Profit By.

In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

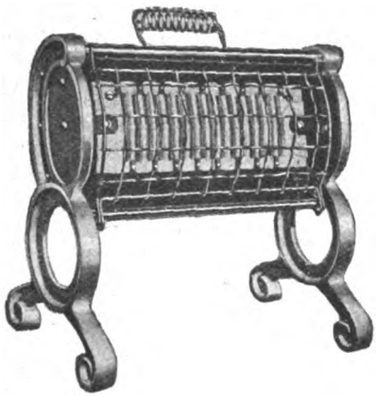
It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

A Small Fire for 25s.

We illustrate a small fire of new design which has just been placed upon the market by the ARORA CO. It has been christened "Bungalow."

There is, it would seem, judging from a recent meeting of the E.D.A., no unanimous opinion as to whether it is good electrical practice or good merchandising to sell small fires. In our opinion it is; and there is everything to support our contention. From the supply company's point of view these small fires are excellent "juice consumers," and from the retailer's point of view they make a quick turnover and profits. Quick turnover is the vital factor in



THE LATEST ARORA FIRE.

a retailer's selling policy. Lines which may show a good profit on paper are often very slow in starting, and if overhead charges are proportioned correctly the actual profit is small when the stock does finally move.

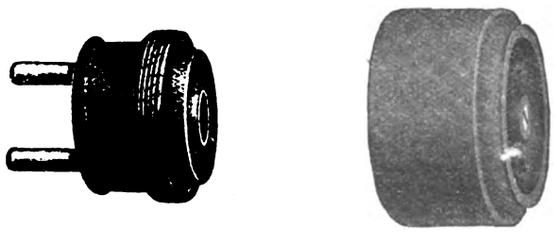
Briefly described, the "Bungalow" fire is made up of two end castings and of a sheet iron or sheet aluminium shell. The guard hooks into two holes at the top of the shell, and is sprung into position and held by two hooks at the bottom. The electrical element consists of a standard "Arora" firebar of either 750W or 1 000W loading. It is mounted on a W.I. strap, which is complete with two insulated pin terminals coupled to the ends of the bar. This forms a complete unit to slide into the shell, where it is held by three screws, one through each end of the castings and one in the middle at the back, the pin terminals projecting through clearance holes in the sheet metal back. It is made in two standard finishes—matt black finish throughout or nickel plated finish throughout.

If it is price which attracts buyers of these small fires, then there will be a big demand for the "Bungalow," because with a 750W rating and finished in matt black the list price is only 25s.

A B.E.S.A. Wall Plug and Socket.

There is one simple reason why the Crabtree range of wall plugs and sockets should be prominently indexed in the buyer's record. The whole range is made to the B.E.S.A. gauge, and it is of vital importance that contractors get the habit, so to speak, of using wall plugs with this standard gauge.

We illustrate the ordinary 5A size with cocos cover and plug, and while from the exterior view the device has nothing to dis-



A STANDARD PLUG AND SOCKET.

tinguish it from other wall plugs and sockets, it has that finesse typical of Crabtree accessories. The sockets can be supplied with ordinary type plugs or the "Handshield" type. Either are interchangeable as regards centres, but the Handshield plugs are necessary if the Engineering Standards Committee specification is to be fully complied with. They are manufactured by J. H. CRABTREE AND CO.

A "Big Figure" Wireless Set.

The turnover in wireless sets is only limited by the vision of the retailer. If it is accepted that the public will only buy sets priced up to, say, £20, and selling plans are laid to deal with sets within that limit, then the "big figure" business will not come. It has to be attracted.

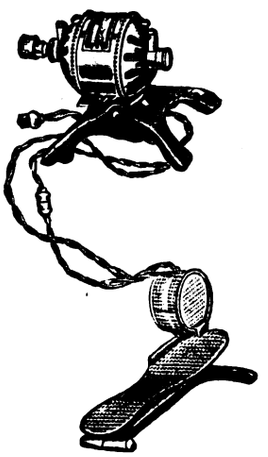
The set which we illustrate is typical of what we have in mind when we refer to "big figure" business. There *are* buyers for these

A WIRELESS SET WORTH BUYING.

sets, and if the electrical retailer is really serious in his plea that he is actively marketing "wireless," then he will see to it that he does not let the large furnishing houses and chemists only cater for the needs of those who wish to buy in this market. The handsome set illustrated is manufactured by RADIO INSTRUMENTS and is listed at 95 guineas.

A Small "Domestic" Motor Appliance.

We illustrate a small sewing machine motor distributed by the SUN ELECTRICAL CO. It is novel in that it can be quickly attached



FOR USE IN THE HOME.

to any hand or treadle sewing machine. No tools are required for fixing, which is a good selling point and will remove the impression

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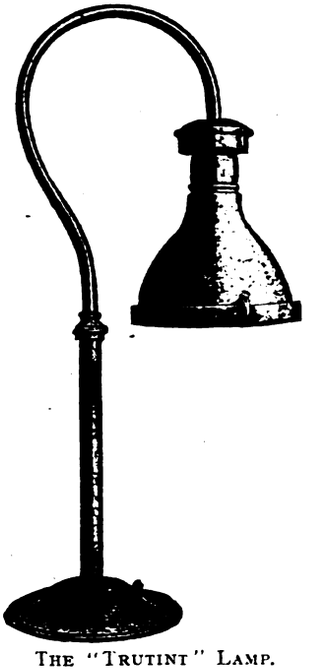
that these small domestic devices require the valuable and expensive services of an electrician (not forgetting his mate) to fix them.

It will probably be argued that, owing to the rapid development of sewing machines with the electric drive built in as an integral part, there is but little outlet for such a device. We only need reflect how many of the ordinary hand or foot treadle sewing machines are still in use, and still being bought, to visualise the market available. Further, by the provision of a simple attachment the motor can be employed for buffing silver and grinding knives.

The list price of the set as illustrated, and with the useful "take-offable" fixing attachment, is £5 10s., with 12s. 6d. extra for the buffing and grinding attachment.

A Unit to Produce a "Trutint."

It is unfortunate that contractors and retailers have so little time to spend on the selection of socks with clocks and shot silk ties. If they had the spare time and could patronise shops which sell such vanities or necessities, they would appreciate how necessary is a colour matching unit. Further, they would realise how few shops are fitted with such a unit in spite of the fact that every other fitment in the shop is the expression of the "last word" in the shopfitter's art. It is for the electrical contractor to show the trader how such a unit can increase his sales.

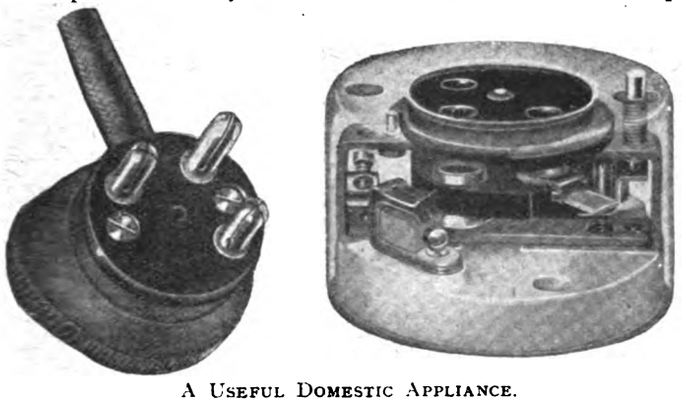


THE "TRUTINT" LAMP.

The "Trutint" colour matching unit is manufactured by the BRITISH THOMSON-HOUSTON Co. We illustrate a standard designed for counter and table use, but the unit can also be supplied in a pendant type. The "Trutint" unit correctly reproduces the daylight from a north sky and this result is achieved by the use of a correctly designed reflector and a screen of Crookes daylight glass. The unit and the many applications to which it can be put are fully described in folder L.226. The numerous applications show the wealth of business there is in actively exploiting this device.

The Kingsway Interlocking Switchplug.

It is the ever-increasing practice of supply undertakings to insist that all heating appliances shall be controlled by an interlocking switchplug. The selection of the best types of apparatus from every point of view is not so simple as it would appear. That there are a host of types on the market is readily admitted, but the fault peculiar to many is that the switch action will not stand up



A USEFUL DOMESTIC APPLIANCE.

to severe and continuous work. For this reason there are some points of advantage in the use of a rotary switch action over the tumbler action. It is still an open question as to whether it is fundamentally sound to use a tumbler switch action with a device of this kind, particularly as such an action, popular and familiar though it is, does not lend itself to a double-pole break.

The "Kingsway" interlocking switchplug is a device with a rotary switch action. It is made in the 15 A size only by the GENERAL ELECTRIC Co.

The CRESSALL MANUFACTURING Co. notify us that they have just published List L.W.B. 1923, describing the "Cressall" electrically heated laboratory water baths. Readers of THE ELECTRICIAN who have need of this apparatus are invited to study the specification of the bath, because, it is claimed, the new design is recognised by laboratory specialists as a distinct improvement.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

"Superior" Ironclad switches are fully described in a price list just issued by WM. SANDERS.

The REAY GEARWORKS have issued a pamphlet describing the "Peak" noiseless pinion.

ELECTRO-DYNAMIC CONSTRUCTION have published an up-to-date price list of dynamos and motors.

A. C. ALEXANDER AND Co. have just published a descriptive price list on Howells A. C. motors.

A leaflet describing the utility of a one-ton electric block for hoisting has been issued by JOSEPH ADAMSON.

TOK SWITCHES are now circulating list No. 2, giving full particulars of their rotary snap switches.

"SIMPLEX" wireless sets are fully described in descriptive folders received from H. P. R. WIRELESS.

CROWTHER AND OSBORN advise us that a new price list of "Sceando" lamps is now ready for circulation.

BAIRD AND TATLOCK (London) have just issued a comprehensive price list of their electric furnaces and pyrometers.

Another help for the retailer wishing to take advantage of the "wireless" boom is the January list just issued by ROSE BROS.

Those to whom presses mean business should see that ARNOLD AND LARGE'S new list, No. 27, is in their catalogue library.

Retailers should note price list 7 312 of the BRITISH THOMSON-HOUSTON Co. broadcasting wireless equipment dealing with crystal sets.

PHILLIPS AND TURNER have issued leaflets dealing with switch plates, ceiling plates, lamp holding galleries, and other lighting fittings.

UNDERFEED STOKER COMPANY has just published a new descriptive circular of the Detrick-Usco Arch. We fully described the arch in our issue of November 17, 1922.

Engineers interested in wormgear units will do well to secure a copy of pamphlet showing examples of these units made by TURBINE GEARS, LTD.

"Everything for the automobile and motor cycle" is the slogan of A. H. HUNT. Their most comprehensive catalogue, No. 48, just issued, well proves this.

A full description of the Durex wiring system just placed upon the market by SIMPLEX CONDUITS is given in a new list, No. 963, just issued by that company.

Price list No. 5 021 and 5 022, of controllers, and descriptive list 3 210 of d.c. switchboard panels are now ready for distribution by the BRITISH THOMSON-HOUSTON Co.

The 18th number of vol. 2, of "M. and C. Machine Mining," which has been anxiously waited by all mining engineers, has just been published by MAVOR AND COULSON.

A very comprehensive list, giving full particulars and illustrations of some of their specialities in the way of portable electric drills, etc., is now published by COOPER AND SMITH.

Contractors who have the entrée to lucrative "country house lighting" business will read with interest the publicity matter by DRUMMOND BROS. on the "Drummond Lighting Set."

Contractors and retailers please obtain the "Jackson" instruction card for using Jackson electric cookers. It will help in the selling of cookers considerably. Applications to the JACKSON ELECTRIC STOVE Co.

"L.W." motors and dynamos and the several other types of machines manufactured by TODMAN, RYALL AND Co. are fully described in a new catalogue just issued. Single phase and three-phase oil-cooled transformers are also included.

Buyers of heating and cooking apparatus who make the "Jackson" loose-leaf price list their *vade-mecum* must be careful to take note of the new lists just issued by the JACKSON ELECTRIC STOVE Co. Prices show a substantial reduction.

E.C.C. multi-speed induction motors are manufactured to the Creedy patents by the ELECTRIC CONSTRUCTION Co. Booklet B.505 has just been issued by this company, and is a valuable text book of considerable technical data on these machines.

We understand that A. C. ALEXANDER AND Co. have been appointed sole representatives for the whole of London and southern area for Burnley components. Publicity matter has been sent us by the new agents describing the "Burco" heater and fan.

Manufacturers and distributors of wireless apparatus will please take note of the fact that the IGRANIC ELECTRIC COMPANY have just issued new leaflets, Nos. 2 226, 2 236 and 2 241, which illustrate and describe coil holders, inter-valve transformers, and filament rheostats.

Works managers and others who have to consider the efficiency of large factories must pay close attention to a new list just brought out by HERBERT MORRIS. In it are described a multitude of devices for increasing the efficiency in the factory. Of particular interest are the several types of overhead electric cranes and electric trucks.

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Electrical Engineer's Slander Action.

£250 Damages for Mr. Tomlinson-Lee.

The LORD CHIEF JUSTICE and a special jury, sitting in the King's Bench Division on March 6th, commenced the hearing of an action in which damages were claimed for alleged slander by Mr. H. Tomlinson-Lee, of King's Road, Wimbledon, formerly chief electrical engineer to the Wimbledon Corporation, against Mr. S. Mussell, the Mayor of Wimbledon. The slander was alleged to have been uttered at a meeting of the Wimbledon Town Council on January 31st, 1922.

The defence was a denial that the words complained of were spoken, and if they were they bore no defamatory meaning. The defendant also claimed that the occasion was privileged.

Mr. Maddocks, K.C., and Mr. Herbert Jacobs appeared for plaintiff, and Mr. J. D. Cassels, K.C., and Mr. C. A. Collingwood for the defendant.

Mr. MADDOCKS, in opening the plaintiff's case, said that Mr. Lee, until May 31st, 1922, was the chief electrical engineer of the borough of Wimbledon, Mr. Mussell being the Mayor, and the gist of the plaintiff's complaint was that the words spoken by the Mayor at the meeting of the Town Council were defamatory, and injured him in his reputation as an electrical engineer. Plaintiff was 45 years of age, and had been in the employ of the Wimbledon Corporation for 20 years. He was a member of the Institute of Electrical Engineers and an associate of the Institute of Mechanical Engineers. In July, 1919, he was receiving a salary of £700 a year, to which amount his salary was raised by the unanimous vote of the Electricity Committee of the Council. It was said that he should take no interest in municipal or parliamentary elections and he was to be polite and courteous to members of the committee, and that he was to bear with them as, after all, the members were not so highly technical in their knowledge.

"Take a Month's Sick Leave."

In 1921, proceeded counsel, there was a party formed of members of the Council, and which included members of the Electricity Committee, who talked matters over before the meetings so that they could regulate their votes. For some reason or other Mr. Lee incurred their dislike, by reason perhaps that he had helped Mr. Mussell in his election. However, no definite complaint was made. The first intimation that he received of the trouble that was brewing was on January 1st, 1922, when by request he attended a meeting of the Electricity Committee and was astonished when he was told that the committee had decided that he was to leave their service. The proposition put to him was that he had better resign. He was told "To make things easier you can take a month's sick leave and then give a month's notice or send in your resignation, and we will do our best to get the Council to give you one month's salary in lieu of notice." Of course Mr. Lee could not accept such a notice and he wrote: "I do not feel in fairness to myself that I should be asked to take the course suggested, and I am not willing to adopt it. The suggestion comes as a surprise to me and I should like to know the grounds upon which the committee acted. As far as I know there is no justification."

The Words Complained of.

At a meeting of the General Purposes Committee the resolution of the Electrical Committee was confirmed, and that notice should be given the plaintiff to terminate his engagement in three months' time and that a cheque should be given him at once to include his salary up to May 31st. A special meeting of the Council took place on January 31st, at which the Mayor presided and at which the public were admitted. Some of the Councillors wanted to know why the plaintiff was being dismissed without good reason, and the defendant said: "I feel confident that if the facts and reasons are asked for by those who think they are working in the interests of Mr. Tomlinson-Lee, they should be circumspect in the manner in which they approach this serious subject."

Mr. LEE gave evidence in support of his Counsel's statement to the effect that he had passed for insurance as a first-class life and was aggrieved at the suggestion which had been made.

Cross-examined, Mr. LEE stated that he felt no animosity against either the Mayor or the Council. He agreed that if the Electricity Committee had a genuine reason and had lost confidence in him they would have been acting in the interests of the borough in giving him notice.

So far as the Mayor was concerned he should say he (the Mayor) had always been a friend of his. He could not say that during the last year he had always got on well with the members of the Electricity Committee. He could not agree that he had been treated with the greatest consideration and with a desire to help him. He thought that what the defendant had said had had a very considerable effect in bringing about his dismissal and that his friends might believe he had been guilty of some offence, criminal or otherwise.

Mr. A. G. WHYTE, electrical engineer, of the Ridgway, Wimbledon, said he read of the conflict between the plaintiff and the Corporation in the local press and attended the special meeting of the Town Council. He heard no reason given why the plaintiff was dismissed from his position.

Mr. CASSELS, in opening the defence, said the real question the jury had to try was whether the defendant said things that were defamatory and whether he was actuated by malice. Defendant had, from start to finish, been actuated towards the plaintiff by the most friendly motives. If the defendant had desired to make a defamatory statement he could have cleared out the public and made it to the Council only and he then would have been able to claim privilege.

Defendant gave evidence to the effect that he was a retired chartered accountant and had always endeavoured to be on friendly terms with the plaintiff. Cross-examined, he said that he knew there were a number of reasons which brought the Council to their decision. So far as he knew the plaintiff's dismissal had nothing to do with the question of intoxicants. He thought it was his duty to do what he did. He agreed with the decision of the Council regarding the plaintiff.

After Mr. STEELE SHELDON and Councillor HICKMOTT, chairman of the Electricity Committee, had given evidence, counsel addressed the jury.

The Question of Privilege.

In summing up, the LORD CHIEF JUSTICE addressed himself first to the question of privilege, and drew a distinction between a privileged occasion and a privileged communication. Counsel for the defendant had not seriously contended that the words complained of were not defamatory, and if the Mayor's statement that there were good and solid reasons for dismissal conveyed the implication that they appeared to convey, the jury had no choice but to find them defamatory. Even so, defamatory statements were protected on certain occasions, but then in order that privilege might be enjoyed it must be properly used. A meeting of the Town Council was only a partially privileged occasion, and the jury must therefore determine whether, when the statements were made, proper or improper use had been made of the occasion.

Reviewing the evidence for the defence his Lordship said that in deciding whether the defendant had an honest mind in what he said, the jury must consider that he knew no reasons for the plaintiff's dismissal and had not asked for any. Though it had been stated that the meeting of the Town Council at which the decision was taken was difficult to control, a very complete and accurate report of it was available. The jury must consider what the real meaning of the words complained of was. Did they mean, "There are reasons for the dismissal and I know what they are; and I advise Mr. Lee's friends to be wise and not to ask what they are." The defendant had been able to give no real reasons for the dismissal except that the case was going to lead to an awkward discussion in the Council and that he wanted to get the latter out of the difficulty. After the words complained of had been uttered there were two separate occasions at the meeting upon which they could have been withdrawn. His Lordship left three questions to the jury: Were the words complained of defamatory, were they a privileged communication, and what damages should be assessed?

After a retirement of three hours, during which they enquired whether a majority verdict would be accepted and returned to Court saying that they could not agree and were instructed by his Lordship to consider the matter further, the jury answered the first question in the affirmative, the second in the negative and assessed the damages at £250. His Lordship, in entering judgment for the plaintiff, said that the only question upon which the jury were at variance was that of damages. He refused to grant a stay of execution on the grounds of misdirection.

Legal Intelligence.

Unsuccessful Home Office Prosecution—Case stated for Appeal

The Bath magistrates, on February 22nd, dismissed a summons against the Bath Electric Tramways Co. for allowing a workman to use a portable hand lamp with a pressure above 150 V not properly protected by a suitable non-conducting cover (see THE ELECTRICIAN, March 2nd, page 233). Mr. JOSEPH OWNER, H.M. Inspector of Factories, of Bristol, who prosecuted, indicated there would probably be an appeal, contending that the magistrates had wrongly interpreted the Home Office regulation under which the summons was taken.

On Thursday last Mr. OWNER formally asked the Bench to state a case for the opinion of the High Court. The magistrates agreed.

B.T-H. Patent Litigation.

In the Chancery Division on March 2nd, Mr. JUSTICE ROMER granted an injunction over Friday, March 9th, on the ex-parte application of the British Thomson-Houston Co. restraining D. Rose and Co., of Osborn Street, Aldgate, E.C., from infringing their patent for improvements in incandescent lamps.

Mr. J. HUNTER GRAY, in support of the application, said he had to ask for an order setting out in detail what they were asking for because in six or seven previous cases they had been put to considerable trouble in seeing that it was carried out. It appeared to be the practice after the order was made for defendants to sell their entire business and then disappear and nothing more was heard of them.

A representative of the defendants was in Court and said they wanted to oppose the application.

The ELECTRO-HARMONIC SOCIETY will hold its last smoking concert of the season at the Caxton Hall, London, S.W., on March 14th, at 8 p.m.

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The Institute of Chemistry.

Young Men Attracted to the Profession.

At the 45th annual general meeting of the INSTITUTE OF CHEMISTRY, held on March 1st, the president, Mr. A. CHASTON CHAPMAN, stated that the roll of fellows and associates had increased during the past twelve months by 421, to a total of 4062, and the register of students by 72, to a total of 955. The Institute was taking an increasing part in the affairs of the country and was frequently appealed to by Government Departments and other authorities for advice and help. The Institute in common with other societies and associations was actively promoting a spirit of solidarity and comradeship among all who were concerned with chemistry, with a view to welding the profession into one coherent whole. With the advances which chemistry was making in all directions and with the high degree of specialisation to which they were tending, many societies had come into existence, but the dangers of decentralisation were greatly lessened by the practice of holding joint meetings of the societies.

The profession had attracted a larger number of young men during the last four years than in any previous corresponding period, but he was very optimistic in regard to the future of chemistry, and it was a remarkable fact that, notwithstanding the increased output from the colleges, and the intense industrial and commercial depression, the new members of the profession were being steadily absorbed. This absorption might be taken as a definite indication that chemistry was more highly valued by the manufacturer than formerly, and as evidence that the leaders of industry and commerce were turning more and more to science to assist them in the solution of their various problems.

British Electrical and Allied Industries Research Association.

At the recent annual general meeting of the British Electrical and Allied Industries Research Association, the Director (Mr. E. B. WEDMORE) referred to the facilities for co-operation between manufacturers, users and independent experts, afforded through the Committees of the Association, in dealing with the technical problems of the day. He drew special attention to the monumental report on the researches on the heating of buried cables, with which we deal in this week's issue, and to the important researches on electric control apparatus now in progress.

During the course of the discussion, Mr. Ll. B. ATKINSON and Mr. C. P. SPARKS, commenting on the work which had been done on buried cables, stated that the saving to be effected by the industry by the application of the results obtained would alone cover, in a very short time, the whole of the expenditure of the Research Association to date on all its researches.

The Chairman (Mr. E. B. VIGNOLES) remarked that the position of the Association was now very different from what it had been a year ago. It had then scarcely begun its work and there had been a tremendous amount to be done in laying the foundations of such an organisation before commencing to build. He believed that it would be easier in the immediate future to undertake, with good hope of success, a propaganda for the broadening of the basis of membership and securing further support for the Association. Expressing appreciation of the past services of Mr. C. H. Wordingham, he moved that he be appointed the first President of the Association. The resolution was seconded by Mr. D. N. DUNLOP and carried unanimously with acclamation.

Mr. F. GILL was elected a member of the Council in place of Mr. J. S. HIGHFIELD, and other retiring members of the Council were re-elected.

The Electrical Operation of Railway Points.

An Interesting Installation at Liverpool.

What is stated to be quite a unique arrangement of electrically operated points has just been installed on the Mersey Railway, as a complement to the automatic signalling on that railway. At Liverpool Central, Low Level station, the western terminus of the Mersey Railway, there are two signal-boxes. That at the Birkenhead end works the two crossover roads which are used for shunting purposes. The other box is at the west end of the station where the platform line on the north side of the island platform is continued and becomes No. 1 siding and that on the south side becomes No. 2 siding. There is a facing crossover road in the former platform line which leads to No. 2 siding and arriving trains usually pass from the north platform road by this connection into No. 2 siding, and when the time arrives for them to proceed to the other platform line, ready to load up and proceed to Birkenhead, the traps are closed and the signal lowered. What has now been done is to have these points and the necessary signal movements automatically made and thus enable a yet more frequent service of trains to be run. We understand the system has worked most satisfactorily.

Leave has been granted for an AMENDMENT of the application by W. W. Drury (No. 1127/1923) for a PATENT for "Variable electric condensers" so as to include Marconi's Wireless Telegraph Co. as applicants.

The Wholesalers' Dinner.

Co-operation Exhaustively Discussed.

The annual dinner of the ELECTRICAL WHOLESALERS' FEDERATION was held at the Trocadero on Thursday, March 1st. The president, Mr. A. G. Beaver, was in the chair.

In proposing the toast of "Kindred Associations," Mr. BEAVER advised the contractors in their negotiations with the manufacturers not to short circuit the wholesaler. He played a part in saving both time and money. The Electric Lamp Manufacturers' Association were suffering for the sins of the past in inheriting a bad selling plan and an utterly wrong method of granting discounts. Fortunately they were reforming. The E.W.F. were not making much progress with the B.E.A.M.A., probably owing to its size, divergence of views and tendency to give too little and want too much. The Wholesalers' Federation lived in hopes of converting the C.M.A. from its fixed ideas as to how and where the wholesaler should operate. The Electrical Development Association was working wholeheartedly for the benefit of the industry, and its sales conferences had done a vast amount of good. There was certainly much to be done before each section of the industry could earn its own profit without detriment to the other sections and without increasing the price to the user. This ideal could only be reached if the scope of each section was defined and certain fundamental principles determined.

A Reply in Bulk.

This toast was replied to by no less than six speakers, representing the various kindred associations.

Mr. J. S. HIGHFIELD, in replying on behalf of the Institution of Electrical Engineers, said that one of the first duties of learned bodies was to help the trader.

Mr. W. RIGGS, in replying for the contractors, said that the body which he represented was working for agreement with other bodies which should be for the benefit of all. The N.E.C.T.A. was formulating a trade policy which he hoped would receive publicity and constructive criticism.

Mr. E. J. BREWER, in replying for the Electric Lamp Manufacturers' Association, said that since last year negotiations on certain outstanding questions had been completed. The E.L.M.A. wanted to co-operate, but he feared there would always be differences of opinion, though there was nothing of a very serious nature at the moment.

Discovery of Fundamental Principles Necessary.

Mr. D. N. DUNLOP, in replying for the B.E.A.M.A., said that it was upon details that divergent views arose between the wholesaler and the manufacturer. He agreed that they both ought to be allowed to make a living, but there was a difficulty in defining what was a wholesaler and what was a contractor. All constructive minds were trying to apply fundamental principles, but these required a tremendous amount of consideration. The B.E.A.M.A.'s existence was justified by its good works such as the Research Association, and other things which had altered the whole character of the industry. The different sections of the industry had got to get together to turn fundamental principles into a working formula, and he had great faith in the ultimate success of the efforts to discover a method of defining the relationship between the manufacturers, wholesalers and contractors in a way which should be beneficial to all. Manufacturers had difficult problems of unemployment and unfair competition to meet, and of keeping abreast with science and invention. Unless they did this they would be unable to maintain their position. He mentioned that the B.E.A.M.A. was responsible for a large section of the British Empire Exhibition, and that this exhibition was likely to be a great success. He suggested that a certain amount of space in the Engineering Section should be devoted to a club for the electrical industry, in the establishment of which all sections might take part.

Mr. J. SNOW HUDDLESTON, in replying for the Cable Makers' Association, said that before the formation of that Association the industry had been in a bad condition. It had done good work in fixing proper standards, and these standards were now practically the standards for the world.

A Federation of Goodwill.

Mr. J. W. BEAUCHAMP, in replying for the Electrical Development Association, said that the principal work of that body was counteracting the backstairs policy of gas companies, and making the public realise the benefits of electricity. In no industry was there such a federation of goodwill as in the electrical industry, and it should be the duty of associations such as theirs to assist the final retailers, the contractor and the central station engineer. Electricity was becoming a great social force, and electrical engineers were social reformers of the best kind.

Mr. J. Y. FLETCHER, in proposing the toast of the "Electrical Wholesalers' Federation," said he was a firm believer in trade associations, and he wished to say that manufacturers did not grudge the proportion of profit which went to the wholesaler. All they cared for was that their factories should be fully employed, and that their products should reach the public at the proper price. On the capability of the consumer to buy depended the recovery of prosperity.

Mr. A. G. BEAVER, in replying to this toast, supported the view that had been expressed, that much could be done by all sections of industry meeting in conference.

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Imperial Notes.

AUSTRALIA.

Pan-Pacific Science Congress.

The second triennial meeting of the PAN-PACIFIC SCIENCE CONGRESS is to be held this year in Australia, beginning at Melbourne on August 13th and ending at Sydney on September 3rd. The Commonwealth Government is to support the meeting, and has promised to contribute £5 000 towards its cost. Invitations to send representatives have been issued by the Commonwealth Government to the various countries bordering the Pacific. The Australian National Research Council is arranging the details, and its president, Prof. Orme Masson, of the University of Melbourne, is to preside over the congress, while Prof. Sir Edgeworth David, of the University of Sydney, is to be chairman of the Pan-Pacific Committee. The tentative programme covers a large range of subjects, including the determination of longitude by wireless.

Electric Power in Railway Workshops.

The RAILWAY WORKSHOPS AT BALLARAT (Victoria), which are described in the "Industrial Australian and Mining Standard," offer an interesting example of the successful application of electric power to engineering work. The current is taken from the Electric Supply Co. of Victoria, and the distribution is effected at a pressure of 440 V d.c. The connected load is 830 kW, half of which consists of machine tools and the remainder of crane motors. All machinery is driven electrically. Two hydraulic pumps are driven by 16 H.P. motors through single reduction gearing and two vertical air compressors by 52½ B.H.P. motors. In the west bay of the main block there is a 10-ton three-motor crane, in the centre bay there are two 50-ton four-motor cranes, and in the east bay two 50-ton four-motor cranes, while a 30-ton four-motor crane runs on high level runways across the end of the centre bay. The heavier machine tools have individual motor drive and the lighter machines are arranged in groups.

CANADA.

General Electric Co.'s Dividend.

The CANADIAN GENERAL ELECTRIC Co. has declared a quarterly dividend of 1½ per cent. for the three months ending March 31st, 1923, being at the rate of 6 per cent. per annum on the common stock, and a half-yearly dividend of 3½ per cent. for the six months ending March 31st, 1923, being at the rate of 7 per cent. per annum on the preference stock.

INDIA.

New Capital for Andhra Valley Power Co.

Arrangements are being made for the issue in London of a substantial amount of short-term notes of the ANDHRA VALLEY POWER SUPPLY Co., a concern which was formed in 1916 to extend the scope of an undertaking supplying electric power to Bombay. Up to the present nearly £2 500 000 has been spent on the undertaking, but the capital cost of the complete scheme is estimated at about £3 400 000. The issued capital, which includes ordinary and 7 per cent. preference shares, amounts to £1 392 800, and there are outstanding at present £602 333 of 8 per cent. debentures. The note issue is for the purpose of redeeming outstanding advances used for capital works and for other purposes. The generating plant of the company consists of six units, each unit producing 15 000 H.P. By the end of June the company hopes to be in the position to deliver 65 000 H.P. in Bombay. With the full plant in operation the revenue is estimated to amount to £465 000 per annum, which is based on contracts running for at least ten years.

SOUTH AFRICA.

Substantial Electric Progress.

The following items relating to SOUTH AFRICA are abstracted from the "British and South African Export Gazette":—The building of the Colenso power station, which is to supply the current for Pietermaritzburg-Glencoe railway, will be commenced in May. There is an improved demand for electrical goods in South West Africa.—The Grahamstown (Cape Province) municipal electricity undertaking will cost £33 000, and is expected to be working by June of next year.—In 1921-2 the South African Railways and Harbours Stores Department ordered electrical materials valued at £116 915, compared with £161 222 in 1920-1; machinery, other than locomotives, £404 122, compared with £159 223, and signal and telegraph material, £44 207, compared with £26 765.—It is not anticipated that the South African Government will give an official decision regarding the Johannesburg-Pretoria electric railway scheme just yet, but committees in favour of the project have been formed in practically every centre on the route, and it is believed that the Government will be forced to take action at no distant date.—During the next few months Johannesburg Corporation will be inviting tenders for important contracts for electrical plant.—Exports from Great Britain to South Africa in 1922 comprised wire, including telegraph wire, valued at £92 138, compared with £89 370 in 1921; railway rails £134 150, compared with £215 175; steam railway engines £8 090, compared with £1 381 587; engines, unenumerated, £149 743, against £138 417; agricultural machinery, £58 369, against £93 218, and other machinery £1 090 194, against £1 933 093. —Electric irons and kettles and movable type electric fans sell well wherever current is available.

Foreign Notes.

EUROPE.

Spanish Tramway Developments.

H.M. Consul at Málaga has reported to the Department of Overseas Trade that the MALAGA TRAMWAYS have been bought by a newly-formed company, with head office in Madrid, to be known, it is believed, as the "Sociedad de Tranvias de Málaga." The capital of the new company is said to be four million pesetas, of which over three million pesetas have been subscribed by the "Sociedad Hidroélectrica de El Chorro." The president of the company is Don Jorge Silvela and the manager will be D. Manuel Alvarez Net. It is stated to be the intention of the new company greatly to extend the system of tram lines and to take immediate steps with a view to purchasing new tram cars and rails.

LATIN-AMERICA.

Mexican Railway Electrification.

In a report by Consul-General Norman King on ECONOMIC AND FINANCIAL CONDITIONS IN MEXICO, it is stated that part of the Mexican railway (owned by a British company) connecting the city of Mexico with Veracruz is to be converted to electric traction. The gradient on the section of line referred to is about 4½ per cent., rising in one or two places to 5½ per cent. The work will be carried out by the International General Electric Co. of the United States, from whom the railway company have already purchased ten electric locomotives, each weighing 150 tons and designed to haul a train of 300 tons. The same contractors will supply the material for the overhead equipment and rail bonding and will also probably supply 2 500 reinforced concrete poles. Power is to be supplied by the Puebla Tramway, Light and Power Co., who have a generating plant near the railway line at Tuxpango. It is expected that the electrification will be completed by the end of 1923.

U.S.A.

American Telephone and Telegraph Co.'s Successful Year.

The report of the AMERICAN TELEPHONE AND TELEGRAPH Co. for 1922 shows that there were 14 050 565 telephones in the Bell System at the end of the year, an increase of 670 000. Taking the American Telephone and Telegraph Co. alone, the report shows that, after meeting all operating charges and making adequate provision for depreciation and obsolescence and for Federal and all other taxes chargeable against 1922 earnings, it had available for interest and dividends $81 668 440. Interest charges were $15 498 011·88, a reduction of $4 023 097·17 from 1921, thus reflecting the reduction of $74 095 100 in the company's debt during the year. Dividends paid to stockholders at the rate of $9 per share per year amounted to $52 971 251, an increase of $10 296 848, being principally the result of an increase in outstanding capital stock of $151 162 100. Of the resulting balance there was appropriated for contingencies $5 000 000, and the remainder, $8 199 176·19, was carried to surplus. The present authorised share capital is $750 000 000, of which amount $699 347 400 was outstanding at the end of the year. The directors recommend the authorised share capital being increased to $1 000 000 000, to take care of present commitments and future requirements, but they announced that no new stock offering is contemplated for 1923.

Manila Electric Dividend.

The MANILA ELECTRIC CORPORATION has declared a dividend of 2 per cent. for the quarter ending March 31st, 1923, on the common capital stock.

I.E.E. Western Centre.

Proposed Summer Meeting at Plymouth.

It is proposed to hold a summer meeting of the WESTERN CENTRE of the INSTITUTION OF ELECTRICAL ENGINEERS commencing on Friday, May 25th. Two programmes have been provisionally outlined. The first provides for a journey by char-a-banc from Weston-super-Mare to Plymouth on May 25th. The following day will be spent in visiting Devonport Dockyard, with a river excursion in the afternoon and a dinner in the evening. A short trip to the moors will take place on May 27th, and the party will return by char-a-banc to Weston-super-Mare on May 28th. The second programme is similar, except that the party will journey from Bristol to Plymouth by train on the evening of May 25th, and return by train on the evening of May 27th. The approximate cost will be £3 3s. for the first programme and £2 12s. 6d. for the second. Members are requested to give early notification of their intentions to Mr. A. J. Ostler, The Exchange, Corn Street, Bristol.

Wage Reductions in North Midland Area.

The Industrial Court issued on Saturday an award relating to standard rates of wages for the electricity supply industry in Yorkshire, North Lincolnshire, North Notts, and North Derbyshire. The employers proposed rates ranging from 1s. 5½d. per hour for the fitter driver to 1s. 2½d. for the labourer in "A" undertakings, with ¾d. per hour less in "B" and 1¾d. less in "C" undertakings, while the men suggested a rate of 1s. 7d. for the following grades:—Electrical fitter, electrician or electrical wireman, mechanical fitter, armature winder, and telephone electrician or linesman. The award is that from the beginning of the first full pay week this month the rate for the grades just mentioned shall be 1s. 6d. per hour in "A" undertakings, with ¾d. less in "B" and 1¾d. less in "C" undertakings.

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Electricity Supply.

Extensions and Developments.

HAMPSTEAD Borough Council has received sanction to borrow £10 000 for extensions to electric light mains.

OBAN Lighting Committee is applying to the Commissioners for sanction to borrow £4 000 for extending the electricity undertaking.

WINCHESTER Town Council has applied to the Commissioners for a loan of £11 300 for the provision of a battery booster, switchgear, cable connections, and feed pump for the power station, and for feeder and distributing cables.

Application is being made to the Electricity Commissioners for Northern Ireland for a special order to authorise the use of land for the purpose of an electricity generating station and the generation, sale, and distribution of electricity by the Markethill Electric Light and Power Co. in the townlands of Coolmillish, Edenykennedy, Crunaght, and Gosford Demesne (Armagh).

WALLASEY Corporation has overspent its loan funds by £17 000 on mains and services, and by £2 300 on transformers. It is now seeking powers to borrow this overspent money and a further £20 000 for work to be done during the next three years. It is proposed to extend the Poulton generating station, and provide new machinery and plant at an estimated cost of £98 700, of which amount £30 000 would be expended during the year ending March, 1925.

Alterations in Charges, Proposed and Actual.

BOGNOR Gas, Light and Coke Co. has reduced the charge for electricity for lighting by 1d. per kWh.

The question of a reduction in electricity charges has been referred to a DARWEN sub-committee, with power to act.

Charges are down at HASTINGS to the pre-war level, viz., 6½d. per kWh for the first 4 000 kWh, and 5½d. for any quantity beyond.

HACKNEY Electricity Committee recommends a reduction of the lighting charge from 6d. to 5½d. per kWh, and of the power charge from 2d. to 1½d.

SWINTON AND PENDLEBURY Urban Council has decided to reduce the charges for electricity for power and lighting from 75 to 60 per cent. above pre-war rates.

NEWPORT Electricity Committee has decided to reduce the price of electricity for lighting from 7½d. to 6¾d. per kWh with a corresponding reduction for power.

SHREWSBURY Town Council has reduced the charges for electricity to 60 per cent. above pre-war figures. Last June the charges were lowered from 100 to 75 per cent.

The charges for electricity were discussed at the annual meeting of the NEWBURY Chamber of Trade, and the reply given by the company was considered satisfactory.

MERTHYR Electric Traction and Lighting Co. has reduced the charge for electricity supplied to the Board of Guardians for lighting from 7d. to 6d. per kWh as from February 1st.

BLACKPOOL Electricity Committee has suggested a reduction from April 1st of 15 per cent. in the price of electricity for all purposes. The charge would then be only 25 per cent. above pre-war tariff.

BRISTOL Electricity Committee has reduced the lighting charge from 6d. to 5½d. per kWh. The combined lighting, heating and cooking rate will be 1d. per kWh, plus 12½ per cent. of the net rateable value of the premises.

NEWMARKET Urban Council has decided to withdraw opposition to the application of the Electric Light Co. for a maximum rate of 11d. per kWh, as it is considered that the company will be able to reduce the charge below this figure.

The North Metropolitan Electric Power Supply Co. has made the following reductions in the charges for electricity :—At ST. ALBANS, lighting, from 9d. to 8d. ; heating, from 3d. to 2½d. per kWh ; power, increase of 50 per cent. above pre-war rate, lowered to 33⅓ per cent.

In connection with the new electricity works at Newton Abbot, TORQUAY Town Council has altered the maximum charge for electricity in the Newton Abbot area from 1s. to 10d. per kWh, subject to the Newton Abbot Urban Council not opposing the Corporation Bill.

MALVERN Urban Council has applied to the Ministry of Transport for a new order fixing the maximum price of electricity as from September 1st next, at 10d. per kWh. The Council has arranged to give a supply of electricity at a cost of £650 to the Great Western Railway Co., and the following loans have been applied for : £2 000 for mains and services ; £1 500 for transformers and transformer sub-stations ; and £500 for meters.

Tapping New Areas.

HASLINGDEN Council is to carry electricity to Ewood Bridge at a cost of £3 094. The work is to be put in hand at once.

A public meeting at MARKET HARBOROUGH has approved the proposed scheme to obtain a bulk supply of electricity from Kettering.

NEWARK is submitting a scheme to the Electricity Commissioners for the installation of two generators of 1 500 kW each, at a cost of £102 495. This scheme is going forward in preference to that for obtaining a bulk supply from LINCOLN.

The Western Electrical Distributing Co., of Cainscross, has informed the MALMESBURY Town Council of its intention to apply for an order authorising them to supply electricity in the borough and seeking the support of the Corporation.

ASHFORD (Kent) Urban Council, after considering offers of a bulk supply of electricity from Maidstone and Canterbury, has decided that the original report of the consulting engineer, recommending a local generating station, should be adopted. Before any steps are taken the decision of the Electricity Commissioners is to be awaited. The Council considers that a supply from Maidstone is unacceptable, and that the terms proposed by Canterbury are too expensive.

Miscellaneous Supply Items.

The SOUTH WALES and MONMOUTHSHIRE District Electricity Supply Conference decided on March 1st to set up a small advisory committee to investigate methods for improving the supply of electricity in the district.

EVESHAM Town Council has decided to oppose the Bill now being promoted by the Shropshire, Worcestershire, and Staffordshire Electric Power Co. It was thought that Evesham would be injuriously affected by the provisions of the Bill in its present form, and that amendments might be secured to the advantage of the town. Alderman New said they ought to stipulate that electricity should be brought to the town within two or three years, and they ought to be in the position that at the end of a term of years the town should have the right to purchase the whole concern.

Halifax Electricity Works Dispute.

The " Yorkshire Observer " states that the new staff engaged by Halifax Corporation at the Electricity Works has now taken charge without incident. Our contemporary also states that the action of the Electricity Committee in dismissing the old staff had the support of the Town Council, the feeling being that they had had plenty of time in which to come to some settlement of the dispute.

The E.P.E.A. has addressed a letter to members of the Halifax Corporation, stating the Association's point of view, and urging that the Council should receive a deputation from the E.P.E.A. A ballot of members of the E.P.E.A. is to be taken on the following question :—" Are you prepared to give the National Executive Council authority to take whatever steps are necessary, even to the extent of taking national drastic action, in order to ensure the continued operation of the National Joint Board Salary Schedule and Conditions, the provision of adequate machinery for giving effect to the decisions of the National Joint Board, and secure the reinstatement of the members at Halifax ? "

Personal Items.

Sir GEORGE SUTTON was presented to the King at the Levee on Tuesday.

Mr. F. R. DAVENPORT has joined the board of the Shropshire, Worcestershire and Staffordshire Electric Power Co.

Mr. H. W. MILLER has been elected president of Faraday House Old Students' Association for 1923, and Messrs. F. T. CHAPMAN and P. J. WATTS vice-presidents.

PROF. MAGNUS MACLEAN will vacate the chair of Electrical Engineering at Glasgow Technical College on July 31st, when he retires under the superannuation scheme.

Hastings Town Council has been readjusting the salaries of its officers, and has decided that that of the electrical engineer, Mr. R. F. FERGUSON, shall be £850, without bonus.

Sir EDWARD MANVILLE has been elected president of a committee of members of Parliament formed to watch matters in Parliament affecting the manufacture and use of motor cars.

Hampstead Borough Council has voted an honorarium of 200 guineas to Mr. J. LEADBEATER, electrical engineer, for extra work involved in the changing over of the system to bulk supply.

Mr. A. H. STURDEE, works manager, and Mr. J. M. WALLACE, switchgear manager of the Siemens Works (Stafford) of the English Electric Co., were recently entertained at a complimentary dinner by the foremen and staff at the works.

Mr. F. J. RYND, formerly South Wales representative for various engineering firms, has taken up a position with the County of London Electric Supply Co., on their head office staff at Moorgate Court, E.C.2, which address will find him for the future.

Mr. F. SWARBRICK, electrical engineer to Basingstoke Corporation, has been retained as consulting engineer to the Cleethorpes Corporation in connection with their electricity extension scheme. He was formerly on the staff of the Blackpool Corporation Electricity Department.

Mr. A. H. BLAGDEN has been compelled, owing to a breakdown in health, to resign from his position as deputy engineer-in-chief and manager of the Shanghai electricity undertaking. Prior to his departure for England he was presented by the foreign members on the staff of the department with a silver tea service and salver. The presentation was made by Mr. T. H. U. Aldridge, engineer-in-chief and manager.

The engagement is announced of Capt. RALPH STALEY, engineer and manager of the Bishops Stortford, Harlow, and Epping Gas and Electricity Co., youngest son of the late Thomas Staley, of Littleover, Derbyshire, and of Burton-on-Trent, and Miss Jean Chapman, daughter of the late Thomas Chapman, Esq., J.P., of Levington Court, Ashford. The wedding will take place at St. Luke's Church, Maidstone, on Wednesday, April 4th.

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Tenders Invited and Accepted.

UNITED KINGDOM.

DUNDEE CORPORATION.—200 steel cranked tiebars for tramway rails. Specification, etc., from the City Engineer, 91, Commercial Street, Dundee.

PEVERIL HOTEL, DOUGLAS. March 13th.—Electric Light installation. Specifications can be seen at the company's offices, 52, Athol Street, Douglas.

LONDON AND NORTH-EASTERN RAILWAY CO. (GREAT CENTRAL SECTION). March 14th.—Electrical apparatus, wires and cables, electric line construction, electric lamps, casings and accessories, signal materials, etc. Specifications from the Stores Superintendent, Gorton, Manchester.

PONTYPRIDD GUARDIANS. March 14th.—Electrical materials ironmongery, etc., for three months. Forms of tender from the Clerk.

ELGIN CORPORATION. March 15th.—Electric light wiring, etc. in the Town Hall. Specifications from the Town Clerk.

EDMONTON GUARDIANS. March 15th.—Electric lamps, ironmongery, oils, paints, etc. Forms of tender from the Clerk, 77, Bridport Road, Edmonton, N.18.

CROYDON GUARDIANS. March 15th.—Electrical appliances, engineers' tools, etc., for six months. Forms and tender from the Clerk, Mayday Road, Thornton Heath.

ABERDARE URBAN COUNCIL. March 16th.—Cable, meters, jointboxes, electric lamps, etc. Specifications from the General Manager, Electricity and Tramways Department, Aberdare.

WORTHING CORPORATION. March 19th.—Concentric, triple concentric and three-core l.t. cables. Specifications, etc., from the Borough Electrical Engineer.

PLYMOUTH CORPORATION. March 20th.—(1) Electricity meters, (2) cables, (3) transformers. Specifications from the Borough Electrical Engineer.

SMETHWICK CORPORATION. March 20th.—Electrical sundries, iron and steel, etc., for the Gas Department. Forms of tender from the Engineer and Manager, Gas Works, Rabone Lane, Smethwick.

NEWPORT (MON.) GUARDIANS. March 20th.—Electric light fittings, ironmongery, engineers' stores, etc. Forms of tender from the Clerk, Queen's Hill, Newport, Mon.

BURTON-ON-TRENT CORPORATION. March 20th.—Laying low-tension mains. Schedules, etc., from the Borough Electrical Engineer.

PORTSMOUTH GUARDIANS. March 21st.—Electrical fittings, engineers' stores, etc., for three months. Forms of tender from the Clerk, St. Michael's Road, Portsmouth.

BERMONDSEY (LONDON) GUARDIANS. March 22nd.—Six months, supply of electric lamps (item 68). Forms of tender from the Clerk, 283, Tooley Street, S.E.1.

PORTSMOUTH CORPORATION. March 23rd.—Four electric vehicles for collection of house refuse. Particulars are given in an advertisement.

KING'S LYNN CORPORATION. March 26th.—One 200 kW converting plant, with switchgear. Specification, etc., from the Borough Electrical Engineer.

BIRMINGHAM TRAMWAYS COMMITTEE. March 26th.—Twenty-five tramcar bodies. Specification from the General Manager, Tramway Offices, Council House, Birmingham.

WARRINGTON GUARDIANS, March 27th.—Supply of electrical goods for three months. Tender forms from the Clerk, Bewsey Chambers, Warrington.

COVENTRY ELECTRICITY COMMITTEE. March 28th.—One 6 000 kW turbo-alternator, with condensing plant and auxiliaries. Specifications, etc., from Mr. Geo. Tough, engineer and manager of Electricity Department, Council House, Coventry.

SUNDERLAND CORPORATION. March 28th.—Remote control e.h.t. switchgear for controlling alternators and feeders. Specification from General Manager, Electricity Offices, Sunderland.

COUNTY OF LONDON ELECTRIC SUPPLY CO. April 10th.—Piping equipment for Barking power station. Specifications from the Manager and Secretary, Moorgate Court, Moorgate Place, E.C.

AUSTRALIA.

NEWCASTLE (N.S.W.) CORPORATION. April 5th*.—10 000 pole number plates. April 19th*.—Potentiometer and accessories.

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE. April 10th—Bronze, copper and galvanised wire (approximate value £200 000). Forms of tender, etc., from the High Commissioner for Australia, Australia House, Strand, London, W.C.2.

POSTMASTER-GENERAL'S DEPARTMENT, ADELAIDE. May 16th*.—Telephone apparatus (Schedule S.A. 641).

BELGIUM.

ANTWERP MUNICIPALITY. April 20th.*—Fifteen 2½ ton electric cranes for use at the Bassin Canal, Antwerp. Each crane is to be provided with four motors, operating on d.c. supply at 550 V.

CANADA.

H.M. Trade Commissioner at Winnipeg states that large extensions to grain storage elevators in MANITOBA will be undertaken during the present year, and he calls attention to the fact that this will involve demands for a.c. squirrel cage motors of 20 H.P. to 100 H.P. capacity, in addition to switchgear, shafting, etc. The address of the consulting engineers in charge of the bulk of the new work can be obtained from the Department of Overseas Trade.

IRELAND.

DUBLIN GUARDIANS. March 14th.—Six months' supply of electric fittings, ironmongery, etc. Forms of tender from the Master of the Workhouse. A preference will be given to articles of Irish manufacture.

DUBLIN CORPORATION. March 16th.—Extra high pressure and low pressure cables, troughing, section pillars and joint boxes for one or two years; also six arc lamp pillars. Specifications from the City Electrical Engineer, Fleet Street, Dublin.

NEW ZEALAND.

PUBLIC WORKS TENDERS BOARD, WELLINGTON, May 29th.*—Two petrol engines, generators, and accessories, and six single-phase transformers, in connection with the Mangahao electric power scheme.

SOUTH AFRICA.

JOHANNESBURG MUNICIPAL COUNCIL. March 27th.*—450 light and 50 heavy steel poles, with finials for lighting purposes.

CAPE TOWN CORPORATION. April 5th.*—Electric motors; also three-phase lift controllers and motors.

* Particulars from the Department of Overseas Trade.

MAIDSTONE CORPORATION have accepted the tender of Bruce Peebles and Co. for a motor converter at £2 139.

The tender of Banks, Warner and Co. for overhaul of two Carels Diesel engines at the electricity works, at £393, has been accepted by REIGATE CORPORATION.

A. Reyrolle and Co. have received orders for switchgear for part of the MANGAHAO (N.Z.) POWER SCHEME and for plant for WELLINGTON (N.Z.) CORPORATION'S Evans Bay POWER STATION.

HAMMERSMITH (LONDON) COUNCIL are recommended to accept the following tenders: Chloride Electrical Storage Co., Exide ironclad 40-cell battery, £218 8s.; Newall's Insulation Co., lagging new boilers and steam pipes, £120; Pirelli-General Cable Works, drawing in and jointing Bowden-Thompson e.h.t. main to Cadby Hall, £700.

The following tenders have been accepted by TORQUAY CORPORATION: British Thomson-Houston Co., transformers for 500 kW rotary converter (£640), and for 300 kW rotary converter (£458); two step-up transformers for 1 250 kW turbo-alternators, £940 each, and earthing devices, trifurcating boxes, etc., £19; Structural Engineering Co., steelwork for sub-station and offices, £571 10s.

The following are recommended extensions of contracts by LIVERPOOL CORPORATION:—H. Jones, wiring and fitting 200 additional houses on Springwood, Edge Lane Drive and Walton-Clubmoor estates at £7 18s., and £8 14s. for types A and B, respectively; Western Engineering Co., wiring and fitting a further 200 houses on the same estates at £7 18s. 6d., and £8 13s. 6d. for types A and B, respectively.

LEEDS CORPORATION have accepted the tenders of the Cargo Fleet Iron Co. for 2 000 tons of straight and 50 tons of curved tramway rails; Franley Iron Co. for axle forgings; Cloke's Extension, Ltd., for overhead power cable from Knostrop Works to the Sewerage Department's bacteria beds (£1 016 19s. 11d.); and S. Dixon and Sons for electric wiring and fitting at Meerwood Park Colony (£49 12s. 2d).

The English Electric Co. have received an order for a reversing electrical drive for the 30 in. finishing rail mill at GUEST, KEEN AND NETTLEFOLDS' Dowlais works. The motor will give a maximum power of 8 600 H.P. at a speed of 60 to 120 revs. per min. The mill is to be completely electrified, and there will ultimately be independent cogging, roughing and finishing drives, with a flywheel equaliser set for each motor.

LONDON COUNTY COUNCIL HIGHWAYS COMMITTEE have accepted the tender of the North-Eastern Steel Co. for 4 900 tons of track rails and fastenings, at £58 351 5s. The company submitted an alternative tender for 3 300 tons, £39 370 7s. 6d. Two other tenders were received, viz., from the Cargo Fleet Iron Co., at £71 034 15s. and £47 910 7s. 6d. for 4 900 and 3 300 tons respectively, and F. Mott and Co. (for the Phœnix Works and Otto Wolff and Co., Cologne) at £41 919 17s. 6d. and £28 376 15s.

MANCHESTER CORPORATION have accepted the following tenders: British Mannesmann Tube Co., tramway poles; Bruce Peebles and Co., 2 500 kW lighting converter and 2 500 kW traction converter; Ferranti, Ltd., reconstruction of two 3 000 kVA transformers; Twiss Electric Transmission, Ltd., extensions to the overhead distribution system on Blackley Estate; Mather and Platt, 1 500 kW and one 1 000 kW rotary converter and transformer; British Thomson-Houston Co., two 500 kW rotary converting sets; Metropolitan-Vickers Electrical Co., one 500 kW rotary converting set; A. Reyrolle and Co., one 500 kW automatic converting set.

Speakers at E.D.A. Luncheon.

The following gentlemen will speak at the E.D.A. ANNUAL LUNCHEON at the Hotel Cecil, London, W.C., on March 10th:—Viscount Haldane, Sir Kenneth Walton Goadby, Mr. W. B. Woodhouse (president-elect of E.D.A.), and Mr. Llewelyn B. Atkinson (chairman of E.D.A.). All who wish to attend and have not yet applied for tickets should do so immediately.

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Electric Traction.

Tramway Extensions and Developments.

The manager of BURNLEY Tramways has been asked to prepare a list of employees, showing the duties each performs and the duties performed in 1914.

ABERDEEN Tramways Committee proposes to carry out extensive repairs to almost the whole of the permanent way at an estimated cost of £31 020, with a view to providing work for the unemployed.

MANCHESTER Tramways Committee has decided upon a scheme to link up Chorlton, Alexandra Park, Withington, Fallowfield, and Levenshulme. About two and a quarter miles of new double track are to be laid to complete a cross-country route of about three and a quarter miles in all.

In connection with the LIVERPOOL tramway undertaking, an expenditure of £100 000 has been sanctioned by the Ministry of Transport for the construction of the initial portion of a new tramway shed and offices, and the reconstruction and doubling of the tramway track on routes in the northern part of the city.

Fares, Receipts and Passengers.

CARDIFF Tramways Committee is considering the reduction of the minimum 1½d. fare to 1d.

At a meeting of BLACKBURN Town Council on March 1st, Ald. Higham stated that a scheme had been drawn up for revised fares on the tramways.

The Ministry of Transport will hold an enquiry in London on March 13th into the application of the WORCESTER Electric Traction Co. to retain the present tram fares until March 31st, 1924.

The revised tram fares approved by the LEEDS City Council last month came into force on March 1st. The general reduction is calculated to involve a decrease in revenue of about £50 000, and an increase of 7½ per cent. in the number of passengers.

Electric Railway Items.

The Underground have just placed an order with MIRRLESS WATSON & Co., for a new 15 000 kW turbo-generator. This will bring the generating capacity of the Lots Road power house up to a total of 93 000 kW.

At a special general meeting of the Southern Railway Co., last week, Sir HUGH DRUMMOND said the Board were giving the most careful attention to the proposed extension of the Southern Suburban Underground line. It was a matter that the Board of the Southern Railway Co. looked upon as serious, as affecting their traffic, and they had lodged a strong petition against it, and intended to oppose it in the strongest manner possible when the case came before Parliament.

Parliamentary Intelligence.

Automatic Train Control.

Mr. A. V. ALEXANDER asked the Parliamentary Secretary to the Ministry of Transport on February 28th whether, in view of the necessity of safeguarding the travelling public from accident, the Government would take steps to convene a Royal Commission to examine the necessity of eliminating the human element from error by the compulsory provision of automatic train-stops on all railways?

Lieut.-Col. ASHLEY: This matter has already been investigated by the Departmental Committee on Automatic Train Control, whose Report was published last year. The railway companies have been asked to consider what action should be taken to give effect to the Committee's recommendations, and I do not think that any further formal investigation of the subject is needed at present.

British Empire Exhibition.

Sir W. JOYNSON-HICKS, Parliamentary Secretary to the Department of Overseas Trade, replying to Mr. DARBISHIRE on March 5th, said: I am informed by the Exhibition authorities that the total expenditure incurred to date on the British Empire Exhibition has been, in round figures, £750 000. The total gross expenditure to the close of the Exhibition is estimated at £2 435 000, and the total guarantees received to date are £1 203 000. Estimates of receipts and expenditure have been framed as from the opening date of the Exhibition.

London Electric Railway Bills.

In the House of Commons the City and South London Railway Bill was read a second time. On the motion of Mr. PERCY HARRIS, seconded by Mr. J. D. GILBERT, an instruction to the Committee was agreed to directing it to insert clauses making the provisions as to fares on the proposed new railways on the same basis as those applicable to the London Electric Railway, and making those provisions temporary, so that the whole of the fares on the company's railways should be subject to revision at the same time. On the London Electric Railway Bill, read a second time, a similar instruction, also moved by Mr. PERCY HARRIS, was agreed to.

Underground Telephone Wires.

The POSTMASTER-GENERAL, in reply to Mr. PENNY, who asked on February 28th whether the Government would consider replacing the present system of overhead telephones by underground wires, said: The substitution of underground for overhead plant, wherever the expense is justified, has been the policy of the Post Office for many years. Extensive works of this character are in progress in various parts of the country, and many other schemes are in course of preparation.

Wireless News.

Premier's Pronouncement on Imperial Policy.

A pronouncement on the Government's Imperial wireless policy has at last been made. In the House of Commons on Monday, Mr. PERCY HURD asked the Prime Minister whether he was aware of the disappointment felt in the Dominions at the delay in announcing the policy of His Majesty's Government in regard to wireless communication; and whether he could now state what that policy was.

The PRIME MINISTER replied: "The policy to be adopted with regard to Imperial wireless communications has recently been under review by the Imperial Communications Committee under the chairmanship of the First Lord of the Admiralty, and the recommendations of that committee have now been approved by the Government.

"In view of developments in the science of wireless telegraphy, and other circumstances which have arisen since the late Government decided upon the policy of a State-operated wireless chain, it is not considered necessary any longer to exclude private enterprise from participation in wireless telegraphy within the Empire. The Government has, therefore, decided to issue licenses for the erection of wireless stations in this country for communication with the Dominions, Colonies, and foreign countries, subject to the conditions necessary to secure British control and suitable arrangements for the working of the traffic.

"At the same time the Government has decided that it is necessary in the interests of national security that there should be a wireless station in this country capable of communicating with the Dominions and owned and operated by the State. A station of this kind will, therefore, be erected as early as possible, and it will be available for commercial traffic as well as for Service messages."

A Question of Wireless Copyright.

The Dutch courts, says the "Sheffield Daily Telegraph," will shortly be occupied with a case having an important bearing on the use of wireless telegraphy generally. The case in question is that of the Amsterdam news agency, "Persbureau Vaz Dias," which has instituted proceedings against the "Nederlandsche Telegraaf Agentschap," claiming that wireless messages intended for the Vaz Dias Agency have been PICKED UP AND DISTRIBUTED TO DUTCH NEWSPAPERS by the Nederlandsche Agency. The messages are those which are wirelessed daily to the Vaz Dias Agency from Hanover. The case is likely to raise important questions of copyright validity.

Wireless Licence for Cinema.

Permission to instal a WIRELESS SET IN A CINEMA has been obtained by the proprietors of the picturedrome, Thatto Heath, near St. Helens. Mr. Davies, who made the application to the magistrates, said he did not know what the procedure was in regard to wireless installations at picturedromes or whether it would be necessary to have a special sort of license. He thought, however, that in time wireless might be a recognised form of amusement, and that as far as picturedromes were concerned his clients were the pioneers locally for that sort of thing. The Chairman of the Bench said that permission would be granted for public use only, and subject to the conditions of the Cinema Committee.

Foreign Notes.

The Central News states that a PHOTOGRAPH OF PRESIDENT HARDING has been successfully transmitted to Philadelphia from Washington by wireless telegraphy.

Under a contract made with the Marconi Co. work will shortly be commenced on high power wireless stations for the establishment of wireless communications between PORTUGAL and the PORTUGUESE COLONIES. The operations are to be completed within three years.

Miscellaneous Wireless Items.

The GLASGOW station of the British Broadcasting Co. was opened on Tuesday night. The call signal is 5SC and the wave-length is 415 m.

In response to a request by the editor of "Fire" a special wave length of 320 m. has been allotted for FIRE SERVICE WIRELESS COMMUNICATIONS.

Voyaging to Australia *via* Cape Town recently, the Aberdeen liner THEMISTOCLES, fitted with the latest Marconi wireless apparatus, was in touch with land stations in Great Britain the whole time, and was able to receive 65 000 words of news, representing 738 words per day, throughout the voyage.

The British Broadcasting Co. have received a letter from a correspondent in MASSACHUSETTS who claims to have picked up London (2 LO) on February 20th, and listened to the last piece of music and the closing down. If the statement is correct this is the first time that the London station has been heard in America.

Three model rooms—dining room, bedroom and kitchen—fitted with the latest electrical appliances, formed the exhibit of the CORPORATION ELECTRICITY DEPARTMENT at the recent Dundee Modern Homes Exhibition. A good collective exhibit was also staged by the local branch of the ELECTRICAL CONTRACTORS' ASSOCIATION. Wireless sets were shown in operation by STURROCK AND ALLAN.

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W. T. Henley's Telegraph Works Co.

A Successful Year's Trading.

The forty-fourth ordinary general meeting of W. T. Henley's Telegraph Works Co. was held on Friday last at the Great Eastern Hotel, London, E.C., Sir George Sutton (chairman and managing director) presiding.

The SECRETARY (Mr. A. E. Salmon) read the notice convening the meeting and the report of the auditors having been read,

The CHAIRMAN said: Ladies and Gentlemen,—Since the board of directors last had the pleasure of presenting you with an account of its stewardship it has been strengthened by the addition of Mr. Alan Campbell Swinton, F.R.S., a personality which must be too well known to you to need any account from me as to his suitability for the board of this company. The confirmation of his appointment will be before the meeting later.

The Accounts.

Turning to the accounts, the liability side of the balance-sheet needs no comment; it is practically the same as it was a year ago. On the assets side additions amounting to £81 983 have been made to buildings, machinery and plant. The other items which are noticeable as differing from the last account are that we have realised our gilt-edged investments, that stock is at £442 000, a reduction of £80 000; debtors at £334 000, a reduction of £88 000; cash in hand, Treasury bills and trading bills at £769 000, an increase of £318 000. Those figures give an exact indication of the condition of trade during the past year, and I hope you will be of opinion that they also indicate the sound methods by which your business is conducted. The decline of trade might have produced a large amount in unsaleable stocks, debts which could not be collected, and a corresponding shortage of cash. Coming to the profit and loss account, the debit side shows an increase of £4 000 over last year in the amount for depreciation, and on the credit side a trading profit of £249 000, against £263 000. The final result is that with a credit of £7 525 profit on realisation of securities there is, after providing for the reserves and dividends recommended, a carry forward into 1923 of £323 988, against £260 243 brought in. We are not asking you this year for an allocation to the pension funds, because during the time of the falling value of securities you added generously to the funds, and now that substantial rises have taken place an allocation is not necessary. The new pension fund for the benefit of the foremen and other employees at the works has been formed during the year.

Increased Carry Forward.

Perhaps some of the shareholders may think that with so large an amount of available cash, and so handsome a carry forward, an increased dividend might have been recommended without endangering the financial stability of the business. That may be so, but the directors have preferred to recommend the adoption of the cautious policy which for so many years past has ensured that the proprietors of this company, while receiving the handsome dividends, shall have a sense of security in regard to the value of their capital. A strong financial position has an important bearing on the market value of a security. I make no apology for dealing at length with this part of my explanation of the accounts. No doubt three quarters of a million sterling is a large sum to have, but it is not equal to six months' turnover of the business, and, as I have already stated, it has accumulated by reason of the depression of trade. Is that depression going to continue for long? We hope not, but we shall be wise to keep large cash resources to meet the improvement when it comes. We have still heavy liabilities to meet in one or two directions. Considerable sums have yet to be paid on account of past and present taxation, all provided for before arriving at the balance of the profit and loss account, but cash must be in hand to meet the liabilities.

Provision for Increased Output.

We have been, and are, expending large sums in the provision of facilities for increased output and general development. The large expenditure on the new research laboratories has not yet been entirely paid, and although expenditure on capital account is being reduced year by year, the last four years it has aggregated roundly £400 000. There is a possibility that the costs of buildings and machinery may get much lower than the high prices which have ruled since the Armistice, and larger sums than usual may have to be provided for depreciation.

We are able to keep in close touch with the position, because we possess a complete record of our property, showing original cost, amounts written off, and the present charge on capital account of each unit.

There is also the possibility that we may have to meet an exceptionally large expenditure in connection with our offices and warehouses. The lease of our Blomfield Street premises expires in two years' time, and we have so far been unable to obtain an extension. Our City staff numbers several hundreds and our premises are very extensive. Besides the Blomfield Street frontage, we have premises in New Broad Street and in Moorfields, and it is difficult to get suitable premises to accommodate all our interests under one roof. We may, and probably shall, have to purchase, and I do not suppose we can get anything suitable under £50 000, and may have to pay much more.

I expect that presently you will be congratulating the directors upon a successful year's trading. I very humbly suggest that the congratulations will be deserved. In a period of great depression we show, with an unimpaired dividend, a stronger financial position. The general depression has affected us rather in the direction of lower prices than lower output. The effect has been a reduction in the money value of our output, but actually our quantity output was rather greater in most departments than that of the preceding year.

Increase in Number of Employees.

We have not added to the number of unemployed. Compared with pre-war 1914, we are employing 50 per cent. more people in our factories and commercial staff. We make acknowledgments to the Government and to the Governments of the Overseas Dominions that since, happily, they have not had orders to place for war material they have encouraged reproductive expenditure in the arts of peace. Probably business in the first half of the year under review has been more greatly depressed than it has been for some years, but in the autumn it began to improve, and is continuing to improve slowly, but we hope, for that reason, the more surely. Considerable advances have been made this year in raw materials, such as copper, lead and tin. There has been, without doubt, much business held up waiting for bottom prices, and the rises now taking place may bring this business to fruition. Labour is still about double that of pre-war, and is not likely to fall appreciably, if at all. Our trade has been, and is, very small with foreign countries. That the foreign trade will come back to us I do not doubt, but it cannot greatly improve until the state of Europe is more settled. In the meantime we are of opinion that the development of electrical engineering in the future will be greater than we can measure, and with good management and direction I see no reason why this business will not have in the future as long a period of prosperity as it has had in the past.

Improvement in Tyre Company's Results.

I reported last year that for the year then under review the Henley Tyre and Rubber Co. had not made a profit; it had just paid its way. The results for 1922 were better, and we have great hopes of the ultimate success of the business. We do not believe that there are any tyres made in the world which will give more satisfaction than the Henley Zigzag pneumatic tyres and the solid tyres which we make for heavy commercial vehicles. Tyres come in duty free and it appears that during the past year this country has imported motor tyres to the value of over £4 000 000. During the war years, when our factories were entirely at the Government disposition, other countries, notably the United States of America, secured markets which hitherto had been held by British manufacturers. We believe they accumulated large stocks, and the large deliveries to England represented part of the surplus which they were unable to sell in the States. The French tyre largely used in England, one must imagine, can be made at a lower cost than an English tyre, by reason of the low value of the franc.

Increase in Price of Rubber.

With regard to the restriction of rubber output adopted by the rubber growers upon the advice of a Rubber Committee appointed by the Colonial Office, I think the consumer of raw rubber—that is, the manufacturer—ought to have had representation on the committee, but I find that there was only one who could be said to have manufacturing interests, and he had also large producing interests. The effect is that rubber, which could be bought between 7d. and 8d. has been forced up to 1s. 6d. per lb., which means that the Government action will be responsible for higher prices for motor tyres and for a considerable advance in the cost of electric lighting wires. Speaking from the manufacturers' point of view, stability of price in raw material is always desirable, but in view of the fact that English and American authorities differ as to the immediate future needs of the world in raw rubber, it does not clearly appear that the restriction measures will give price stability. Should the American estimate be correct, and they are far and away the largest consumers, there will be a considerable shortage and price stability will be gone.

In conclusion, the Chairman moved the adoption of the report and accounts.

Mr. SYDNEY GEDGE, M.A., seconded the resolution, and referring to his long connection with the company, remarked that he was in his ninety-fourth year, and that would probably be the last occasion on which he would have the pleasure of addressing the shareholders.

After a short discussion, the resolution was carried unanimously.

On the motion of the Chairman, seconded by Mr. Martin Roberts, M.Inst.C.E., the proposed dividend on the ordinary shares at the rate of 3s. per share, less income-tax, including the interim dividend of 1s. per share paid September 1st last, was agreed to.

The retiring directors and auditors were re-elected, and a hearty vote of thanks having been accorded to the chairman, directors, and staff, the proceedings terminated.

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Companies' Meetings, Reports, etc.

GLOBE TELEGRAPH AND TRUST CO. :—Quarterly interim dividend of 5s. per share on the ordinary shares.

CLARKE, CHAPMAN AND CO.—Final dividend proposed of 1s. per share on the ordinary shares, making 10 per cent. for the year. £10 000 is placed to reserve and £34 647 carried forward.

WESTERN TELEGRAPH CO.—Second quarterly interim dividend of 5s. per share, free of tax, for the year ending June 30th, 1923, payable on March 24th, to shareholders registered on March 12th.

WASTE HEAT AND GAS ELECTRICAL GENERATING STATIONS.—Dividend recommended at the rate of 6 per cent. per annum for the year ended January 31st, 1923. Balance of £14 018 to be carried forward.

TYNESIDE ELECTRICAL DEVELOPMENT CO.—Dividends at the rate of 6 per cent. recommended on both the preferred ordinary and the deferred ordinary shares, carrying forward £624, as against £573 brought in. The profit for the year to January 31st was £3 850.

TELEGRAPH CONSTRUCTION AND MAINTENANCE CO.—Dividend proposed of 7½ per cent., free of tax. The net profit for 1922 was £117 097 plus £116 628 brought forward. It is proposed to add £30 000 to the reserve fund, making it £210 000 and to carry forward £114 085.

FERGUSON, PAILIN LTD.—The net profit to November 30th last was £10 480, making, with £15 264 brought in, £25 744. A further dividend of 3½ per cent. is declared on preference and ordinary shares, making 7 per cent. on each class. £2 000 is placed to reserve, and £18 743 carried forward, subject to E.P.D. for 1919 and 1920 and corporation tax.

The STOCK EXCHANGE COMMITTEE have granted official quotations to $257 366 200 capital stock of the American Telephone and Telegraph Co., £1 500 000 6½ per cent. convertible 10-year 1st debenture stock of Marconi's Wireless Telegraph Co., and 300 000 £1 fully paid ordinary and 500 000 £1 fully paid 6½ per cent. cumulative preference shares of Pinchin Johnson and Co.

Supply Undertakings.

BOURNEMOUTH AND POOLE ELECTRICITY SUPPLY CO.—Dividend of 7½ per cent. (15s. per share) less tax, payable March 23rd.

NEWCASTLE-ON-TYNE ELECTRIC SUPPLY CO.—Dividend of 2½ per cent. on the ordinary shares for the year.

CAMBRIDGE ELECTRIC SUPPLY CO.—Dividend at the rate of 7 per cent. for 1922. £5 953 is carried forward, and £10 000 placed to the depreciation fund.

CITY OF LONDON ELECTRIC LIGHTING CO.—The directors propose a dividend of 2s. per share, making 15 per cent. for the year, compared with 14 per cent. for the previous year, placing £130 000 to reserve, against £85 000, to a dividend equalisation fund £30 000, carrying forward £30 230, compared with £29 844 brought in.

OXFORD ELECTRIC CO.—The net revenue for 1922, after deducting debenture and sundry interest, amounted to £26 832 (against £11 249). Of this sum £15 665 is placed to reserve and renewal of plant account, while the dividend on the ordinary shares is 6 per cent. (against 5 per cent.) for the year. A sum of £2 437 is to be carried forward (against £20 brought in).

Electric Traction Companies' Results.

DUMBARTON BURGH AND COUNTY TRAMWAYS CO.—No dividend will be paid on the preference shares on March 1st.

GATESHEAD AND DISTRICT TRAMWAYS CO.—At an extraordinary general meeting last week, the directors were authorised to borrow on mortgage or bond sums not exceeding a total of £70 000.

LLANDUDNO AND COLWYN BAY ELECTRIC RAILWAY.—Dividend recommended at the rate of 4 per cent. per annum, less tax, carrying forward £1 084 5s. 3d., against £1 419 14s. 7d. brought in. The profit for the year to November 30th last was £5 720 5s. 4d. £2 140 is appropriated for the redemption of debenture stock.

LONDON AND SUBURBAN TRACTION CO.—Dividend proposed on the five per cent. cumulative preference shares as follows :—4 per cent. in respect of 1918 ; 1 per cent. on account of 1919 ; 3½ per cent. was paid in respect of 1921. The available total, after deducting interest, income-tax, service fund for debenture stock, etc., was £97 416. There remains £17 243 to be carried forward.

New Companies.

TOMLIN BOOKER, LTD.—Private. Reg. Feb. 24th. Cap., £100 in £1 shares. Manufacturers of electrical and mechanical signs, etc. Reg. office : 12-13, Henrietta Street, Strand, London, W.C.2.

RIPAULTS, LTD.—Private. Reg. March 1st. Cap. £100 in £1 shares. Manufacturers, manufacturers' agents of motor, electrical and ignition appliances and accessories, etc. Reg. office : 44, Bedford Row, London, W.C.

ADAM, SMALL AND CO., LTD.—Private. Reg. in Edinburgh Feb. 23rd. Cap., £2 000 in £1 shares. Motor, electrical and general engineers and merchants, etc. Reg. office : 298, Maxwell Road, Pollokshields, Glasgow.

EASTERN WIRELESS CO., LTD.—Private. Reg. March 2nd. Cap., £500 in £1 shares. Manufacturers of and dealers in electrical apparatus, wireless and broadcasting instruments, etc. Solicitors : Harrington Edwards and Cobban, 33, Southampton Street, Strand, W.C.2.

HARRISON'S, LTD.—Private. Reg. Feb. 23rd. Cap., £1 500 in £1 shares. To take over the business of an electrical engineer and contractor carried on by A. R. Harrison at 84, Oxford Street, Manchester. Reg. office : 84, Oxford Street, Manchester.

FLACTEM WIRELESS, LTD.—Private company. Reg. Feb. 26th. Cap., £5 000 in 4 000 ordinary shares of £1 each and 20 000 deferred shares of 1s. each. To take over the business of a wireless electrical engineer carried on by C. F. Metcalf at Cow Green, Halifax. Reg. office : The Chambers, 7, Park Square, Leeds.

EMPSON ELECTRICAL ENGINEERING CO., LTD.—Private. Reg. March 2nd. Cap., £2 000 in £1 shares. To ratify and adopt an agreement between A. W. Empson and W. Howgrave and N. S. Wolfendale, and to carry on the business of electrical engineers, instrument makers and patentees, at 39, Victoria Street, London, S.W.

FRIEND WINTLE AND CO., LTD.—Private. Reg. Feb. 28th. Cap. £2 000 in £1 shares. To adopt an agreement with H. Wintle, for the sale of the business known as Friend Wintle and Co., and to carry on the business of electricians, mechanical engineers, suppliers of electricity for light, heat, motive power or otherwise, etc. H. Wintle, 22, The Walk, Cardiff, electrical engineer, is permanent managing director.

Portable Batteries for Wireless Work.

The accompanying illustration shows a battery which has been designed for the filament circuit of wireless valves by the HART ACCUMULATOR CO. It is of the 6 V "Meg. 9" type and has a capacity of 40 Ah on continuous discharge. The battery is made in portable form, being contained in a waxed wood crate with finger grips on the ends, or with a strap for carrying, as desired. It consists of three cells in glass boxes with sealed ebonite lids and vent plugs. Stocks are held by the manufacturers at their various depots throughout the country. The battery is made in both 4 V and 6 V sizes, with from 20-60 Ah continuous supply.

THE "HART" PORTABLE BATTERY.

Storage Batteries and Continuous Supply.

The value of storage batteries in ensuring continuity of supply was recently demonstrated at Sydney (N.S.W.). According to a report in the "Sydney Morning Herald" of January 10th, there was recently an interruption in that town for about twenty minutes, with intermittent interruptions from 8.20 a.m. to 9.35 a.m. The city electrical engineer in his report stated that "practically the only portion of the area supplied with electricity by the City Council in which there was not an interference with supply was the centre of the city, and in this portion the supply was maintained by using the storage batteries and the auxiliary supply drawn from the Railway Commissioners' system." The batteries referred to were supplied by the Tudor Accumulator Co., the largest one having an output of 5 832 A continuously for one hour, whilst the output of the smaller one is 3 888 A for the same period.

Business Items.

WAILES DOVE BITUMASTIC, LTD., have opened a branch office at 2, Bank Street, Sheffield. Mr. Arthur Swindale is in charge.

BASTIAN AND ALLEN inform us that owing to the large demand for their "Pygmy" heater, they have reduced the price from 20s. to 15s. each, subject.

H.M. Commercial Secretary at BUENOS AIRES reports that a local firm is desirous of getting into touch with United Kingdom manufacturers of electrical plant and installations. Particulars from the Department of Overseas Trade.

CHADBURN'S (SHIP) TELEGRAPH CO. announce that all communications regarding "De Laval" centrifugal oil purifiers should now be addressed to the De Laval Chadburn Co., Wellington House, Buckingham Gate, London, S.W.1.

The Department of Overseas Trade states that a firm in Hilversum (Holland), doing a fair business in photographic articles, desires to secure the representation of British manufacturers of WIRELESS SETS. Inquiries to the Department should quote reference 290.

Mr. G. W. P. PAGE, who has had a varied experience in theoretical and practical engineering, besides having been engaged in engineering journalistic and publicity work, informs us that he has opened an office at 36, Maiden Lane, Strand, London, W.C.2, on behalf of Fisher, Knight and Co., printers and publishers, advertising specialists, etc. Mr. Page's personal services are available in connection with all engineering publicity matters. (Telephone : Gerrard 2460.)

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Reference Index to Recent Wireless Publications.

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Design and Erection of Masts (*Popular Wireless*, 1, p. 690, December 23rd, 1922). R.320.

Leading-in Wires (*Model Engineer*, 47, p. 559, December 7th, 1922) R.320.

P. Bouvier. Multiple Antennae (*Radioélectricité*, 3, pp. 459-466, November, 1922). R.328.

S. R. Winters. Every Lamp Socket a Radio-Phone (*Scientific American*, 126, p. 384, June, 1922). R.329.

Our Aladdin's Lamp. Recent Developments in Vacuum Tubes of Giant Size for Radio and Power Transmission (*Scientific American*, 128, pp. 24-25, January, 1923). R.330.

Applications of the Thermionic Valve (*Scientific American*, 127, p. 325, November, 1922). R.330.

Experimental Tube Using 110-V. a.c. on Filament and Plate (*Wireless Age*, 10. pp 65 66, December, 1922). R.330.

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N. J. Rohan. The Magnetron. A Novelty in Thermionic Tubes (*Broadcaster*, 1, pp. 341-343, January, 1923). R.330.

Tubes used in Trans-Oceanic Service (*Wireless Age*, 10. pp. 55-56, November, 1922). R.330.

Exhibition of 10 kW Vacuum Tube (*Wireless World and Radio Review*, 11, p. 424, December 30th, 1922). R.331.

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A special type of thermionic valve for use on a.c. circuits. R.331.

P. D. Tyers. The Dynatron (*Modern Wireless*, 1, pp. 29-31, February, 1923). R.334.

A Cheap and Efficient Telephone Transformer (*Work*, 64, p. 335, January 6th, 1923). R.342.

H. de A. Donisthorpe. A Valve Circuit for High Amplification without Reaction (*Model Engineer*, 47, pp. 558-559, December 7th, 1922). R.342.

P. D. Lowell. Notes on the Development of an Electron Tube Amplifier (*Journal of the American Institute of Electrical Engineers*, 41, pp. 488-490, July, 1922). R.342.

A. Ringel. Practical Reflex Amplification (*Wireless Age*, 10, pp. 60-62, January, 1923). R342/132.

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Armstrong's Super-Regenerative Receiver (*Scientific American*, 127, p. 160, September, 1922). R.343.

G. G. Blake. Application of Loose Coupling to an existing Single-Circuit Set (*Wireless World and Radio Review*, 11, pp. 495-497, January 13th, 1923). R.343.

R. W. H. Bloxham. A Five-Valve Experimental Receiver (*Wireless World and Radio Review*, 11, pp. 462-465, January 6th, 1923). R.343.

M. Child. A Selective Five-Valve Amplifier (*Wireless World and Radio Review*, 11, pp. 343-345, December 9th; p. 446, December 30th, 1922). R.343.

Failures of Two Receiving Wireless Instruments on One Set (*English Mechanic and World of Science*, 66, p. 241, December 29th, 1922). R.343.

Adrian B. Jones. A Receiver-Amplifier for Short Waves (*Wireless World and Radio Review*, 11, pp. 361-363, December 16th, 1922). R.343.

M. Moye. The Utilisation of Alternating Current in Valve Receiving Sets (*Revue Générale de l'Electricité*, 12, pp. 513 515, October 7th, 1922). (*Annales des Postes, Télégraphes et Téléphones*, 6, pp. 1 384-1 387). R.343.

A Practical Super-Heterodyne Receiver (*Wireless Age*, 10, p. 75, December, 1922) R.343.

A. Ringel. A.C. for Filaments and Plates of Receiving Tubes (*Wireless Age*, 10, pp. 72-73, December, 1922). R.343.

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B. Dill. A Hornless Loud Speaker (*Wireless Age*, 10, p. 67, December, 1922). R.366.

Electrical Recording and Reproduction of Sound (*Wireless Age*, 10, p. 67, December, 1922). R.366/367.

C. Fitch. Loud Speaker Circuits and Devices (*Wireless Age*, 10, pp. 68-69, December, 1922). R.366

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H. P. Waran. The Problem of Aerial Insulation and a New Type of Aerial Insulator (*Wireless World and Radio Review*, 11, p. 448, December 30th, 1922). R.387.

R.400. RADIO COMMUNICATION SYSTEMS.

G. Reboul. A New Short Wave-length Radiation (*Journal de Physique et le Radium*, 3, pp. 341-361, October, 1922). R.402.

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W. R. G. Baker and I. F. Byrnes. Duplex Radio Telephone Transmitter (*General Electric Review*, 25, pp. 477-483, August, 1922).

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P. P. Eckersley. Some Modern Developments in Duplex Telephony (*Wireless World and Radio Review*, 11, pp. 456-461, January 6th, 1923). R.460.

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The Manchester Broadcasting Station (*Electricity*, 37, p. 15, January 12th, 1923) R.550/610.

The Manchester Broadcasting Station (*Wireless World and Radio Review*, 11, pp. 421-423, December 30th, 1922). R.550/610.

W. G. W. Mitchell. How to make use of the Scientific Time Signals (*Wireless World and Radio Review*, 11, pp. 501-504, January 13th, 1923). R.551.

The Paris "Radiola" Concerts (*Wireless World and Radio Review*, 11, p. 481, January 6th, 1922). R.550.

Post Office Statement on Broadcasting (*Wireless World and Radio Review*, 11, p. 482, January 6th, 1922). R.550.

The Radiola Concerts (*Radioélectricité*, 3, pp. 468-472 November, 1922). R.550.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

BERG, J., AND CO., 169, City Road, E.C., electrical engineers. £35 15s. 6d. January 8th.

ECON MANUFACTURING CO., LTD., Econ Works, 63A, Paris Garden, Stamford Street, Blackfriars, electrical engineers. £12 2s. January 15th.

ELCO MANUFACTURING CO., LTD., registered office, 59, Upper Maudlin Street, Bristol, electricians. £19 5s. 8d. January 15th.

WRIGHT, Robert (trading as ROBERT WRIGHT AND CO.), 34, Oxford Street, W., electrical engineer. £18 14s. 10d. January 15th.

Receivership.

COMAC MANUFACTURING CO., LTD. R. M. Ward, of 44, Church Road, Barnes, S.W., was appointed receiver on February 12th, 1923, under powers contained in debenture dated April 20th, 1921.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

BATTISCOMBE AND HARRIS, LTD., London, W., electrical dealers. Registered February 19th, £2 000 (not ex.) charge, to Mrs. E. A. Humphrey, Park House, Cookham; general charge, in priority to £1 000 debentures dated December 1st, 1922. *Nil. May 12th, 1922.

COX-CAVENDISH ELECTRICAL CO., LTD. (late CAVENDISH ELECTRICAL CO., LTD.), London, N.W. Registered February 24th, £1 250 debentures balance of £6 000; general charge. *£15 000 mortgage, £4 750 debentures. September 28th, 1922.

TEIGNMOUTH ELECTRIC LIGHTING CO., LTD. Registered February 22nd, £5,000 debentures (filed under sec. 93 (3) of the Companies (Consolidation) Act 1908), present issue £4,000; general charge.

Satisfaction.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD. (late BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD.), London, S.W. Satisfaction registered February 22nd, £300 000, registered April 10th, 1908.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

ACME ELECTRIC TRACTION CO., LTD., 700, Seven Sisters Road, London, N. A meeting of creditors was held recently, at the offices of Biddle, Thorne, Welsford and Gait, solicitors, 22, Aldermanbury, E.C., when the representative of Hawkins Bros., the largest trade creditors, was elected to the chair. The solicitors submitted an approximate statement of affairs which disclosed liabilities of £2 760, of which £1 620 was due to unsecured creditors, the balance representing amounts owing to Mr. J. Franklin and Mr. Curtis, who had been identified with the company. The assets were estimated to realise £1 932, from which had to be deducted £15 for preferential claims, leaving net assets of £1 917. It was suggested that the company should be allowed time in which to discharge its liabilities. The company was prepared to meet the wishes of the creditors, even to the extent of going into voluntary liquidation. One creditor had commenced proceedings. After discussing the position the opinion was expressed that the company should execute a debenture and trust deed to a trustee on behalf of the creditors for the purpose of securing the debts, while it was intimated that Franklin and Curtis would withdraw their claims until the trade creditors had received 10s. in the £. A committee was also appointed consisting of the representatives of Hawkins Bros. (creditors for £500), London Electric Wire Co. (£284). Donald Scott and Co. (£250), Spicers, Ltd. (£140), and Jenson and Nicholson (£130).

BAZLEY, George Edward, and BOLTSA, Sam Harry, trading in co-partnership as G. E. BAZLEY AND CO., at 6A, Cromford Court, Corporation Street, Manchester, electrical fitters and suppliers. A meeting of creditors was held last week at the Grosvenor Hotel, Deansgate, Manchester. A statement of affairs showed liabilities amounting to £1 921 against assets estimated to produce £1 065, a deficiency of £856. It was decided that the debtors be called upon to execute a deed of assignment with a committee of inspection. A resolution was also passed authorising the trustee to sell the assets to the debtors for a sum sufficient to pay the creditors a composition of 10s. in the £. The following are creditors:—British Thomson-Houston Co., Ltd., Rugby, £68; Lelios Lamp Co., Ltd., London, £30; Vulcan Electric and Mechanical Co., Ltd., London, £109; Electric Heating and Hardware, Ltd., Birmingham, £113; The General Cable Manufacturing Co., Ltd., Leatherhead, £58; The General Electric Co., Ltd., Manchester, £42; Metropolitan Vickers Electric Co., Ltd., Manchester, £59; Crabtree, J. A., and Co., Ltd., Walsall, £43; O'Brien, R., and Co., Manchester, £56; Reynard Electric Co., Ltd., Manchester, £60; Telga, N. V., Ltd., London, £87; Wholesale Fittings Co, Ltd, Manchester, £45; The Cable Accessories Co., Ltd., Tipton, £128; Underwood (Manchester), Ltd., Manchester, £83; Hackbridge Cable Co., Ltd., Hackbridge, £67; Ashworth and Smith, Manchester, £282; Sapra Electric Co., Ltd., London, £33; Ward and Goldstone, Ltd., Manchester, £29; B.T.T. Lamp Co., Ltd., London, £99.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Winding-up Petition.

ECON MANUFACTURING CO., LTD. A petition for winding-up has been presented by Nettlefold and Sons, Ltd., 54, High Holborn, and is to be heard at the Royal Courts of Justice, Strand, London, on Tuesday, March 13th.

Bankruptcy Information.

CHADFIELD, Cecil Richard Almas, 12, Nottingham Street, Melton Mowbray, in the county of Leicester, electrical engineer. Receiving order, February 26th. Debtor's petition. First meeting, March 9th, 3 p.m., Official Receiver's Office, 1, Berridge Street, Leicester. Public examination, April 6th, 11 a.m., The Castle, Leicester.

Bankruptcy Proceedings.

RUSSELL, Reginald William, late trading at 30, King Street, Bridlington, Yorkshire, as electrical engineer and contractor. The receiving order was made on February 17th on debtor's own petition. The statement of affairs shows liabilities of £704 and net assets £100, or a deficiency of £604. Debtor, who attributes his failure to bad trade and lack of capital, commenced business at his present address on October 11th, 1920, and traded there until January 27th last. He had no capital when he commenced, his father paying £250 for the business. Debtor states that he has been in difficulties since commencing business.

Prices of Metals, Chemicals, etc.

TUESDAY, March 6.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£76 10 0	£2 0 0	—
Electro Wirebars	,,	£82 0 0	£2 0 0	—
H.C. Wire, basis	per lb.	11⅜d.	⅛d.	—
Sheet	,,	11 3/16d.	—	1 1/16d.
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 3⅜d.	¼d.	—
Brass 60/40—				
Rod, basis	,,	7½d.	—	—
Sheet, basis	,,	10½d.	¼d.	—
Wire, basis	,,	11d.	⅜d.	—
Pig Iron—				
Cleveland Warrants	per ton	£6 0 0	—	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 0 0	—	—
Lead Pig—				
English	,,	£30 10 0	—	—
Foreign or Colonial	,,	£29 7 6	—	—
Tin—				
Ingot	,,	£209 2 6	£9 7 6	—
Wire, basis	per lb.	2s. 9½d.	1½d.	—
Aluminium Ingots	per ton	£100 0 0	—	—
Spelter	,,	£30 17 6	7s. 6d.	—
Mercury	per bottle	£10 5 0	—	—

Sulphur (Flowers)—Ton £8 10s. *Sodium Chlorate*—Per lb. 2⅞d.
,, (Roll-Brimstone)—,, £8 *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.— ,, £26 per ton, £7 10s.
Boric Acid (Crystals). ,, £55 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 4⅛d.; plantation 1st latex, 1s. 5⅞d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Company.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

178 079 FORGES AND ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE JEUMONT. Regulation of polyphase commutating motors. (5/4/21.)
188 299 P. ROMBACH. Electric pocket and night lamp. (1/11/21.)
189 053 B. ROGGE. Electric pocket lamps. (18/4/22.)
189 060 WAYNE ENGINEERING AND EQUIPMENT CO. and N. D. G. ROBERTSON. Lamp holders and switches. (20/4/22.)
189 075 WESTERN ELECTRIC CO. Loaded conductors. (17/5/21.) (Divided Application on 188 688.)
184 482 AKTIEBOLAGET BIRKA REGULATOR. Switches. (30/9/20. (Divided Application on 169 696.)
189 822 T. LENAGHAN. Motor mechanism for automatic telephone switching. (14/6/21.)
189 823 T. LENAGHAN. Metering for automatic telephone systems. (14/6/21.)
189 824 T. LENAGHAN. Automatic telephone systems. (14/6/21.)
189 832 WESTERN ELECTRIC CO. Magnetic material for loading telephone and telegraph conductors. (12/7/21.) (Addition to 188 688.)
175 595 W. DUBILIER. Insulation of high potential condenser terminals. (18/2/21.)
189 840 C. J. BEAVER and E. A. CLAREMONT. Glands of electric joint boxes. (6/8/21.) (Cognate Application, 3423/22.)
189 841 H. BARON (F. ALDENDORFF). Automatic telephone switching. (6/8/21.) (Cognate Application, 23 869/21.)

APPLICATIONS FOR PATENTS.

February 19th.

4 718 B. R. SIMMONS. Wireless telegraph apparatus, etc.
4 727, 4 728 and 4 729 V. HOPE. Electric fuses.
4 751 G. W. SHARD and C. W. WOODS. Locking electric lamps on holders.
4 762 A. H. RAILING and A. E. ANGOLD. Magneto-electric hand lamps.
4 769 E. H. ROBINSON and P. D. TYERS. Electric circuits employing thermionic devices, etc.
4 770 W. T. IVORY. Electrically lighted alarm clock.
4 775 T. F. GAYNOR. Electric terminal multiple connector.
4 777 W. H. WHITE and G. MYERS. Crystal detectors.
4 792 SANDYCROFT, LTD., and L. J. HUNT. Electrical machines.
4 802 M. FREEMAN. Trolley harps.
4 813 G. WEISSMANN. Dry cells.
4 815 SCINTILLA. Starting motor gearing for engines. (23/2/22, Germany.)
4 817 STERLING TELEPHONE CO. and A. E. HEARNE. Telephone receiver.
4 818 MITCHELL'S ELECTRICAL AND WIRELESS, LTD., and J. F. SUTTON. Adjustable resistances.
4 820 L. J. HARTNETT. Insulators.
4 839 EDISON SWAN ELECTRIC CO. and W. B. CLARKE. Thermionic valves.
4 845 BENJAMIN ELECTRIC, LTD. Signalling arrangements for motor vehicles. (27/3/22, U.S.)

February 20th.

4 852 B. E. D. KILBURN (NEDERLANDSCHE THERMO-TELEPHOON MAATSCHAPPIJ). Long distance telephony.
4 853 C. H. SPENCER. Control of motors for electric vehicles.
4 879 F. W. COOMBER. Wireless receiving apparatus.
4 905 H. W. LONGBOTTOM. Potentiometers, etc.
4 912 SIR W. NOBLE and A. R. KAHL. Wireless receiving apparatus.
4 913 L. R. BLACKBURN. Radio communication.
4 918 M.-L. MAGNETO SYNDICATE and E. A. WATSON. Transformation of electrical energy.
4 947 IGRANIC ELECTRIC CO. Adjusting devices.
4 952 PACENT ELECTRIC CO. Inductance coil mountings. (24/7/22, U.S.)
4 961 A. H. HUNT. Variable inductance coils.
4 962 A. H. HUNT. Variable leaks for thermionic valves.
4 979 W. V. HUNT. Electric railway systems.
4 981 W. DUBILIER. Electric devices.
4 982 W. DUBILIER. Variable electrostatic condensers.
4 992 R. M. ELLIS and W. A. CHAMBERS. Replacing thermionic valve by crystal detector, etc.
4 993 S. RUBEN. Vacuum or electron table apparatus.
5 002 W. PRICE AND SON. Switchgear and switchboard for charging accumulators.

February 21st.

5 010 R. GORMAN. Containers for wireless instruments, etc.
5 023 W. WHITEHEAD. Carrier for accumulators, etc.
5 025 F. ASHWORTH. Prevention of infection from telephone mouthpiece.
5 031 COOKE AND WHITFIELD WIRELESS, LTD. and H. H. WHITFIELD. Wireless receiving apparatus.
5 063 A. LUTZ. Electric vulcaniser for artificial teeth and limbs.
5 070 SIR W. NOBLE and A. R. KAHL. Battery controlling devices for wireless apparatus.
5 072 E. H. ROBINSON. High frequency signalling.
5 073 J. D. K. RESTLER. Means for preventing use of telephone.
5 075 and 5 076 A. E. WHITE (ELGERIA IRON AND STEEL CO.). Electric welding machines.
5 082 C. DAHMS. Combination electric globe and thermionic valve.
5 101 R. P. FUGE. Electrometers.
5 102 N. ROBINSON. Circuit breakers.
5 106 L. J. STEELE, A. E. MCCARTHY and H. MARTIN. Electric power plant for arc welding, etc.
5 119 BRITISH THOMSON-HOUSTON CO. and E. B. TUPPEN. Motor control systems.
5 120 BRITISH THOMSON-HOUSTON CO. Electric generating apparatus. (17/3/22, U.S.)
5 125 E. Y. ROBINSON. Vacuum electric tubes.
5 126 SIEMENS and HALSKE A.G. Telephone systems. (9/5/22, Germany.)

February 22nd.

5 134 R. W. ANSTEY. Wireless telephony, etc.
5 143 J. R. C. AUGUST. Electric control keys.
5 164 W. AND H. JOHNSON. Telephonic and telegraphic multiplier.
5 191 A. S. CUBITT. Electric terminals.
5 192 L. T. CLARK. High tension ignition devices.
5 193 H. G. HUGHES, T. E. GOLDUP, C. SEYMOUR, and B. HODGSON. Vacuum tubes.
5 200 P. AMBERTON. Electric controllers.
5 201 FULLER'S UNITED ELECTRIC WORKS, LTD. Smoother or sifter circuits.
5 211 E. HARBERD. Transformers for wireless telegraphy, etc.
5 212 METROPOLITAN-VICKERS ELECTRIC CO., B. BEESLEY and J. B. HANSELL. Terminals for transformers.
5 213 T. ZWEIGBERGK. Motor control.
5 218 S. G. BROWN. Production of sound vibrations, etc.
5 219 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Insulators.
5 246 E. HAEFELY ET CIE. Insulating tubes. (9/3/22, Switzerland).

February 23rd.

5 254 A. C. BROWN. Diaphragms for telephones, etc.
5 274 W. WEEKES. Electric geysers, etc.
5 276 BRITISH INSULATED AND HELSBY CABLES, LTD., and S. C. BULLOCK. Rail bonds for electric railways.
5 281 E. MIKSCH. Branch for taking current for lighting mains. (19/6/22, Austria.)
5 302 S. E. GRUBB and D. WALLIS. Switch and plug box.
5 303 S. E. GRUBB and D. WALLIS. Radiators.
5 306 F. S. AND S. LYLE. Crystal detectors for wireless telephony.
5 317 RELY-A-BELL ALARM CO. and H. EISLER. Electric burglar alarms.
5 318 MERRYWEATHER AND SONS and J. H. OSBORN. Automatic starting gear for electric fire pumps.
5 319 W. H. ECCLES. Electric signalling.
5 323 G. A. COOPER and A. S. CUBITT. Electrically heated devices.
5 324 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Electric discharge apparatus.
5 325 SIGNAL GES. Sound receiving equipment for ships.
5 329 E. G. PYNE. Locking device for incandescent lamps.
5 333 F. C. R. HOLLAND. Thermionic valve.
5 353 W. DUBILIER. Communication by high frequency currents.
5 358 ELECTRICAL IMPROVEMENTS, LTD., and J. R. BEARD. Electric protective systems.
5 359 ROSE STREET FOUNDRY, ETC., CO. and S. H. GORDON. Rotary electrodes for welding machines.
5 361 MARCONI'S WIRELESS TELEGRAPH CO. Loop antennæ. (14/3/22, U.S.)
5 367 T. ROMBACH. Electric table lamp.

February 24th.

5 389 F. B. COX. Electric resistance heating elements.
5 402 E. H. HILL. Instrument for adjustment of wireless apparatus.
5 405 A. J. ROUND. Electrolytically determining weight of metal deposited from an electrolyte, etc.
5 415 A. BRICE. Controlling gas or electric cookers.
5 419 W. J. RICKETS. Regulation of electric generators.
5 429 K. KANDO. Pole-changing system for polyphase induction motors. (25/2/22, Austria.)
5 435 M. V. PIRIE. Variable electric condensers.
5 440 S. H. VARNALS. Stationary transformers.
5 443 LODGE-COTTRELL, LTD. (METALLBANK U. METALLURGISCHE GES. A. G.). Rectifying h.t. alternating current.
5 444 METROPOLITAN-VICKERS ELECTRICAL CO. and L. S. PECK. Alternating current meters.
5 447 A. BRIERLEY. Telephone fittings.
5 450 H. J. MARSHALL. Electric condensers.
5 458 MUIRHEAD AND CO. Artificial lines for telegraphy.
5 466 BRITISH LIGHTING AND IGNITION CO. and E. O. TURNER. Control of current in electric systems.

Arrangements for the Week.

FRIDAY, MARCH 9th (To-day).

INSTITUTE OF COSTS AND WORKS ACCOUNTANTS.
At the Connaught Rooms, Great Queen Street, London, W.C. Second Annual Costing Conference. Subject: "Standardisation in Costing."
INSTITUTION OF ELECTRICAL ENGINEERS. (SOUTH MIDLAND CENTRE.) (STUDENTS' SECTION.)
Radio Demonstration and Discussion.
INSTITUTION OF ELECTRICAL ENGINEERS. (LONDON STUDENTS' SECTION.)
7 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London. Address by the President, Mr. F. Gill.
INSTITUTION OF HEATING AND VENTILATING ENGINEERS.
7 *p.m.* At the Engineers' Club, Coventry Street, London. Lecture on "Gas as a Fuel," by Mr. J. G. Clark.
JUNIOR INSTITUTION OF ENGINEERS.
7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Paper on "Rolling Mill Machinery," by Mr. R. C. D. Fell.
EDINBURGH ELECTRICAL SOCIETY.
8 *p.m.* At Philosophical Institute, 4, Queen Street, Edinburgh. Lecture on "Colliery Plant," by Mr. E. Cunningham.

SATURDAY, MARCH 10th.

BIRMINGHAM AND DISTRICT ELECTRIC CLUB.
7 *p.m.* At the Grand Hotel, Colmore Row, Birmingham. Lecture on "The Wave Transmission of Power," by Mr. Dinwoodie.

TUESDAY, MARCH 13th.

INSTITUTION OF ELECTRICAL ENGINEERS. (WESTERN CENTRE.)
5.30 *p.m.* At Merchant Venturers' Technical College, Bristol. Joint meeting with Institution of Post Office Engineers. Lecture on "The Imperial Wireless Station at Leafield," by Mr. E. H. Shaughnessy.
INSTITUTE OF TRANSPORT.
6 *p.m.* At the Institution of Electrical Engineers, Victoria Embankment, London. Meeting of the Metropolitan Graduates' and Students' Society. Paper entitled "Some Present-day Transport Problems," by Mr. D. R. Lamb.
NATIONAL ASSOCIATION OF SUPERVISING ELECTRICIANS.
6.45 *p.m.* At St. Bride's Institute, Bride Lane, London, E.C.4. Lecture on 'Incandescent Electric Lamps," by Mr. Bernard B. Dudding.
INSTITUTION OF ELECTRICAL ENGINEERS. (SCOTTISH CENTRE.)
7 *p.m.* At the North British Station Hotel, Edinburgh. Paper on "The Maintenance of Voltage on a D.C. Distribution System by means of a Fully Automatic Substation," by Mr. P. J. Robinson.
INSTITUTION OF ELECTRICAL ENGINEERS. (EAST MIDLAND SUB-CENTRE.)
7 *p.m.* At the Technical College, Derby. Paper on "Automatic Telephones," by Mr. E. A. Laidlaw.

WEDNESDAY, MARCH 14th.

UNIVERSITY OF LONDON.
5.15 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Lecture on "The Control of the Speed and Power Factor of Induction Motors," by Prof. Miles Walker. (Lecture III.)
ASSOCIATION OF ENGINEERS IN CHARGE.
7.30 *p.m.* At St. Bride's Institute, Bride Lane, London, E.C.4. Paper on "Scientific Instruments in the Boiler House," by Mr. J. B. C. Kershaw.
INDUSTRIAL LEAGUE AND COUNCIL.
7.30 *p.m.* At Caxton Hall, Caxton Street, London, S.W.1. Lecture on "Functions of Works Committees," by Mr. John Murray, M.P.

THURSDAY, MARCH 15th.

INSTITUTION OF ELECTRICAL ENGINEERS.
6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London. Lecture on "Co-operation between the Architect and the Electrical Engineer," by Mr. F. Hooper and Mr. J. W. Beauchamp.

FRIDAY, MARCH 16th.

BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION.
12 noon. At the Hotel Cecil, London, W.C. Annual General Meeting.
RADIO SOCIETY OF GREAT BRITAIN.
6.30 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Lecture on "Accumulators, Dry Cells and the Currents Used in the Reception of Radio Telephony," by Mr. L. F. Fogarty.
JUNIOR INSTITUTION OF ENGINEERS.
7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecture entitled "Comparative Power Costs," by Mr. C. H. Woodfield.
BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION.
7.30 *p.m.* At Caxton Hall, Westminster, London. Salesmanship Conferences. Lecture on "Showroom and Exhibition Work," by Mr. H. W. Gregory.

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CONTENTS.

Notes of the Week	271	The Institute of Metals	285
Electrical History	273	Large Converters for Manchester	286
Modern Boiler House Practice. By David Brownlie. Illustrated	274	E.D.A. in Yorkshire	286
		Industrial Lighting Equipment	286
Notes on High Frequency Rheostats. By J. H. Vincent and A. L. Beak. Illustrated	276	Books Received	286
		Legal Intelligence	287
Rubber and Gutta Percha in Telegraph Cable Manufacture	276	Obituary	287
		Personal Items	287
Bare Aluminium Conductors. Illustrated	277	Imperial Notes	288
Electric Drive in Cement Works	278	Foreign Notes	288
Modern Stage Lighting. Illustrated	279	Forty Years Ago	288
Some Problems of the Staff Employee	280	Electricity Supply	289
Maintenance of Voltage on a D.C. Distribution System by Means of a Fully Automatic Substation	280	Tenders Invited and Accepted	290
		Institution Notes	290
The Supply Authority and Salesmanship	281	Electric Traction	291
Correspondence	281	Wireless News	291
The Need for Co-operation	281	Companies' Meetings, Reports, etc.	292
Merchandise to Sell and Profit By. Illustrated	282	New Companies	292
Municipal Electricity Finance	284	Business Items	292
Ex-British Westinghouse Association	284	Commercial Intelligence	293
Electrical Imports and Exports	285	Prices of Metals, Chemicals, etc.	293
Power Engineers' Salaries	285	Patent Record	294
The Second London Inquiry	285	Arrangements for the Week	294

Notes of the Week.

London's Electricity Supply.—Further Delay.

THE second inquiry into the London and Home Counties Electricity District came to an abrupt and untimely end on Monday before it had well started. As will be remembered, the Commissioners' scheme provided for a Joint Electricity Authority, certain of whose powers would be compulsorily delegated to two committees representing the local authorities and companies respectively. Mr. TYLDESLEY JONES, for the companies, contended that this delegation was *ultra vires*, and in spite of Sir JOHN SNELL'S statement that the procedure had the approval of the highest legal authority, he announced his intention of having its validity tested in the courts. The inquiry was therefore adjourned *sine die*. From one point of view we regret that this point should have been raised. It will delay the re-organisation of London's electricity supply and will help to support the opinion that the companies do not want to do anything but hold things up. From another point of view it is well that the point should have been raised when it was. It is essential that the Joint Authority and the two committees should have the full force of legality behind them in performing what will be a very difficult task. Any suspicion that their constitution is not what it should be would be disastrous. In the meanwhile we remain in a state of suspended animation, a state which we hope will be altered with the least possible delay. The point is to be argued in the Courts to-day.

International Telephony.

THE worst of many great suggestions is that they are put forward only to die. That, apparently, is not to be the fate of Mr. GILL'S proposals for European international telephony. A conference of members of the engineering departments of the European Post Offices is meeting in Paris this week, and representatives are attending from Great Britain, France, Italy, Belgium, Holland, Spain, Switzerland, Morocco, and Algiers. Mr. R. A. DALZELL and Major T. F. PURVES, together with Messrs. J. G. HILL, A. B. HART, and H. G. TRAYFOOT, are representing this country, but Mr. GILL, not being a Post Office official, will be absent. We hope, however, that an opportunity has been taken to obtain his detailed views, for he knows more about the question than anybody else. We understand that the conference is first examining the physical possibilities of the proposed scheme and estimating the amount of traffic which would have to be dealt with. We hope the results of their labours will be satisfactory: their importance cannot be overstressed. "Communications dominate war," says MAHAN. There can be no doubt they are a most potent factor in the maintenance of peace.

Electricity Supply Politics.

IN commenting on the withdrawal of the employers from the Joint Board for the electricity supply industry we said that one of the inevitable results would be disputes all over the country. We spoke only too truly. The sittings of the Joint Board were suspended when the negotiations on the question of salary revision were almost completed. This left no body to which such disputes could be referred. At Halifax, therefore, the opportunity was seized to revise salaries, to give notice of dismissal to the existing staff, with the option of re-engagement at a lower scale, and, when this option was not exercised on the ground that the reductions had not been sanctioned by the Joint Board, to put the notices into force and to engage other men in the places of the E.P.E.A. members. At Birkenhead, on the recommendation of the "Economy" Committee, the same course is to be followed, and generally up and down the country, signs are evident that the opportunity

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given by the temporary demise of Whitleyism is being seized to bring about reductions which are as unnecessary as they are unwise.

The Economics of Low Salaries.

Our views on the general question have been stated sufficiently often to require no repetition. Drastic wages cuts in the supply industry are a false economy. When wages cuts are necessary they should be determined by Joint Boards and not be the subject of individual negotiation. In withdrawing from the Joint Board the employers took a step which at the time we regarded, and continue to regard, as being likely to do a grave injury to the industry. Cheap electricity is an essential to the well-being of all industries, including the electrical industry. Cheap electricity will only be attained by the employment of a well-trained and contented electrical staff. In any undertaking the wages are among the smaller items of expense, but they may have a profound effect on those that are more important. This is a fact which is often overlooked.

The Halifax Dispute.

ABOUT the Halifax dispute it is difficult to write without adding to the acerbity of the situation. Members of the E.P.E.A. have left the Corporation's employment and other men have been taken on under circumstances which are, if rumour speaks correctly, strange to say the least of it. The Town Council have refused to receive a deputation, and the Electrical Power Engineers' Association is balloting its members on the question "of taking national drastic action," which, we fear, can only mean one thing. This is being done not on account of Halifax alone, but because it is feared, with some justice, that other Corporations will follow their example. We sincerely hope that such "drastic action" will be unnecessary, and our hope is strengthened by the resolution passed by the District Joint Board for Yorkshire deploring the action of the Halifax Corporation and suggesting a return to the *status quo*. This advice should be taken without delay or matters will reach a stage which all will deplore. We are glad also to hear that the E.P.E.A. are to-day meeting the employers, whose responsibility in this matter is very grave. We hope this means the resuscitation of the National Joint Board. For it is a reflection for the cynical that Mr. WHITLEY represents Halifax in Parliament. What, we wonder, does he think of his constituents.

Honour is Avenged.

THE thanks of all electrical engineers are due to Mr TOMLINSON-LEE for so valiantly upholding the good name of that profession to which we are proud to belong. There is no need to go into the details of the scandalous treatment which he received at the hands of the Wimbledon Corporation, treatment which culminated last week in a successful action for slander, except to say that it should be a warning to municipal bodies that their employees, be they only engineers, are entitled to consideration as civilised human beings. On technical questions, as on others, a man may hold his own opinions, and if that opinion differs from those of others it is not necessarily a sign of incompetence. Mr. LEE had served the Wimbledon Corporation well and faithfully for over twenty years, yet had the Electricity Committee, who as the evidence shows conduct their business in a mysterious way, done what they wished he would have been dismissed summarily and without a reason. Moreover, as if this was not bad enough, he would by subtle innuendo have had a stigma attached to his name as cruel as it was untrue. Those who had the opportunity of seeing Mr. LEE himself and the witnesses for the defence under cross-examination, can have had no doubt as to the rights of the case, and the verdict therefore only performs an elementary act of justice. We hope the lesson will be learnt by those who need to learn it, and once more our thanks are freely given to Mr. LEE. He had nothing to fear from publicity; the Mayor and Electricity Committee had.

Broadcasting Troubles.

THE publication of the text of the licence granted by the POSTMASTER-GENERAL to the Broadcasting Co. to establish eight stations and to transmit matter has been made the occasion for an outburst of spleen against the latter which is as unwise as it is unnecessary. It is stated that there is general dissatisfaction at the composition of the board of the company and at the domination of the "Big Six." In other words, the tail is annoyed because the dog wags it, and not it the dog. That, of course, is a drawback of majority rule, but when the tail wags the dog it is generally neither good for the tail or the dog, and we see no reason to suppose why that almost universal rule should not apply in this case.

The Need for Unity.

As is well known, any *bona fide* British manufacturer of wireless apparatus can become a member of the Broadcasting Co. on signing an agreement, an essential clause in which is that the signatory will not sell wireless parts to any retailer not a member of the company or to any member of the general public. The POSTMASTER-GENERAL'S approval is withheld from any instrument whose maker is not a member of the Broadcasting Co. These two conditions, it is claimed, will force the small man out of business, while the payment of royalties is said to be tantamount to setting up a monopoly. We cannot see the justification for these claims. If the Broadcasting Co. do not receive an adequate revenue, broadcasting must cease, and then where will the manufacturers of wireless apparatus large and small be? The larger firms will turn to other spheres of activity, but the small ones will go out of business. The assembling of wireless sets by amateurs has been declared illegal, and no wireless manufacturer can complain if he is prevented from doing what is against the law. Though this matter of the amateur is an important and difficult one, we think it can be settled; and it can certainly be settled by better means than those suggested by the discontents. For the rest, the criticisms are either unfair or unfounded, and are likely to recoil on the heads of those making them.

Making Hay Without Sunshine.

WE are glad to see that Mr. BORLASE MATTHEWS' ideas on the subject of electro-farming are finding acceptance among farmers. Mr. J. W. SYKES, the secretary of the Manchester branch of the National Farmers' Union, has especially interested himself in Mr. MATTHEWS' methods of making hay without sunshine, and the public lecture which the latter recently gave should convince the farmers of that conservative and somewhat dismal county that here is something which will enable them successfully to counteract the climatic conditions from which they often suffer. The samples of electrically made hay which were shown at the lecture convinced the farmers that as good a product can be obtained by these means as by any other, and the fact that this can be done at a less cost should be a telling argument in favour of its adoption. The agricultural industry in this country, like many others, is at present suffering from depression. The way to recover from that state is by the adoption of new methods. The use of electricity in the way suggested by Mr. MATTHEWS is an idea which is worthy of test and adoption.

What Does Boiler Efficiency Mean?

IN an article which we publish on another page of this issue, Mr. DAVID BROWNLIE draws attention to an interesting point in connection with modern boiler plant efficiencies. In a recent specification for boilers, full particulars of which he gives, a net efficiency of 85 per cent. was called for. He agrees that this is a sign of grace, but he points out

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that with the coal used and in spite of the method adopted those concerned will be very lucky to get that figure. His chief point is, however, that nobody knows quite what an 85 per cent. efficiency means. The position with regard to coal analysis is in a state of confusion, it is not clear whether the steam used for auxiliary purposes should be deducted in calculating the net efficiency, and when it is, exactly what is involved is left to the imagination. Several other points, which Mr. BROWNLIE mentions, have also to be taken into consideration, and generally what the figure really indicates is a very open question. This, it will be agreed, is a matter upon which some decision must be come to without delay. We wish to see the coal burnt in generating stations more efficiently used, but to attempt to modify design and manufacture to that end without first deciding on vital questions of specification and measurement will lead not to progress, but to the reverse.

Electrical Hot Water.

WE are pleased to be able to announce that Mr. J. HORACE BOWDEN, borough electrical engineer of Poplar, and Mr. C. G. NOBBS, of Nobbs & Co., have consented to act as judges of the designs sent in for the second ELECTRICIAN competition. This competition will open as soon as all the entries for the All-Electric House have been received, and full particulars and conditions will be published in our issue of April 6th. None better than the engineers we have named could have been selected for the duty of judging. One, as a supply engineer, and the other, as a manufacturer, have kept closely in touch with developments in this most important field, and can be trusted to judge the designs sent in in the broadest and most enlightened spirit. That, after all, is what is required. The problem is difficult, but not insoluble; we feel sure this competition will help to solve it. Meanwhile we remind our readers that in less than a fortnight the All-Electric House Competition will close.

Electrical History.

One of these days a history of electrical engineering, r a history of electricity, or both, will have to be written. The compiler of that history will be faced with at least two difficulties: where to start and what to leave out. If we postulate, as well we may, that modern electrical engineering was born on Christmas Day, 1821, when FARADAY converted electrical into mechanical energy by causing a wire carrying current to rotate in a magnetic field, our suppositious author will find that his work is divided into two main sections: the chronicling of what has happened in the last hundred years and a survey of what was done in the centuries that had gone before. The first will be a labour of Hercules with which we do not propose to deal, but the second will be much alleviated by the energy and research of the late Dr. P. F. MOTTELAY whose "Bibliographical History of Electricity and Magnetism Chronologically Arranged," has just been published by C. Griffin and Co.

Salute to the Adventurers.

The sub-title of the work is "Researches into the Domain of the Early Sciences, especially for the Period of the Revival of Scholasticism, with Biographical and other Accounts of the Most Distinguished Philosophers throughout the Middle Ages," and this title, which is a pamphlet in itself, adequately describes the book and the manner in which it is treated. We presume, considering the problems of our suppositious author once again, that in an electrical history four short chapters will have to be written on the early days of the compass, on magnetism, on electrical communication and on electrostatics, four subjects on which our philosophical forefathers worked gropingly, disjointedly, and with varying success. But the vast advances of the last hundred years must not obscure the value of much that they did, without altogether knowing what it was. In the compilation of those four chapters, the results of Dr. MOTTERLAY'S patience, attention to detail and orderly mind will be of the very greatest value not only for the matter which his book contains but for the copious references and cross references with which it is annotated. Reading it with interest, as we have done, we feel inclined to apply both to it and to its author the title of a well known romance, "Salute to the Adventurers."

A Tragic Story.

For as Sir RICHARD GLAZEBROOK rightly says in his foreword, "This splendid volume has a tragic story." It is dedicated to KELVIN, it opens with an introduction by SILVANUS THOMPSON, than whom no one better appreciated or illuminated the work of the pioneers, and the author himself died before his monumental work was ready for publication.

Monumental Toil.

Monumental toil is indeed the best description of Dr. MOTTELAY'S book. It covers no less than 4 458 years, from B.C. 2637 to A.D. 1820, and though about 350 pages of the 500 of which the book proper consists are devoted to the eighteenth and the early part of the nineteenth centuries, the work of compiling those first 150 pages must have been out of all proportion to the labour involved in preparing the latter and, of course, the more interesting part of the book. The first reference, B.C. 2637, is to the compass which was apparently discovered in China in the reign of the Emperor HOANG-TI. Other references to this essential piece of magnetic equipment appear under the date B.C. 1110, and later in AESCHYLUS' "Agamemnon," in the Bible, and in HOMER. About B.C. 600 the Etruscans are known to have devoted themselves to a study of electricity and to have used lightning conductors, while in B.C. 588 JEREMIAH first refers to signalling by fire which, though not strictly electrical, is sufficiently cognate for the author to include it in his references to means of communication.

The Father of the Magnet.

In the writings of ARISTOTLE there are references to the torpedo fish, but perhaps the earliest entry which modern electrical engineers will find worthy of close study is that dated A.D. 1269. It relates to the work of PETER PEREGRINUS, entitled "De Magnete." This work, which is really the earliest formal treatise on magnetism, was thought to be worthy of translation into English by SILVANUS THOMPSON. PEREGRINUS, in fact, successfully developed a theory of the lodestone which has equally successfully stood the test of time. With the work of this pioneer we may appropriately couple that of GILBERT who, in six books, dealt with the subject of permanent magnetism and especially with the important question of terrestrial magnetism. His second book is the earliest published on electricity and contains a description of the first electroscope.

A Winnowing of Information.

In the course of a short review, or indeed of a long one, it would be impossible to do more than indicate the amount of important and useful matter which this book contains for the electrical student. But one final point may be made which is of a great value both to the compiler and the reader of electrical history. The early writers were not scientific men. They were ignorant or did not believe in the scientific method. They drew largely upon their imagination. To take one example LUCIAN, the H. G. WELLS of his time, described what may be called electrical phenomena, but, if we may rely on the excellent index, Dr. MOTTELAY has rightly disregarded his work. He has, in fact, sifted and collected and, as far as our present knowledge of ancient writings stand, he has put into readable and easily accessible form, not perhaps all that is known, but certainly all that is worth knowing of the electrical works of the earliest philosophers. That must be his monument. It is a worthy one.

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Modern Boiler House Practice.

Some Remarkable Guarantees.

By DAVID BROWNLIE.

We have heard a lot lately about super-power stations, and now we are beginning to hear also of what one may term super-boiler plant efficiencies. For example, I have just come into possession of the efficiency specifications relating to one of our very latest power stations in Great Britain. This plant is to be the last word in efficiency, on the lines indicated in the diagram, and is being supplied by firms of the highest repute. The boilers are Babcock and Wilcox, of 8 619 sq. ft. heating surface, working at 210 lb. pressure, with an evaporation (in conjunction, of course, with the economiser) of 60 000 lb. of water per hour at normal rating, and 75 000 lb. overload. The superheater (B. and W.) is of 3 190 sq. ft. heating surface, and will deliver the steam at 677° F.—that is, 285° superheat. The economisers, of the "tri-tube" cast iron pattern, are supplied by E. Green and Son, on the latest high-pressure horizontal design, with a heating surface of 4 620 sq. ft., and are expected to raise the temperature of the feed-water, at 60 000 lb. evaporation, from 180° F. to 285° F. The air heater is of the "Usco" pattern, manufactured by the Underfeed Stoker Co., to supply the air to the stokers at 220° F., whilst the stokers are the latest "Underfeed" travelling grate "Type A," also by the Underfeed Stoker Co.

Remarkable Performance Guarantees.

The performance guarantees of this plant are so remarkable that they merit the careful attention of everyone interested in fuel economy, and the firms in question have taken on "some" guarantee in the shape of 85 per cent. actual net working efficiency, which corresponds to about 88½ per cent., according to the ordinary methods of calculation.

This 85 per cent. figure is for the whole installation working at 60 000 lb. evaporation per hour, after deducting the power absorbed for induced and forced draught and mechanical stoker drive. This is not to exceed the equivalent of 1¼ per cent. of the total evaporation of the plant, and calculated on the basis that 1 kW is to be generated for 18 900 B.Th.U.'s. The over-all figure is, however, still more remarkable, inasmuch as it is distinctly specified first that a comparatively low grade coal has to be used, 10 800 B.Th.U. with 28 per cent. volatile matter; and, secondly, the higher heating value has to be taken—that is to say, the figure by the direct combustion in the oxygen bomb calorimeter without any deduction for the hydrogen content of the coal. The difference in this respect, with a normal 3 to 4 per cent. hydrogen in the coal as fired, probably corresponds to 3 to 3½ per cent. in the efficiency. That is to say, 85 per cent. efficiency on the higher value is about 88 to 88½ per cent. on the lower value, with at least 300 to 350 B.Th.U. per lb. of coal difference.

Startling Exit Temperatures.

In order to get a net efficiency of 85 per cent. on these lines, some of the exit temperatures that will be necessary are rather startling, to say the least of it, as indicated in the diagram. Thus the gases must leave the boiler and superheater at 646° F. as usual, at the normal evaporation of 60 000 lb. per hour, and burning 7 816 lb. of the medium quality coal in the same time. The superheater is to raise the steam from 392° F. to 677° F., and the gases then enter the economiser and raise the temperature of the feed-water from 180° F. to 285° F., as already stated, leaving at 396° F. They then enter the air heater at this temperature and heat up the volume of air required for the stoker, 1 273 000 cub. ft. (at N.T.P.) per hour (corresponding to 37·73 per cent. air above the theoretical and 12 per cent. CO_2 in the flue gases) from 60° F. to 220° F., whilst the exit gases finally pass to the chimney at 236° F.

An extreme guarantee of this kind raises all kinds of fascinating points, and I, for one, should not like to attempt to draw up an effective agreement between the parties on the matter. Naturally one is delighted that 85 per cent. real efficiency is even being talked about, in view of the fact that the average steam generation of Great Britain is less than 60 per cent., and the average power station boiler plant is probably not 70 per cent. All good luck, therefore, to the firms in question, but if they exceed 80 to 82½ per cent. efficiency with the quality of coal specified they will have done well, in spite of the latest methods of design adopted, particularly air heating, and the very low radiation losses because of the design.

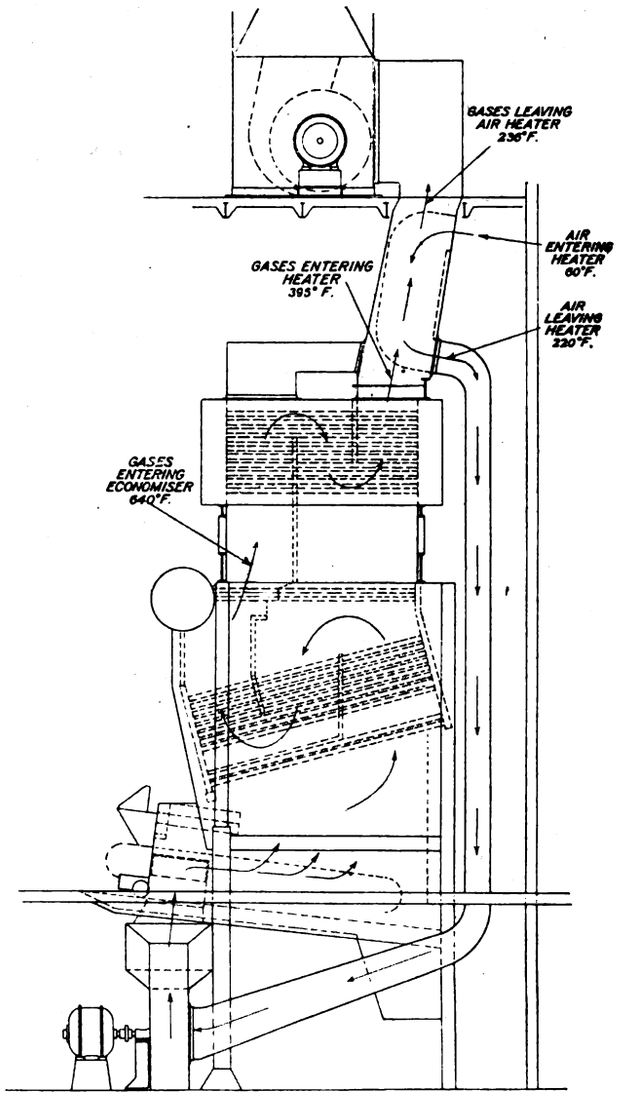
GASES LEAVING AIR HEATER 236°F.
AIR ENTERING HEATER 60°F.
GASES ENTERING HEATER 395°F.
AIR LEAVING HEATER 220°F.
GASES ENTERING ECONOMISER 640°F.

DIAGRAM OF A MODERN BOILER PLANT.

Normal Capacity of Boiler and Economiser (actual) 60 000 lb. Overload Capacity of Boiler and Economiser (actual) 75 000 lb. Heating Surface of Boiler, 8 619 sq. ft. Heating Surface of Superheater, 3 190 sq. ft. Heating Surface of Economiser, 4 620 sq. ft. Heating Surface of Air Heater, 9 020 sq. ft.

Methods of Boiler Plant Testing.

The chief point is, however, that the approach of these super-station guarantees raises in a very acute form the whole question of the methods of boiler plant testing, and I maintain that—with any of the present codes—it is not possible to come to any definite agreement at all as to what is the exact meaning of 85 per cent. efficiency, and the British Institution of Civil Engineers' Code, in particular, is simply hopeless in such a connection. I am very glad to note that in this case the contracting parties have, however,

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largely thrown over the "Civils" Code, and have made some attempt to come to real grips with the question, but they have not gone far enough, and a number of points are not clear.

Confusion on the Question of Coal Analysis.

First of all we have the question of the method of analysis of the coal and the state of utter confusion that exists with regard to the knotty question of higher and lower heating value. The "Civils" Code states that the lower heating value must be taken—that is to say, the percentage of hydrogen in the coal must be determined and then a calculation made for the heat that escapes in the steam in the flue gases from the hydrogen in the coal burnt to water, in addition to the further steam due to moisture in the coal. Apparently, for the calculation, the final exit flue gas temperatures to the chimney base are taken as 212° F., and, of course, the assumption is made that all the steam escapes from the plant. In this way the so-called net or lower heating value is determined, although practically no one ever carries out boiler tests on these lines. In this particular guarantee of 85 per cent. it is expressly stated, however, that the higher or gross heating value is to be taken, but what this means exactly is also not clear. Presumably it is the gross heating value in the dried sample as determined in the bomb calorimeter, and then a simple allowance made for the percentage of moisture so as to get the heating value as fired. Personally, I agree with this method, and have always advocated it for an International Boiler Testing Code. It must be remembered, however, as pointed out in my book, "Boiler Plant Testing," that when we are dealing with extreme figures like 85 to 88 per cent. guarantees, in which the last 2½ per cent. is going to be the difficult matter, it may be possible for the hydrogen to vary in the coal equivalent to ½ to 1 per cent. efficiency. It would appear, therefore, that some clause about hydrogen would be essential in cases like this, although not necessary in an International Code.

Steam for Auxiliary Purposes.

Again, take the question of steam or power used auxiliary to the production of steam. The existing boiler testing codes are all at sea on this point, and there is no clear guidance as to whether this has to be deducted or not, so that every engineer is apparently a law unto himself on the matter. It is obvious that all power so used should be deducted in calculating the real net working efficiency of a boiler plant, that is on the basis of the actual net amount of steam passing out of the boiler-house available for useful work away from the boiler plant. A large number of the ridiculous boiler test results advertised as being obtained by various appliances will be found conveniently to ignore this vital matter. In this case, however, the guarantees are on much better lines in stating explicitly that the power used by the forced and induced draught fan and the stoker drive is to be deducted in calculating the efficiency, and also that this power is not to exceed about 1¼ per cent. of the steam production of the plant.

But this point is not quite clear. Auxiliary steam or power may be used on a boiler plant of this character in other ways besides in the mechanical draught and the stoker drive, as, for example, for coal and ash conveyors, boiler-feed pumps, water-softening plant, and soot cleaners. Does this 1¼ per cent. guarantee mean, as it should do, *all* auxiliary steam, or only the three uses mentioned? If the latter is the case, there seems to be no logic in leaving out some of the uses and including others. And if the 1¼ per cent. is meant to include everything, our heroic contractors are going to have some job to get the guarantee, although there is no question that the modern mechanical stoker with forced draught and thin fires has reached a high stage of perfection equal to a consumption of only about 0·35 per cent. of the production of the plant. The most elaborate precautions will have to be taken, however, to keep down the induced draught fan consumption by ensuring ample area in the boiler, economiser, and air heater, and to design the flues on correct lines, and a most rigid system installed of using every trace of exhaust steam from the boiler feed pumps, etc.

As showing the difficulties of obtaining in practice figures such as 1¼ per cent. of the total production of the plant, at the famous Connors Creek plant in America, with very large "Type W" Stirling boilers of 23 654 sq. ft. heating surface, fired with an underfeed type of stoker, after months of continuous testing the total figure has been got down to 0·7 per cent. of the steam production of the plant at normal rating, but this soon rises to 1·6 per cent. at low ratings, and it may be stated that the efficiency figures have finally been put up from 77¾ per cent. to 79 per cent., still a long way removed from 85 per cent., although air heating is not installed. It may be stated also that at Dalmarnock, with the most elaborate system of testing, the results are 76 to 77 per cent., and that the Lakeside plant at Milwaukee, running at 85 to 86 per cent. on pulverised fuel is taking 1·6 per cent. of the steam generated as auxiliary on normal rating.

Hour to Hour Evaporation Must be Known.

Many other points could be discussed in detail did space permit. To decide definitely upon 85 per cent. net efficiency some clear understanding is required as to the hour-to-hour evaporation of the plant, the moisture content and mechanical condition of the coal, and the method of starting and stopping the test. But above all the duration of the test is a vital point. Is this 85 per cent. efficiency to be the result of one short duration test only, with everyone strung up to the highest pitch of endeavour to "do or die" for eight hours only, with the plant in a purely abnormal condition of efficiency and the figures rushed through? And in this connection how long will the boiler be running before the test starts—that is to say, what is to be the condition of the inside and outside of the boiler tubes? There is considerable confusion on this point, and it seems to be the established practice in testing a boiler and stoker equipment for the guarantees to allow the contractors to carry out the trials with the plant in as nearly a perfect condition as possible. Also it is usual to allow contractors to run the boiler for 24 hours before starting test. In my opinion, it is quite easy to vary the net efficiency at least 1 to 2 per cent., depending on how these points are handled.

If the coal exceeds 10 800 B.Th.U., how is this to be calculated? Few people realise the enormous importance of the heating value of the coal in obtaining high efficiencies with mechanical stokers. Thus if the coal goes to, say, 11 100 B.Th.U., I should like to guarantee that the efficiency will rise at least 1 per cent. after taking into account the extra calculated heat. It is obvious, therefore, there will be some arguments of considerable piquancy as to what exactly 85 per cent. means, and whether it has been attained or not. I should love to be present—like Harry Lauder's caddy—"if only for the fun o' the thing." (!)

The Question of Radiation.

In this connection the question of radiation is very interesting, and it will be noted that the plant is designed on the most efficient lines from this point of view. It has been customary, as is well known, to take a purely arbitrary figure of about 5 per cent. for the radiation losses of a boiler plant, which is purely guesswork, and again shows how absolutely unpractical is the present method of testing boiler plants by struggling to arrive at a ridiculous "heat balance sheet." It is, of course, very difficult indeed to determine accurately the radiation losses of a super-power station plant, but this figure of 5 per cent. radiation loss cannot be correct, and the real figure is nothing like this.

And, in one final word, the only test of any real value is practical daily testing week in and week out all the year round, and if this plant is going to give 85 per cent. net working efficiency under these conditions it will not only be by far the most efficient boiler plant in the whole of the British Isles, but one of the best in the world, and equal to the latest pulverised fuel installation.

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Notes on High Frequency Rheostas

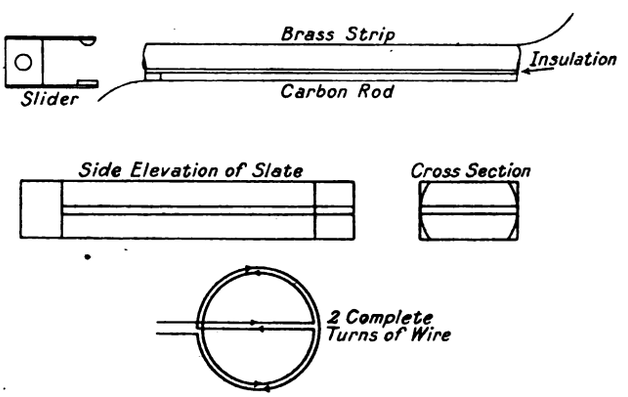
By J. H. VINCENT, D.Sc. and A. L. BRAK, A.M.I.E.E., L.C.C. Paddington Technical Institute.

In certain experiments with valve maintained oscillating circuits, rheostats are required which provide changes of resistance unaccompanied by appreciable changes of inductance or capacity, or at any rate only such changes as can be readily computed. Several rheostats have been designed and made to comply with these conditions.

Rheostats for Use in the Oscillating Circuit.*

In the earliest form two wires, one of copper and the other of resistance material, of the same small diameter and one metre long were stretched parallel to each other and about one centimetre apart on a board. The current flowed from one end of the copper wire to the other end of the resistance wire. This is similar in principle to a rheostat designed by A. Campbell who wound the wires on a cylinder. Connection between the wire was made, first, by a thick copper wire twisted round the thin wires and capable of sliding on them. Next a slider of two blocks of brass clamped in place by a screw and moving parallel to each other on guides was used and finally the blocks were employed, without the screw, contact being made by their own weight.

A great improvement on this is to use a cylindrical roller with eleven segmental knife blade contacts at each end so arranged that the contacts pass between spring clips to connect in circuit. Between pairs of contacts, first, a copper wire is stretched, next a composite wire consisting of ninety centimetres of copper and ten centimetres of



A High Frequency Rheostat.

resistance wire and so on, the eleventh wire being wholly resistance wire. The wires have two joints in each so that any thermo-electromotive forces shall be opposite.

In the first rollers thus made all contacts were entirely separate but to obviate possible small changes of capacity the eleven contacts at one end have now been joined together. A further modification consists in arranging the contacts so that in changing from one resistance to another the circuit is not broken.

In this form of rheostat a wire of one material can be replaced by another wire of the same dimensions but of different material. The linear dimensions of the whole circuit can thus be kept accurately constant.

Filament Rheostats.†

A constant inductance rheostat for use where the filament current has to be varied considerably during experiments is made thus. A flat brass strip has a piece of insulating material affixed to it and on this a semi-cylindrical piece of arc carbon is glued. The current flows from one end of the carbon through a slider to the other end of the brass. Connection is made to the carbon by soldering to electrolytically deposited copper.

A wire rheostat of low inductance has been constructed from an Isenthal slate rheostat. A saw cut was made in the slate and the wire wound as shown in the diagram.

* Vincent. "Proc. of the Royal Society, A.", vol. 97, 1920, page 192.

† Curtis and Grover. "Bulletin of U.S. Bureau of Standards," vol. 8, page 512.

Rubber and Gutta Percha in Telegraph Cable Manufacture.

At a recent meeting of the Institution of the Rubber Industry Mr. H. Savage (Works Manager, W. T. Henley's Telegraph Works Co.,) dealt with "Rubber and Gutta Percha in Telegraph Cable Manufacture."

In an historical review the author traced the process of evolution of the electric conductor to 1837, when wires for overland telegraphy were laid in saw cuts in tarred timber buried in the ground. Then followed bare aerial wires, and those covered with a dielectric, after which came the demand for telegraphic communication across the seas. Though various forms of dielectric had been tried and suggested for this purpose, only rubber and gutta percha survived; the former, however, had only been used to a comparatively small extent, while the latter remained standard practice.

The two main factors preventing the perfect transmission of telegraphic signals were the resistance of the conductor and the electrostatic capacity of the dielectric. It was desirable to keep these factors down to a minimum, and the most usual form of conductor consists of seven similar wires stranded together.

Rubber as a Dielectric.

Between 1860 and 1875 rubber was much used as an alternative to gutta percha, but its scarcity and price were disadvantages. Vulcanised rubber containing pigments and having good mechanical properties had a relatively high capacity. This was objectionable, as it tended to retard signals and cause inefficient transmission, and conductors were, therefore, covered with a thick coating of pure rubber; but this, being soft, allowed the conductor to get out of centre and did not resist successfully the absorption of water. The gutta percha was subsequently enclosed in an outer covering of rubber containing a large proportion of sulphur to produce rapid vulcanisation and a tough covering, and between the thick pure rubber and the outer covering was a layer of rubber containing oxide of zinc. Even under these circumstances rubber was not so impervious to water as gutta percha. A method of vulcanising in ozokerite was invented by Mr. Henley in 1875, but was only partially successful.

History of Gutta Percha.

Gutta percha was introduced in 1847 and was used at a very early date by Siemens as a covering for wires for telegraphic purposes with phenomenal success. An attempt to apply it in the form of strips with a longitudinal seam was quickly abandoned in favour of the method of forcing it on by a tubular process. This was adopted almost universally, and had remained until the present day.

As gutta percha was liable to attack by minute forms of marine life the core was protected by brass or Muntz metal applied in the form of a tape with overlapping edges. It was common to apply the metal taping to the core of all cables where the depths are comparatively shallow, but as the attacking creatures were stated not to exist below 300 or 400 fathoms this protection was not considered necessary for deep water.

In conclusion, the author dealt with the development of the industry during the last 25 years. "The Electrician Blue Book" for 1922 gave the total length of submarine cables at the end of 1921 as 309 164 nautical miles (length of cores, 325 520 nautical miles). Obach, 25 years ago, estimated that the world's submarine cables had a core length of 184 000 nautical miles, employing a weight of 16 000 tons of gutta percha. The increase in the period, therefore, was 141 520 nautical miles, while, taking the average weight of gutta percha at 180 lb. per nautical mile, the total amount of gutta percha in use at the end of 1921 was 26 000 tons. The largest system, the Pacific cable, was being duplicated, and the Chairman of the Eastern and Associated Companies states that 28 000 miles had been laid since the Armistice. A fleet of 50 ships was engaged in various parts of the world, and at least a dozen had been built or fitted since the war. And this at a time when wireless telegraphy was receiving so much attention!

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Bare Aluminium Conductors.

(COMMUNICATED.)

"What capital have I invested in conductors, and to what extent am I adding to this investment annually?" The answers to these questions should be known to all engaged in the generation and distribution of electrical energy, because the sums involved are often surprisingly large, and the promise of a reduction of 20 per cent. in this investment will itself justify the closest investigation into the claims of aluminium as an alternative to copper.

There is no better example of the usefulness of aluminium than as the material for heavy current busbars, or for other bare station conductors such as those shown in Fig. 1. For such purposes aluminium can be used instead of copper with a cost saving which at present prices is even higher than that mentioned. In addition the weight to be supported by the insulators would be halved by such a substitution, and other advantages are obtained in the direction of easier erection and better cooling.

Aluminium has of course been used for many years for such purposes, and there is sufficient practical experience to confirm that it is entirely reliable in operation, and that the economy in initial cost is not accompanied by any increase in maintenance or other running costs.

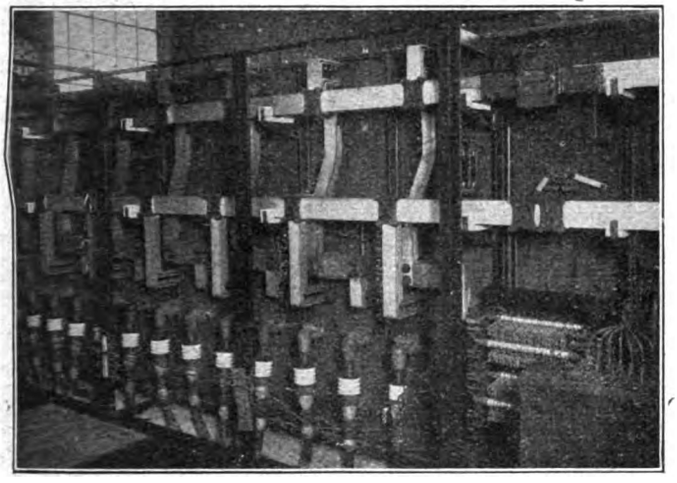

FIG. 1.—BACK OF L.T. SWITCHBOARD, SHOWING ALUMINIUM BUSBARS.

Equivalent Sizes of Copper and Aluminium.

The average specific resistance of aluminium bars can be taken as 2·84 microhms per cm. cube at 20° C. and that for ordinary hard drawn copper bars as 1·76 microhms per cm. cube. An aluminium bar should therefore be 61 per cent. larger in section than a copper bar of equal conductance. In actual practice, the size of copper bar used is selected from one or other of the manufacturers' standard sizes, and often is based upon some assumed value for current density, usually 1 000 A. per sq. in. In these circumstances it is unnecessary to consider the exact equivalent section for aluminium, and it will usually be found that, having fixed the size of copper, the most suitable size of aluminium is a bar of the same width and 1½ times the thickness. Suppose, for example, a bar is required to carry 225 A continuously. At 1 000 A per sq. in. the section of copper bar is 0·225 sq. in., and the aluminium section for equal resistance would be 0·362 sq. in. The nearest standard sizes to these are 2 in. by ¼ in. for copper (=0·25 sq. in.) and 2 in. by $\frac{3}{16}$ in. for aluminium (=0·375 sq. in.). It will be appreciated that these bars will not be exactly equivalent in resistance, but as the voltage drop is not of vital importance provided that it lies within reasonable limits, they will be equally satisfactory in operation. For round rod a similar working rule is to make the aluminium rod 1¼ times the diameter of the copper rod.

Temperature Rise Data.

The section of an aluminium bar being larger than that of a copper bar of equal resistance it will normally have a larger radiating surface, and hence a smaller temperature rise when carrying the same current. Conversely for equal temperature rise a smaller section of aluminium bar can be employed having a higher resistance, and when the necessity for keeping the temperature rise within safe limits becomes the deciding factor on conductor size, an additional cost and weight saving is effected by the use of aluminium.

Mechanical Considerations.

Under short circuit conditions the attraction and repulsion forces between parallel bars may be of considerable magnitude and the mechanical rigidity of the bars is a matter of some importance. A comparison in this respect between a copper bar and an aluminium bar of the same width and 1½ times the thickness may be made by applying the simple formulæ for loaded beams. The maximum stress in a rectangular beam supported at its two ends and loaded uniformly is inversely proportional to wt^2, w and t being the width and thickness of the beam. For the aluminium bar we are considering, this product will be 2·25 times that for the copper bar, and hence if the copper and aluminium bars are erected under exactly the same conditions, the maximum stress in the copper will be 2¼ times the maximum stress in the aluminium. Since the elastic limit of aluminium is about half that of copper it follows that, with any particular support spacing and distance between bars, the current required to give a permanent distortion to the copper will not stress the aluminium beyond the elastic range.

Jointing Quite Easy.

There is a fairly widespread impression that jointing with aluminium is a matter of some particular difficulty, and that aluminium joints cannot be relied upon. Nothing is further from the truth. Aluminium flat bar is jointed by overlapped joints, clamped or bolted together, as is the case with copper, and there is no difficulty whatever in obtaining a sound joint having less resistance than an equal length of unjointed bar, and maintaining this resistance constant.

The best results are obtained by rough filing the bars and arranging that the file marks on the two surfaces will be at right angles when they are put together. This filing is not enough of itself, however, and, before bolting up, the two surfaces should be covered with a thick layer of vaseline and cleaned with emery cloth under the grease. The reason for this is that aluminium oxidises upon the surface with extreme rapidity, and a freshly filed surface in a few seconds becomes covered with an invisible layer of oxide, which, though microscopically thin, has an appreciable effect upon the contact resistance. If the surface is cleaned under vaseline the oxide is removed and the vaseline protects the surface from re-oxidation by the air. When the two bars are finally pressed together, the tightening of the bolts squeezes out the vaseline and leaves the clean surfaces in contact. Further, the vaseline fills any small cavities which may be left, and tends to maintain the efficiency of the joint by preventing the condensation of moisture within such gaps.

Joint Efficiencies.

The efficacy of this process is endorsed by a paper entitled "The Efficiency of Overlapping Joints in Copper and Aluminium Busbar Conductors" (Jour. I.E.E., Vol. 60, No. 312, Aug. 1922), by Messrs. S. W. Melsom and H. C. Booth, whose investigations at the National Physical Laboratory show that when made by this process the contact resistance is only about 5 microhms per sq. in. at a normal surface pressure of 2 000 lbs. per sq. in., this being only about one-third of the contact resistance when the bars are pressed together without special cleaning. For the purpose of calculations, a conservative value for contact resistance between aluminium surfaces is 10 microhms per sq. in. and for copper 4·2 microhms per sq. in. The total resistance of a joint depends upon the specific resistance of the metal and upon a further factor due to the distortion of the streamlines of current, as well as upon the contact resistance itself. Taking these factors into account, the length of overlap required to produce a joint having a resistance equal to that of an equal length of unjointed bar is calculated to be as follows:—

Thickness of bar. In inches.	Overlap with Aluminium. Inches.	Overlap with Copper. Inches.
½	3·1	2·8
$\frac{3}{8}$	2·7	2·3
¼	2·2	1·9
$\frac{3}{16}$	1·9	1·6

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It should be noted that the width of the bar has no bearing on the length of overlap required, the same length of overlap being equally suitable for all bars of the same thickness whatever may be the width.

Obviously the values in the table are much smaller than would normally be employed for mechanical reasons, but they indicate that no abnormal length of overlap is necessary with aluminium, and indeed that there is very little difference in the lengths required for either aluminium or copper. It follows that the common practice of making the length of overlap equal to the width of the bar should be entirely suitable for both copper or aluminium since the width is usually at least eight times the thickness.

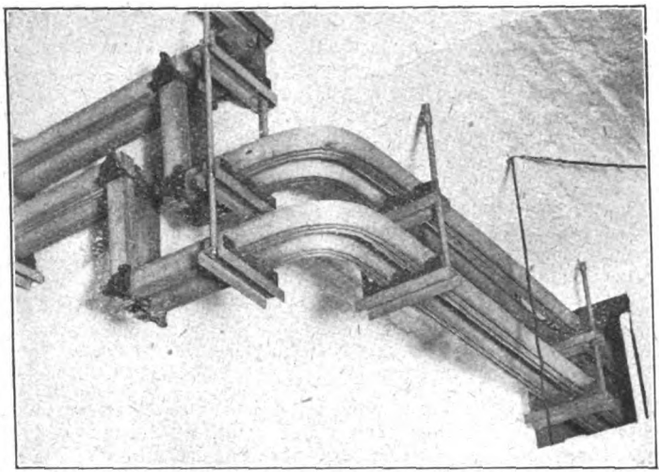

FIG. 2.—BARE ALUMINIUM CONDUCTORS IN USE IN A BATTERY ROOM AFTER TEN YEARS' EXPOSURE TO ACID FUMES.

Welding.

The welding of aluminium is a matter of simplicity. The usual practice in jointing round rod, for example, is to heat the ends in the flame of a plumber's blow lamp until they begin to melt, when they are pushed together. The result is a joint which is homogeneous throughout, and, when filled up, cannot be detected either by appearance or by mechanical or electrical tests. Although the method of making these joints is ridiculously easy the joints are nevertheless perfect.

Electric welding is not yet commercially possible with aluminium, but welding with the oxy-acetylene blowpipe is a well-established process which would appear capable of solving many of the problems of installation. A more general

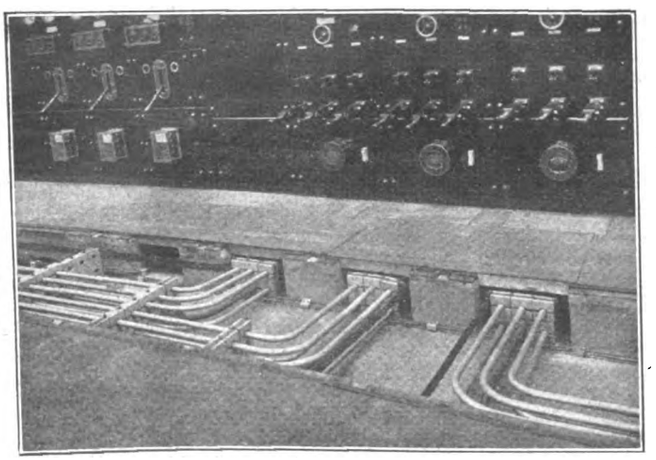

FIG. 3 —ALUMINIUM ROD CONNECTIONS.

appreciation of the possibilities of this process should lead to its employment ot a wide extent for bare conductor installations, since by its aid bolted joints can be practically eliminated.

Corrosion.

In general, aluminium is much less subject to corrosion than copper as is testified by Fig. 2, which shows a number of bare aluminium conductors which have been in use in a battery room for over ten years without appreciable deterioration. The bars are not painted, and have not been touched since they were first installed, and the photograph indicates their remarkably good state of preservation in spite of the constant exposure to sulphuric acid fumes. This is by no means an isolated instance, and there are many examples of excellent service with aluminium in conditions where copper would very rapidly deteriorate.

On the other hand, aluminium being highly electro-positive, it is somewhat susceptible to corrosion by electrolysis, although, fortunately, trouble due to this cause is always avoidable. Joints between aluminium and other metals, though perfectly satisfactory in a dry atmosphere, are liable to rapid corrosion should moisture condense on them, due to the constant circulation of minute currents under the action of the electro-chemical potential. Too much emphasis cannot be placed upon the desirability of painting such joints when moisture deposits are likely to occur.

For a similar reason a slow leakage of current from an aluminium bar through moisture is also liable to result in local corrosion. In one case recently brought to the writer's notice aluminium bars rested upon unenamelled slate supports in a damp atmosphere. Appreciable surface leakage occurred at the slate, and corrosion of the aluminium commenced at the points where the bars rested on the supports. The whole trouble was overcome by inserting strips of mica between the bars and the slate.

In conclusion, it should be remarked that such troubles are by no means common. In ordinary circumstances the corrosion risk is a very remote one, and there need be no hesitation to take advantage of the many good qualities of aluminium through fear of encountering unknown difficulties. In many cases copper is specified as a matter of habit, and it is now becoming recognised that this is an expensive habit, which adds to the cost of the scheme without in the least increasing its efficiency or reliability.

Electric Drive in Cement Works.

At a recent meeting of the Sheffield Sub-Centre of the Institution of Electrical Engineers a paper was read by Mr. W. J. Coles, on "Cement Manufacture and the Application of Electric-Drive Thereto." After dealing with the various processes in the manufacture of cement, from the obtaining of the raw material to the sending-out of the finished product, the author said that the adaptation of electric drive had been of great benefit to cement manufacturers. A cement works necessarily covered a considerable area, and power was required at numbers of points scattered all over the area. If any other drive than electric was used it was found difficult to design the lay-out so as to enable small-power requirements to be brought together to be driven off one engine. With the electric drive this was, of course, obviated. The most suitable supply was three-phase, which would be used on high-tension motors for the larger sizes and transformed down for the smaller sizes. The average consumption of electricity per ton of cement manufactured was of the order of 105 to 110 kWh in modern works, whilst the maximum demand was about 0.8 to 1 kW per ton per week. Thus, a plant producing 100 000 tons a year would have a maximum demand of from 1 600 to 2 000 kW, and would consume 11 000 000 kWh per year. The load factor of cement works was very high, being about 75 per cent. This was due to the fact that the heavy loads were generally required to run from 140 to 168 hours per week, whilst the latter loads might only be required for 50 hours per week.

The majority of the power required was used in crushing and grinding the raw material, and the coal for firing the kilns. The crushing of the raw material and grinding is generally required to carry on for 150 hours a week, whilst the pulverised fuel for firing the kilns had to be produced for 168 hours a week, since the rotary kilns were never shut down except for repair. Since the motors and apparatus had to work in a dusty atmosphere, it was essential that they should be robust in construction. The class of labour is generally unskilled, and all apparatus ought, therefore, to be foolproof, and since the power to overload motors was often dependent on the method of running the plant, they should be put in with ample capacity for taking sudden peaks. He said that in a well-equipped modern cement works the power-factor was in the neighbourhood of 0.8.

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Modern Stage Lighting.

The Schwabe-Hasait System and its Applications.

An interesting demonstration of the Schwabe-Hasait system of stage lighting was given at the St. Martin's Theatre, London, on Friday. The system has been introduced into this country by Mr. BASIL DEAN, and, with the assistance of the GENERAL ELECTRIC Co., he has installed it for future Reandean productions, and in particular for use in the new repertory theatre, The Play Box, which is shortly to be opened.

Some Interesting Effects.

The demonstration was principally directed to showing what could be done in the way of projecting light, colour and cloud effects on the back of the stage, and so giving the illusion, both as regards illumination and movement, of a natural sky. These effects are obtained by means of two special pieces of apparatus, one of which is known as the artificial horizon. This horizon, though it may have other forms, at the demonstration in question consisted of a special plain white back canvas screen, upon which the effects were thrown. It is electrically operated, and can be rolled or unrolled in a few seconds. The lanterns which light this horizon are fitted with an aluminium reflector, and each contains a 1 000 W tubular gasfilled lamp and a coloured glass slide. They are formed into a homogeneous unit, as shown in Fig. 1, and are supported in a rigid metal framework which is suspended from the roof. A natural shade of blue is given by the rays emitted from the lamps employed, and any

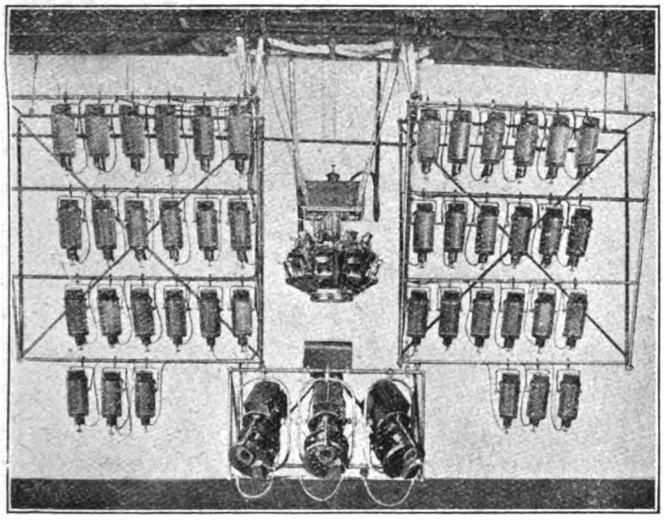

FIG. 1.—SCHWABE APPARATUS AT THE ST. MARTIN'S THEATRE, SHOWING HORIZON LAMPS, CLOUD AND PANORAMA APPARATUS.

variation in the depth of paleness of blue sky thus obtained can be effected by means of dimmers. To obtain other combinations each lamp is fitted with a coloured slide, and by a combination of colours a very wide series of tones is available by means of which any sky effect may be produced.

Cloud Apparatus.

The cloud apparatus, which is perhaps the most interesting part of the equipment, is shown in Fig. 2. It consists of two essential portions, one of which is stationary and carries the main driving motor, the collector rings, and a 3 000 W gasfilled lamp. The other, which rotates round the first, carries the system of cloud pictures, lenses and reflectors as well as two small motors, which drive two lines of shafting through suitable gears. These shafts give motion to a series of eccentrics which cause a number of reflectors to rotate through a definite angle so that the cloud images rise or fall as desired. The moving system has its cloud slides arranged in two tiers. Immediately behind each slide a condenser transmits the rays from the lamp through the slide on to a fixed glass reflector. This in its turn transmits the picture through an objective lens on to a movable glass reflector, which is actuated by one of the eccentrics, and this reflection throws the picture on to the horizon screen.

The slow motion of the clouds across the sky is effected by rotating the two tiers, and it is possible in this way to project two separate banks of clouds travelling independently one above the other. Varying rates of movement can be obtained as well as different effects by operating the dimmers.

Panoramic Apparatus.

The effect of the cloud apparatus may be intensified by the panorama equipment shown in Fig. 3. It consists

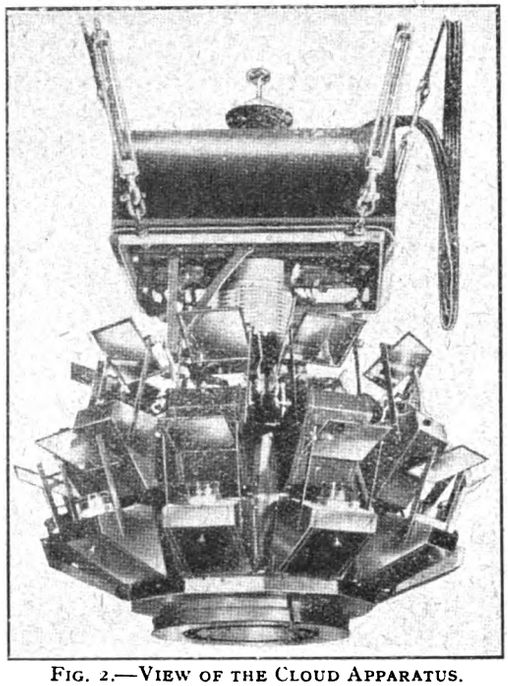

FIG. 2.—VIEW OF THE CLOUD APPARATUS.

essentially of three projectors mounted on a tubular steel frame, which is capable of being tilted in an upward or downward direction. Each lamp in it is mounted in such a manner that it can swing on its horizontal axis and be locked in the desired position by a set-screw. The raising and lowering movement is effected by a small motor driving a screwed spindle, the rotation of which operates wires attached to the projectors. Each projector, in addition to its 3 000 W gasfilled lamp, which is adjustable by means of a hand wheel operated from the exterior, is equipped with an adjustable reflector which enables the focus of the beam of light to be readily corrected. Two discs are fitted to each lamp, one being a colour screen, the other containing several diapositives, so that it is possible (to take one illustration) to obtain three entirely different panoramas without the necessity of changing slides. In front of the projector lens a circular

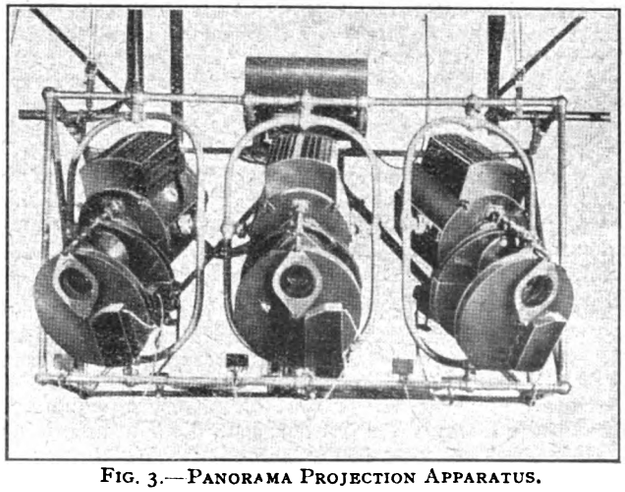

FIG. 3.—PANORAMA PROJECTION APPARATUS.

motor-driven colour screen is fitted, by which the operator can control various special colour effects.

Special electrical apparatus is also available for creating storm, rain and lightning illusions.

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"Control in Industry."

Some Problems of the Staff Employee.

At the meeting of the Informal Section of THE INSTITUTION OF ELECTRICAL ENGINEERS, on Monday, March 5th, MR. J. H. PARKER opened a discussion on "Control in Industry."

He commenced by saying that all electrical engineers desired the smooth working of the industry and he hoped to start a discussion that would expose some problems that required ventilating. He emphatically declared that his Association (the E.P.E.A.), desired only the welfare of the industry and were acutely aware of their moral obligations to give continuous and efficient service to the public, as it was in accordance with the higher evolution of Society that public opinion should be against anyone who flouted the law or broke deliberately made agreements. He described recent happenings at a northern borough where the national schedule of salaries was repudiated and the employment of the staff terminated after rejection by them of considerably lower offers. This borough's cynical repudiation of an agreement was typical of what we had so often been told the manual workers' unions were adept at. One problem put by Mr. Parker was to suppose five or six supply authorities all linked up and one refusing to pay the scheduled rates. Should the victimised staff be condemned if they extended the trouble?

Thorough Understanding Necessary.

MR. W. DAY said the chief problem with control in industry was to understand the reason of the employees' demand for a share in control, and the extent to which this was possible. No man had a right to share in control unless he thoroughly understood the industry. The masses had found that political freedom alone had not meant economic security, and just as they had a share in the destiny of the country, they desired a share in the direction of their economic affairs. Whitleyism had tended to develop into a system where deputations very skilfully presented requests that were equally skilfully refused.

MR. NORMAN WYLD thought Mr. Parker's description of the action of the northern borough made an excellent case for an appeal to public opinion, and he invited discussion of the possibility of the co-operation of the Society of Technical Engineers. He thought it perfectly manifest that the E.P.E.A. tended to the stabilisation of the industry, and therefore would obtain public support.

Disappearance of Whitleyism Probable.

MR. W. E. WARRILOW declared that since he served as a shift engineer 20 years ago he had learned a good deal of the difficulties of this subject. The employer after all was governed by economic conditions which make him the sole arbiter of the conditions of employment. Whitleyism was a war time product arising out of abnormal conditions, and with the settling down of conditions will tend to disappear. In this connection he thought the most sardonic comment on the issue was that Mr. Whitley should be M.P. for Halifax.

MR. W. J. OSWALD disagreed with Mr. Warrilow. He held that the employer could only be sole arbiter so long as he could maintain his position as director to the benefit of the industry and to the public service. A workers' trade union should be in being for the improvement of the craft; a professional trade union for the improvement of the profession. His Association had been incidentally concerned with salaries, because they believed that improved salaries would attract more efficient men. Whitleyism was not a war time product but the natural evolution of industrial conditions, for it was clear that the greatest good was only attained by service, co-operation and confidence.

The Employers' View.

MR. A. G. WHYTE said he felt the meeting should be reminded of the views of the employer. He interpreted them to be that those in control had statutory undertakings to maintain supply, and regarded their technical staff like a Commanding Officer regards his officers. Many employers retained the military metaphor, and looked upon bargaining with their staffs as subversive of discipline. Directors were often so conscious of these statutory obligations that they would enter into agreements as expedients which they all the time might feel could not be maintained. He urged fuller publicity of the Association's objects, and thought that better advertisement of alleged hard treatment would ensure pressure of public opinion for justice.

The Maintenance of Voltage on a D.C. Distribution System by Means of a Fully Automatic Substation.

Discussion at Manchester.

MR. P. J. ROBINSON'S paper on "A D.C. Distribution by Means of a Fully Automatic Substation" was recently read in Manchester. In the discussion which followed, Mr. B. WELBOURN, chairman of the newly created LIVERPOOL CENTRE, commented upon the credit due to Liverpool of having the first fully automatic substation in the world to be used for this purpose. The paper showed that the effect of this installation had been an improvement in efficiency and therefore was an influence for good.

Automatic *versus* Manual Control.

Those who had seen the substation commented upon the almost uncanny precision with which the gear operated. Mr. CHEETHAM and Mr. BENTON, however, pointed out that certainty of operation was only to be expected, and Mr. H. A. RATCLIFF joined later in pointing out some of the many advantages, apart from that of economy, of the automatic substation. A manually operated station might possibly be mishandled or neglected; an automatic substation would function properly or not at all, and was free from the danger which would result from an operator being incapacitated by accident or sudden illness. Perhaps nothing was quite so dull and ambition-destroying as operating a substation which had long periods of idleness.

Mr. G. G. PREECE suggested the alternative of substations which could be started up manually and left running without attendance, but Mr. ROBINSON, in his reply, disapproved on principle of leaving machines unattended, apart from reasons of inefficiency, in that the plant would often be running when not required. The alternatives of semi-automatic control, as used at Hull, and remote control were also discussed. It was interesting to hear that the operation of starting up only took 41 to 45 seconds, according to whether the rotary converter pulled in on correct or incorrect polarity.

Simplification of Apparatus.

Some suggestions were made with regard to possible simplification of apparatus, but it was generally agreed that experience only could tell what might be eliminated. Mr. H. C. LAMB said that within the next year there would be operating in Manchester four completely automatic substations, these being installed respectively by three different makers, and interesting comparative results should be obtained from these.

Mr. HARCOURT WILLIAMS and Mr. G. A. JUHLIN pointed out that though there had been little experience of such plant in this country some manufacturers had the benefit of the considerable experience of manufacturers in the United States, where over 300 automatic stations were in operation.

Mr. G. F. SILLS suggested possible simplification by eliminating the brush-lifting operations, and Mr. RATCLIFF also deprecated the use of this device, feeling that the less one tinkered with the brush gear and commutator the better. Mr. ROBINSON pointed out in reply that only the brushes themselves and not the brush gear were moved, and said that no trouble had been experienced in this respect. Even with manual operation brush-lifting would be necessary for a tap-started rotary.

Further Applications.

Mr A. B. MALLINSON suggested the application of automatic substations to systems with no alternating current, suggesting automatic control of Diesel, semi-Diesel or water-generator stations, and in defence of British progressiveness Mr. J. FRITH related some details of house lighting installations made ten years ago, the automatic operation of which was exactly similar in principle to that now under discussion. With regard to present development, Mr. FRITH considered it was an excellent thing to obtain, as in this instance, the views of the purchaser and user of electrical apparatus.

Though suggestions were made as to the possibility of extending automatic control to provide selective operation of several rotary converters in one station, Mr. ROBINSON felt that this might not be desirable for larger stations.

Mr. BENTON pointed out that each case should be considered on its merits, and Mr. ROBINSON was convinced that they had in their own case secured the most economical and effective arrangement.

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The Supply Authority and Salesmanship.

At the fifth Salesmanship Conference at Newcastle, Lt.-Col. W. A. VIGNOLES gave an address on "The Electric Supply Authority's Point of View in Connection with Salesmanship."

The Cheapness Fallacy.

In the course of his address Lieut.-Col. VIGNOLES stated that many people held the opinion that if only a commodity was cheap enough it would sell itself. This view was not correct; price was not the only factor. The education of the public was also necessary. For instance, if electricity was generally available at a charge of 0·5d. per unit, there would still be an enormous number of people who would not purchase it, simply because they would not know what to do with it. On the other hand, with correct salesmanship it was possible to sell a commodity properly and at a proper price which allowed a reasonable margin of profit. All sales should be conducted on that basis. In the case of electricity, for instance, it was still possible to sell it for lighting purposes, even where the price exceeded that of gas, because the consumer appreciated the advantages of electricity, and was prepared to pay for them.

Supply Authority and Contractors—Points of Divergence.

The points of view of a Supply Authority and a contractor on salesmanship were very different. It was the contractor's business to sell apparatus, from which transaction he had to make his profit. After the sale of the commodity the contractor's direct interest ceased. There was, therefore, a tendency for a contractor to push the sale of cheap apparatus and novelties which possibly would not be satisfactory from the consumer's point of view. On the other hand, the Supply Authority obtained a profit from all apparatus all the time it was in use. They were, therefore, in a position to take a longer view, and disliked to see discarded apparatus, however cheap it might have been. The sphere of the Supply Authority was to create the electrical atmosphere, leaving the detail work to the contractor, whence much benefit would be derived by both. A consumer was always more inclined to believe a man from the electricity works in preference to a contractor. To advise a consumer how to reduce his electricity bills, whenever the opportunity arose, was the best policy, and one which increased satisfaction and confidence on the part of the consumer and ultimately produced good results for the Authority.

The present time was a most favourable one for everybody in the electrical world to do business, because charges were coming down, bills were being reduced, and the consumer was in the mood for purchasing other apparatus.

DISCUSSION.

In the course of the discussion, in which many speakers took part, it was generally agreed that whilst Supply Authorities should take a broader view of the problem than contractors, it was necessary for all parties to take a broader view than was generally held at present. The main object should be to sell "service" and keep in touch with apparatus installed. No apparatus should be sold until it was known to be satisfactory. In cases where it was necessary to give a consumer an estimate of probable consumption, it was better to give a high estimate than to run the risk of under-estimating and causing dissatisfaction to the consumer at the end of the quarter. One speaker thought that the Authorities and the contractors' salesmanship policy were often antagonistic to each other. If the ideal policies of each party were laid down for discussion, it was possible that these policies could be welded into one. Close co-operation between the Supply Authority and contractors, factors, and manufacturers was essential in order to determine the type of apparatus which was to be pushed. The excessive cost of service installations was referred to as an obstacle, the removal of which would introduce many more consumers.

The use of properly designed wall plugs cannot be overstressed at the present time, in order that safety in the home may be ensured. REYROLLE AND CO. have, therefore, done well in issuing an artistic showcard, which they are distributing to contractors, factors, etc., showing the Reyrolle wall plug in use in a bathroom. It will be remembered that the essential points in this plug are that no switch is needed, that the hand is screened from the live contacts, and that these contacts are made and opened in deep recesses of insulating metal closely surrounding the pins.

Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

ADVERTISING IN THE ENGINEERING PRESS.

To the Editor of THE ELECTRICIAN.

SIR,—I have read with considerable interest your correspondent's contribution, "Advertising in the Engineering Press," which appeared in your issue of the 2nd inst. With much of this I am in entire agreement, and specially commend the fourth paragraph, which deals with the question of allocation of moneys in newspaper space, to the consideration of any firm seeking guidance in this matter.

But in the preceding paragraph there is a vital omission. Your correspondent says "this important duty (advertising) should be allocated to some responsible member of the staff who is in a position to devote a reasonable amount of time to its performance." He goes on to say that a thorough technicl knowledge is of the first importance, but omits entirely to stress the point that above all else the man *must be a salesman*.

Your correspondent opens his article with the statement that "engineering advertisements in general do not *sell*," and may I point out that such result is a natural corollary of the action he advises, namely, the appointment of a man to control advertisements who has a thoroughly sound technical knowledge and "*a correspondingly slight acquaintance with advertising*," which latter, if worth anything at all, is "salesmanship."

Your correspondent's idea of a service agent is also erroneous—the man he is referring to is the "service-cum-space-broking" agent. The real service agent takes no remuneration from any other source than the advertiser whom he serves, and, being remunerated for his service and that alone, is enabled to render entirely unbiassed advice, and even recommend retrenchment when that is necessary. Again, why is "the value of such a service to the engineer not necessarily quite the same as to advertisers in other fields"? Real advertising service—the service founded on a complete knowledge of salesmanship and supported by a long experience in the practice of the science—is of equal value in all fields.

But I think your contributor confuses the issue—he should start from this point: The engineer knows little or nothing about advertising—if he knows little it is "the little learning that is a dangerous thing"—the service man knows nothing about engineering. The latter would not dream of dictating to the engineer on matters of which he has no intimate knowledge—neither must the engineer dictate to the advertising man in questions on which he is similarly ignorant.

The successful application of the advertising man's knowledge to any proposition, engineering or otherwise, is a matter wherein collaboration is an essential factor, and the reason so many firms choose the man who has so "slight an acquaintance with advertising," in preference to the man with an abundance of knowledge, is that the latter will so seldom give the time and personal concentration necessary for that close association with the internal government—technical and sales.—I am, etc.,

EDWARD H. REEVES.

Wylde Green,
March 12th.

The Need for Co-operation.

Informal Views to be Put Forward.

The attention of the electrical industry is especially drawn to the next informal meeting of the Institution, to be held in London on Monday next at 7 p.m. The Committee have arranged a debate on "The Need for Co-operation between Manufacturer and Retailer," which will be opened by Mr. J. F. Caine (Siemens and English Electric Lamp Co.), and Mr. H. T. Young (Troughton & Young). The object of the discussion is to ventilate opinion upon a subject of great importance to the industry at the present time. The Committee hope there will be a good attendance of manufacturers of electrical supplies, factors, and wholesalers, and of retailers and contractors. The debate will be confined to the trading relations of the chief sections of the industry concerned with the lighter electrical products, including motors; the heavier plant and material will not on this occasion be considered. The Committee wish this fact to be announced beforehand, so that the proceedings can be regularised and the meeting be of genuine service to the electrical trade. Constructive criticism is required and will be welcomed.

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Merchandise to Sell and Profit By.

In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

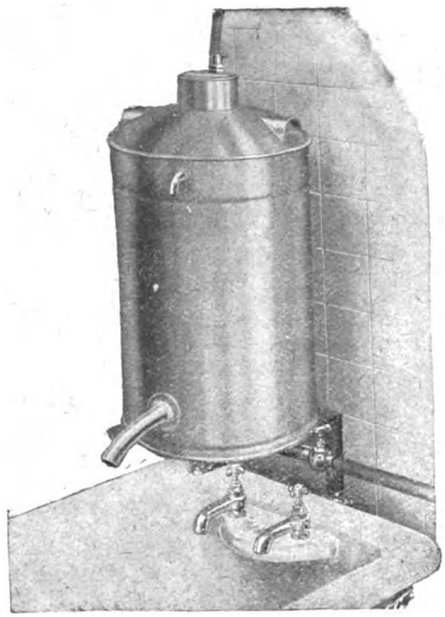
It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

The "Jackson" Bath Water Heater.

There is solid ground for the belief that we are now on the right road to the solution of the hot water problem, but we still need the help of all manufacturers. We are a long way behind in development, and any manufacturer who markets the best water heater that he can design at an economic price is a benefactor to the electrical industry.

Among the several manufacturers who are unceasing in their efforts to improve upon their designs of water heaters is the



HOW TO FIT AN ELECTRIC BATH.

JACKSON ELECTRIC STOVE CO. Our illustration shows their bath heater, which is fully described in a recent publication issued by them (list D.C. p. 10). In our judgment the publicity matter of this company is not the least important service which they render the retailer and contractor. The details of this bath water heater are simply and concisely stated, which means that the retailer can quickly lay out his selling talk and plans. It is for this reason we shall not describe the apparatus. The publicity can be had for the asking, and the business secured for the boosting.

A "Cosmos" Fire for 37s. 6d.

The fact that the "Cosmos" bowl fire manufactured by the METROPOLITAN VICKERS ELECTRICAL CO. is not a newcomer does not exclude it from these columns. If buyers have the fire indexed—all to the good, but the record, in whatever form it takes, should be endorsed "one of the best fires." There is to-day a galaxy of designs in these small bowl fires, but the best sellers can be counted on the fingers.

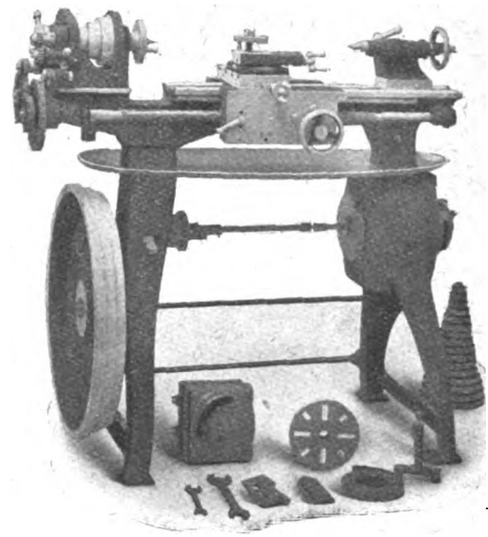
The fire which we illustrate is a "multum in parvo" of usefulness, and does not require any elaboration of its details. Retailers should make the free publicity matter (in the way of showcard and folders offered by the Metropolitan-Vickers Co.) the lodestone with which to attract business. The price is seductive and the winter has not gone yet. Some pessimists still say—"if winter comes . . ."

A CHEAP "COSMOS" FIRE.

A Self-contained Motor-driven Lathe.

The new self-contained 4 in. motor-driven lathe, which we illustrate, has recently been placed upon the market by the BRITANNIA LATHE AND OIL ENGINE CO.

In the past contractors and retailers have had no thoughts of business in small lathes because the electric drive of the usual type has always been too expensive. Further, lathes have not been regarded as a plum for the electrical retailer. If, however, the specification of this Britannia lathe is studied, it will be doubted whether this is the right line of thought. This Britannia lathe is a domestic



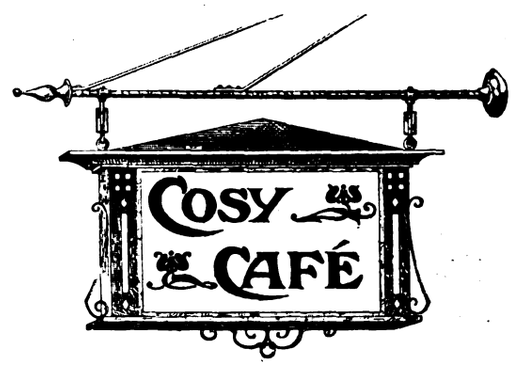
A HANDY LATHE.

electrical device almost as much as an electric washer. There is a big turnover in small lathes by machine tool traders, and now that we have this self-contained electrically-driven lathe the retailer can have a large slice of this business.

The manufacturers have designed this electrically driven lathe as they appreciated that if any firm could offer a simple arrangement of electric drive with a really modern designed tool, capable of a wide range of work at a moderate price, there would be an ever-increasing demand for it. They have now perfected the novel arrangement of embodying the motor in the actual leg of the lathe itself, and have carried out exhaustive tests with the most satisfactory results. As to the merits of the lathe itself, the makers claim that so far no attempt has been made to offer a competitive 4 in. lathe capable of doing such a wide range of useful and accurate work.

Signs for all Trades.

AUSTIN WALTERS offers the trade an excellent range of signs. "Signs for all trades" is their logan. It would be well for con-



AN ELECTRICAL ATTRACTION.

tractors if they would make it their resolution. The resolution should be "more business and a sign order from every trader."

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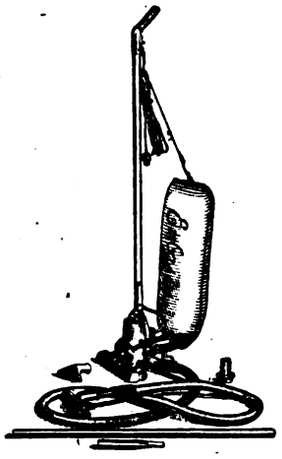
We are far away from the saturation point of this class of business. It is not realised by many contractors what excellent turnover can be made in sign work, not only from the price obtained for the installation, but from maintenance and lamp renewals long after. A boost on sign installations can be easily carried out. First and foremost (the obvious is often neglected) the contractor must erect one outside his own premises, and then come to some arrangement with a local man to install a sign at a keen figure on the understanding that it can be used for demonstration purposes. Next he must see that the local man is a trader in a class of business where competition is keen, and that the sign is on circuit and glowing brilliantly well up to eleven o'clock. It is between eight and eleven that traders take a walk to see what their rivals are doing. The effect on a progressive trader who observes a rival using a most pulling advertising medium is obvious.

The sign which we illustrate is one of many manufactured by Austin Walters.

A Vacuum Cleaner for Eight Guineas.

A drapery establishment making a big boost with a six guinea vacuum cleaner need not be taken very seriously. It does not mean the end of the more expensive machines. Quality, backed by forcible and consistent publicity must prevail in the end, and the business will come to the retailer who puts his faith in two or three of the best makes.

There is, however, a demand for a "medium priced" cleaner and it is for this reason that we illustrate the "Embassy," marketed at eight guineas. The price, however, does not denote the quality because the manufacturers have succeeded in producing a "medium priced high quality" device. The usual auxiliary attachments can be supplied at an extra price of two guineas. The "Embassy" is manufactured by the EMBASSY MANUFACTURING Co., who are we understand, running a vigorous selling campaign. Retailers should accept the challenge of the drapery store and trump with the "Embassy."



LABOUR SAVING IN THE HOME.

The Runbaken Petrol Gauge.

It is complacently accepted by many electrical retailers that they have no chance of reaping any profit from electrical devices which are primarily designed for automobiles. They do not, therefore, pay any attention to the merchandising of motor-car electrical accessories. This is a pity, as no small turnover can be obtained on these lines, and it is to interest unbelievers that we illustrate and briefly describe the Runbaken magnetic dashboard gauge.

FIG. 1.—THE INDICATOR GAUGE.

The device consists essentially of two parts, the indicator gauge (Fig. 1) and the controller (Fig. 2). In the controller the actuating apparatus consists of a metallic diaphragm which is connected to the petrol supply. The pressure of the petrol in the tank, which is proportional of the depth of the petrol irrespective of shape or size of tank, distends or contracts the diaphragm, and the movement is passed on to a small arm, which slides over the commutator and is connected to the indicator itself. The circuit is therefore never broken. The movement of the control arm across each bar causes the indicator needle to give two progressive movements. Twenty-two indications are given from full to empty, so the reading is progressive and practically continuous.

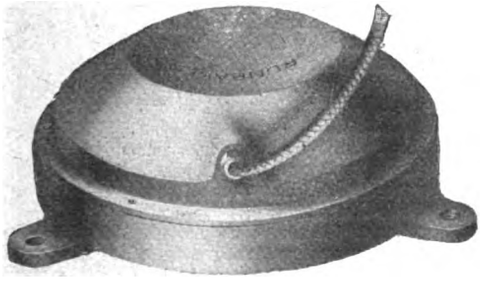
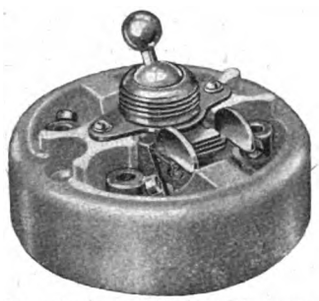


FIG. 2.—VIEW OF THE CONTROLLER.

In the indicator gauge the instrument pointer is caused to move by a rotating magnetic field, the poles of which take up their position in accordance with the movements of the controller. The reading is said to be unaffected by the variations of voltage or vibration. The current consumed is negligible, being less than two watts, and a small switch is provided to disconnect the gauge when the car is put out of use. The complete apparatus is marketed at a list price of £5 5s.

New Developments in "Tucker" Tumbler Switches.

"The quality and reliability of Tucker goods are known and appreciated all over the electrical world." This is the proud claim of J. H. TUCKER AND Co., and the fact that it is always substantiated in the terms of "quality" goods has made the claim a commonplace. Certainly it is substantiated in the new range of "intermediate" and "series parallel" tumbler switches recently placed upon the market by this firm. These new types are well worthy of much study by contractors. It has become the habit of mind of many to regard anything novel in tumbler switches as "highbrow" and far beyond the "bread and butter" interest of the average installation job. This attitude is wrong; it savours of the argument that "what was good enough for my grandfather to install is good enough for me." As in the case of outlet sockets, we are far behind in the development of the tumbler switch as a "service" device. Man is not content with the mean comfort to be derived from an ordinary single-pole tumbler switch.



THE LATEST TUCKER SWITCH.

The new switches offered by Tuckers are (*a*) intermediate switch, (*b*) two-light or "all or part" switch, (*c*) three-light or double-pole switch.

(*a*) By the addition of one or more of the new intermediate switches—in conjunction with ordinary two-way switches—lights can be controlled from three or more points. By adding additional intermediate switches there is no limit to the number of control points. This switch may also be used as a current reversing switch for low voltage low current circuits.

(*b*) The two-light or "all or part" switch is suitable for dimming lamps or for giving two heats on small heating and cooking circuits. It may be used as an "all or part" switch to control either the whole or only a portion of the light in a room, or for two part heaters in series or parallel.

(*c*) The third model is useful for dimming metal filament lamps as their superior brightness requires a greater number placed in series to obtain a suitable reduction in light.

Each type of switch is supplied with plain or fluted brass covers or with plain china covers. All are listed at 5s. each.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

An excellent publication has just been published by MARSHALL SONS AND Co. It is a treatise on Marshall superheated-steam semi-portable engines.

The CHLORIDE ELECTRICAL STORAGE Co. have favoured us with a copy of a new publication which will show the retailer the reasons why there is such a big demand for "Exide batteries for wireless."

"Electric Light Fittings for All Industrial Purposes" is the title of a new catalogue just published by ENGINEERING AND LIGHTING EQUIPMENT Co. Many designs of outside lanterns, metal reflectors, lanterns for street lighting, and ships' fittings are fully described and priced.

METROPOLITAN-VICKERS ELECTRICAL Co. have kindly advised us of new publicity just issued. Circular 1287/1 is a treatise on "Electrolytic Lighting Arresters," and circular No. 1250/1 is entitled "High Voltage Switchgear Design." Both are from the pen of Mr. W. A. Coates, the latter being a reprint of the articles which appeared in THE ELECTRICIAN of May 5th and 12th, 1922. "Auto Transformer and Star-delta starters" is the title of descriptive leaflet No. 59/5-1, and publication No. 7445 is a treatise on "Steam Turbines."

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Municipal Electricity Finance.

Accounts, Estimates and Rate Appropriations.

The accounts of some municipal electricity undertakings for the year ending March 31st, 1922, are only just to hand. Their publication in some cases coincides with estimates for the year to March 31st, 1924. In two cases, sums borrowed from the rates have been repaid, but there is a marked tendency on the part of municipalities to make calls upon their electricity undertakings for contributions in aid of the rates.

Harrogate Undertaking Pays its Way.

The accounts of the HARROGATE undertaking cover the twelve months to March 25th, 1922. The revenue during that period amounted to £44 742, and the expenditure to £27 228, a gross surplus of £15 513, to which fell to be added interest, etc., bringing the total to £15 832. Interest on mortgage debt absorbed £2 577, instalments of principal of money borrowed, £2 198; sinking fund, £6 061; reserve fund, £947; and capital expenditure, £4 059, a total of £15 842. A sum of £10 was transferred from reserve towards capital expenditure. The number of kilowatt-hours generated was 3 452 760, and the total maximum demand was 1 760 kW, these figures applying to the twelve months ending December 31st, 1921.

£10 000 to Reserve at Leicester.

At LEICESTER the gross excess of receipts over working expenses was £123 610. Of this sum, interest, sinking fund charges and income tax absorbed £65 990, leaving £57 620 for disposal. This was dealt with as follows:—£7 110 in respect of the converter and transformer at the Newark Street sub-station; £12 108 to pay off the balance of the excess expenditure in respect of the installation of the 5 000 kW generating set including boilers at the Aylestone station, and buildings and plant at the Newark Street sub-station; £10 000 for providing cooking and heating apparatus, etc., to be let on hire under the scheme sanctioned by the Council on November 28th last; £1 000 in respect of fitting up the showroom in Market Street and office alterations; and £17 000 for meters, new services and mains for the current year. The remaining £10 402 was carried to the reserve fund.

Previous Year's Loss Paid Off at Reigate.

The REIGATE undertaking made a net profit of £3 591 for the year ending March 31st, 1922, income being £20 101 and expenditure £16 510. In the previous year there was a net loss of £922. After paying this off the balance of £2 669 was transferred to renewals and contingencies account. The total of kilowatt-hours generated amounted to 1 110 766, as against 828 160 in the previous year. New loans amounting to £2 000 were raised during the year.

Satisfactory Position at Dover.

The total expenditure of the DOVER undertaking for the year to March 31st, 1922, was £28 355, against which was the gross revenue of £44 167. To the balance of £15 812 there was added £9 287 brought forward and £949 special payment by the War Department. After making provision for interest on loans and sinking fund, £9 670 was carried forward. The number of kilowatt-hours generated was 1 923 664.

Sunderland to Repay Sums Borrowed from Rates.

SUNDERLAND Corporation electricity estimates for the year ending March 31st next show the output to be the same as last year on a reduced coal consumption of 6 000 tons. The income is estimated at £124 402 against £144 490 last year, and working expenses at £69 934 against £98 202 last year, leaving a balance of £54 468 to be carried to net revenue account. After providing for repayment of loans, interest and income tax, there is left £5 905 for repaying two amounts borrowed from the rates in 1917 and 1919, when an adverse balance was made. This sum represents about 2d. in the £ off the rates next year, but the electricity department will be able to place practically nothing to reserve.

Cardiff Accounts and Estimates.

The accounts of the CARDIFF undertaking show that the total revenue for the year to March 31st, 1922, was £168 370, an increase over the previous year of £7 473. Working expenses amounted to £93 492, leaving a gross balance of £74 878. From this was deducted capital charges, £41 171; cost of new meters, £6 709; income tax, £5 481; the net surplus on the year's working being £21 517. To this is added the unappropriated revenue balance to March 31st, 1921, amounting to £57 356, making a total of £78 873. The sum of £6 466 has been spent on new equipment, and £15 000 is transferred to the borough fund account, leaving a net revenue surplus of £57 407. The number of kilowatt-hours generated during the year was 14 779 414, and the total maximum demand was 8 178 kW.

A report by the electrical engineer shows that the estimated surplus for the year ending March 31st, 1924, is £22 584. The estimated working expenditure is £90 223, as compared with £99 347 for the year ending March 31st, 1923, and an actual expenditure of £105 682 for the year ended March 31st, 1922. The estimated revenue is £175 000, compared with £154 000 for the year ending March 31st next, and an actual income of £168 369 for the year ending March 31st, 1922. Loan charges will amount to £33 775, and for Roath Power Station £28 418 and the total estimated expenditure of £152 416 compares with £146 012 for the year ending March 31st, 1923, and an actual expenditure of £146 852 for the year ended March 31st, 1922. The City Treasurer recently pointed out to the Electricity Committee that the reserve fund amounted to £57 406 and depreciation fund to £12 846. They were only entitled to have a reserve fund of £43 130, and the committee agreed to a vote of £6 470 towards the relief of the rates.

Appropriations for Rate Relief

The BRIGHTON undertaking will have an estimated surplus of £25 000, of which £15 000 has been appropriated for rate relief.

A contribution of £30 000 from the electricity undertaking has been reckoned on in fixing the rates for the coming year at LEEDS.

As the result of last year's working of NEWPORT (MON) electricity undertaking, it is expected that the rates will be relieved to the extent of 3d. in the £.

In view of the anticipated profit on the year's working of the BECKENHAM electricity undertaking, £4 000 has been contributed to the relief of the rates. This represents £2 000 for the past and current years.

BIRMINGHAM Electric Supply Committee decided to contribute in relief of the rates a sum of £12 500 out of the trading profits for the current year. This decision was reached in view of the favourable results of the trading for nine months to December last.

Finance Items in Brief.

There was a net profit of £81 on the EPSOM electricity undertaking for the last financial year.

LEYTON Corporation accounts show a profit for the year of £4 733 on the electricity department.

It is estimated that WHITBY electricity undertaking will show a profit for the first time when the next accounts are published. There is a total deficiency at present of £10 653.

Ex-British Westinghouse Association.

Fifth Annual Re-Union Dinner.

At the Holborn Restaurant, London, on March 9th, Mr. A. R. Dyer, Chief Officer of the London Fire Brigade, presided at a gathering of about 150 ex-B.W. men, meeting for their Fifth Annual Re-union. The company included old British Westinghouse men from all parts of the country, and in fact from all parts of the world. As in past years, the fullest opportunity was given for reunion, and this was greatly welcomed. The seating plan contributed to this, for separate tables were provided and named after Manchester suburban thoroughfares and districts familiar to ex-B.W. men, such as Greenheyes, Chester Road, Old Trafford Baths, Moreton Avenue, Stretford Road, etc. The evening proved an immense success and was thoroughly enjoyed by everyone.

After the loyal toast, Mr. A. MCKINSTRY submitting "The ex-B.W. Association," reminded the company of the great work of George Westinghouse in laying the foundations of a great industry. He further remarked upon the value of the Association for renewing friendship and coming into contact with personalities encouraging, cheering and brightening the lives of men. The CHAIRMAN in reply spoke of the many activities of the British Westinghouse Co.'s successor, The Metropolitan-Vickers Electrical Co.

The toast of "Our Guest," was given by Mr. P. A. SAUNDERS (Mayor of Colchester) and Capt. R. S. HILTON (managing director of the Metropolitan-Vickers Co.), appropriately replied.

During the evening the CHAIRMAN, on behalf of the Association, presented a case of pipes to Sergt. MCCULLY on his retirement. Sergt. McCully was the renowned commissionaire at the Norfolk Street office, the man who, as he said in his reply, "endeavoured to be courteous to everybody from the managing director to the office boy," and slyly added "because he found it paid."

Mr. TEARLE proposed a toast to Mr. PHILIP LANG which was musically honoured. Mr. J. BISSETT proposed "Absent Friends and Old Associations," and Mr. J. TURNBULL proposed "The Chairman," with special references to the ancestry of that individual —a toast which produced a characteristic "dyertribe" (!) in reply.

To Major S. MOHR, M.C., O.B.E., fell the task of the "Silent Toast" to the everlasting memory of those who died in the Great War, and the ex-B.W. men deceased since the last re-union. The untiring efforts of the hon. secretary, Mr. L. S. RICHARDSON, were acknowledged in a toast of his health, proposed by Mr. J. G. WILSON, and enthusiastically honoured by the assembly. Mr. RICHARDSON, in reply, announced that the Committee had decided to accept life members of the Association at two and a half guineas subscription, and a number of the members present at once enrolled.

Copies of the menu and programme (we are assured well worth 2s. 6d.), can still be obtained at 1s. 1½d., post free, from Mr. L. S. Richardson, 14, Sydney Road, Richmond, Surrey.

A party of students from the East Anglian Institute of Agriculture, on March 3rd, visited Greater Felcourt, the East Grinstead farm of Mr. R. BORLASE MATTHEWS, where they were shown the latest applications of electricity in agriculture.

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Electrical Imports and Exports.

Totals and Comparisons for the Last Two Months.

IMPORTS.—The following are official values of electrical machinery, apparatus and material imported into this country (*a*) during February, 1923, and (*b*) the aggregate figures from January 1st to February 28th, with increase or decrease compared with corresponding periods of 1922 :—

Electrical machinery, (*a*) £84 086 (decrease £114 077), (*b*) £195 062 (decrease £49 972); telegraph and telephone cables, other than submarine, (*a*) £6 491 (increase £3 891), (*b*) £14 884 (increase £8 787); telegraph and telephone apparatus, (*a*) £28 869 (increase £20 240), (*b*) £53 729 (increase £27 905); other electrical wires and cables, rubber insulated, (*a*) £14 777 (increase £11 211), (*b*) £30 177 (increase £22 004); with other insulations, (*a*) £6 174 (increase £1 467), (*b*) £14 742 (increase £6 502); carbons, (*a*) £4 571 (increase £2 085), (*b*) £8 778 (increase £3 645); glow lamps, (*a*) £25 805 (increase £3 678), (*b*) £49 949 (increase £8 786); arc lamps and electric searchlights, (*a*) £256 (increase £256), (*b*) £274 (increase £274); parts of arc lamps and searchlights (other than carbons), (*a*) £726 (increase £155), (*b*) £3 269 (increase £2 131); batteries, (*a*) £9 310 (increase £5 945), (*b*) £21 580 (increase £14 565); electrical instruments (commercial and scientific) and electricity meters, (*a*) £10 651 (increase £5 841), (*b*) £20 828 (increase £10 185); switchboards, (*a*) nil (decrease £20), (*b*) £80 (decrease £885); other electrical goods and apparatus, (*a*) £53 838 (increase £17 277), (*b*) £116 304 (increase £29 543). Total of electrical machinery, apparatus and material (other than insulated wire), (*a*) £245 554 (decrease £42 051), (*b*) £529 656 (increase £83 470).

EXPORTS.—The exports of electrical machinery, apparatus and material (*a*) during February, 1923, and (*b*) from January 1st to February 28th, with increase or decrease compared with corresponding periods of 1922, were as follows :—

Electrical machinery (*a*) £284 290 (decrease £99 725), (*b*) £719 192 (decrease £232 087); including railway and tramway motors, (*a*) £28 170 (increase £12 992), (*b*) £44 991 (increase £13 935); other generators and motors, (*a*) £131 968 (decrease £45 272), (*b*) £386 027 (decrease £135 712); and other electrical machinery, (*a*) £124 152 (decrease £67 445), (*b*) £288 174 (decrease £110 310); telegraph and telephone cables, submarine, (*a*) £27 274 (decrease £33 811), (*b*) £102 395 (increase £37 917); other than submarine, (*a*) £67 000 (increase £32 766), (*b*) £121 909 (increase £6 012); telegraph and telephone apparatus, (*a*) £170 932 (increase £31 200), (*b*) £345 656 (decrease £15 147); other electrical wires and cables, rubber insulated (*a*) £95 301 (increase £54 375), (*b*) £213 562 (increase £116 516); with other insulations, (*a*) £90 433 (decrease £24 550), (*b*) £176 788 (decrease £62 161); carbons, (*a*) £3 489 (increase £1 126), (*b*) £10 159 (increase £1 053); glow lamps, (*a*) £26 206 (decrease £3 377), (*b*) £55 238 (decrease £3 355); arc lamps and searchlights, (*a*) £300 (increase £159), (*b*) £746 (decrease £346); parts of arc lamps and searchlights (other than carbons) (*a*) nil (decrease £244), (*b*) £84 (decrease £697); batteries, (*a*) £47 168 (increase £23 169), (*b*) £94 523 (increase £36 130); electrical instruments (commercial and scientific), electricity meters, (*a*) £31 359 (decrease £4 369), (*b*) £56 993 (decrease £15 201); switchboards, (*a*) £7 538 (decrease £16 851, (*b*) £23 046 (decrease £87 318); other electrical goods and apparatus, (*a*) £85 192 (decrease £15 164), (*b*) £212 281 (decrease £10 995). Total of electrical machinery, material and apparatus, other than insulated wire, (*a*) £936 482 (decrease £56 296) (*b*) £2 132 572 (decrease £229 719).

Power Engineers' Salaries.

Action by Chesterfield and Birkenhead Corporations.

Following the dispute at Halifax between the Corporation and members of the E.P.E.A., CHESTERFIELD Corporation gave notice to six members of the staff who are members of the Association of a 10 per cent. reduction in their salaries. It appears that the staff were given a month's notice to terminate their engagements, with the offer of re-engagement at the lower rate. Later, the notices were withdrawn pending further negotiations between the E.P.E.A. and the Electricity Committee.

A report by the BIRKENHEAD Corporation Economy Committee states that the electricity department is economically worked except in the direction of staff remuneration and wages. The expenditure under these heads in 1914 was £6 015, against £20 271 for the present year. "The extravagant remuneration of the technical staff," says the report "(other than that of the electrical engineer himself, whose remuneration is not governed in the same way as the rest of the technical staff), forced upon the Corporation and other local authorities and companies by the National Joint Board of Employers and Members of Staff (Electricity Supply Industry) in spite of widespread objection at the time, provides a very clear illustration of the extent to which the management of these undertakings has been alienated from the direct control of the governing bodies in matters of remuneration and conditions of service." The committee recommends that the technical staff be notified that their engagements cannot be continued at their present rates of remuneration and that as from July 1st their services can only be retained subject to their accepting reduced rates of remuneration under the scales of salaries and bonus adopted for the Corporation service, the bonus to be subject to revision from time to time, as provided for by the resolution of the Council. It is also proposed that the formula of 80 per cent., falling to 50 per cent., be applied to the workmen of the committee.

The Second London Inquiry.

Proceedings Adjourned on a Legal Point.

The second inquiry into the Electricity Schemes for the London and Home Counties District opened at the Institution of Electrical Engineers on Monday and was adjourned *sine die* after the proceedings had lasted quite a short time.

Committees Ultra Vires.

This unexpected outcome was the result of a point raised by Mr. TYLDESLEY JONES, K.C., on behalf of the companies. He submitted that the scheme outlined in the draft order* depended on the compulsory formation of two committees and the compulsory delegation to those committees, as regarded certain areas in the district, of the powers and duties of the joint electricity authority which it was proposed to set up. The two points of objection were that the provisions of the scheme, whereby it was made compulsory on the joint electricity authority at their first meeting to appoint, and thereafter keep appointed, two committees, was *ultra vires* to the Commissioners and contrary to the provisions of the Electricity (Supply) Acts, 1919 and 1922; and that the provisions of the scheme, whereby it was rendered compulsory upon the joint electricity authority to delegate to the two said committees the powers and duties of the joint authority which were proposed to be delegated by the order (clause 9), were also *ultra vires*.

Counsel went on to say that the same point was raised at the North Wales and Chester inquiry, when the Commissioners held that the objection was in law not good. Notwithstanding that, he was prepared to argue that that opinion was wrong in law.

Sir LYNDEN MACASSEY (for West Ham) and Mr. CRAIG HENDERSON (for the L.C.C.) supported this view. Mr. S. G. TURNER (for the Conference of Local Authorities) supported the Commissioners' proposal that the Committees were *intra vires*.

Highest Legal Authority Consulted.

The CHAIRMAN (Sir John Snell) said that the Commissioners were advised by the highest authority (a law officer of the Crown) which they could seek that the opinion given in that case covered affirmatively the two points raised by counsel. They had thought it desirable also to put the substantial case raised in the draft order to the highest authority open to them, and when that opinion was obtained they would feel bound to act upon it.

A Joint Authority Essential.

In opening the enquiry the CHAIRMAN reviewed some of the objections to the scheme and said that the Commissioners regarded the establishment of such a body as an essential part of the scheme, and it was agreed to in principle at the first inquiry. The Commissioners, however, were prepared to hear a general statement from counsel on those points, but they did not propose to take any further evidence except in regard to developments which might have taken place since the first inquiry.

The question was also raised as to whether the consent of the London County Council was necessary to the transfer of their purchase powers to the local authority and Sir JOHN SNELL stated that though it was necessary it might be dispensed with.

Motion to Defer the Inquiry.

In the Lord Chief Justice's Court on Tuesday, Mr. TYLDESLEY JONES informed the Court that he had been instructed to move for a *rule nisi*, a writ of prohibition and a *rule certiorari* directed to the Electricity Commissioners with reference to a scheme they were now considering. The matters on which he should have been then moving in the form of an affidavit, were put in the hands of the printers on the preceding night and had not yet arrived.

The LORD CHIEF JUSTICE gave permission for the motion to be brought up again later, and said it would be deemed to have been moved and adjourned.

It will be brought into Court again this (Friday) morning.

The Institute of Metals.

Officers and Members of Council for 1923-24.

At the annual general meeting of the INSTITUTE OF METALS held in London on March 7th, the following officers were elected to serve for the year 1923–24:—President, Mr. Leonard Sumner; Vice-presidents, Sir John Dewrance, Mr. W. Murray Morrison, Sir Thomas Rose, Mr. W. Rosenhain, Sir William E. Smith, Prof. T. Turner; Hon. Treasurer, Mr. A. E. Seaton; Members of Council, Messrs. W. H. Allen, L. Archbutt, G. A. Boeddicker, T. Bolton, H. W. Brownsdon, Engineer Vice-Admiral R. B. Dixon, Prof. C. A. Edwards, Messrs. S. Evered, R. S. Hutton, F. C. A. H. Lantsberry, Sir Charles A. Parsons, Messrs. H. A. Ruck-Keene, R. Seligman, James Steven, F. Tomlinson and H. B. Weeks.

Sixty new members were elected, bringing the total to 1,458. The next election is due to take place on April 19th; particulars can be obtained from the secretary, Mr. G. Shaw Scott, 36, Victoria Street, London, S.W.1.

* See THE ELECTRICIAN, February 16th, p. 167.

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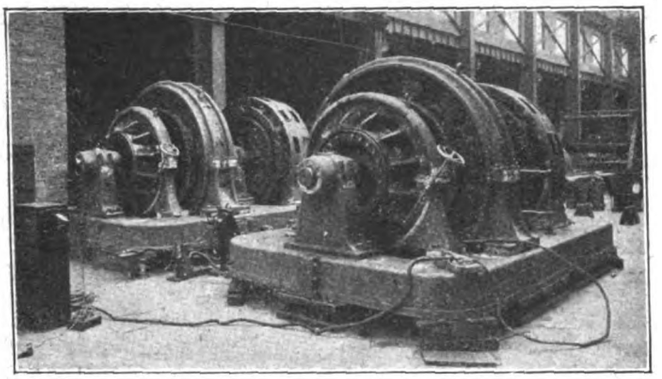
Large Converters for Manchester.

Testing a 2 500 kW Machine.

By courtesy of BRUCE PEEBLES AND CO., we are able to reproduce a photograph of two 2 500 kW self synchronising Peebles-la Cour motor converters, which was taken on the test bed at their works shortly after the full load trials had been carried out. The machines were built to the order of the Manchester Corporation, and each is designed to operate directly off a three-phase, fifty cycle supply at 6 400/6 500 V on the a.c. side and to deliver at the d.c. end 5 700 A continuously at any pressure between 400 and 440 V. The fields are shunt wound and each converter deals automatically with an out-of-balance current on the direct current side up to 1 000 A. In addition to the foregoing the order included the supply of a 1 500 kW set of similar type and characteristics.

Bruce Peebles and Co., inform us that they attach a great deal of importance to their works tests, and every machine is exhaustively tested in order to satisfy themselves, and also the customer, that



TWO 2 500 kW PEEBLES-LA COUR CONVERTERS FOR MANCHESTER.

everything is entirely satisfactory before being finally finished off and prepared for despatch.

Evidence, they tell us, accumulates as to the increasing use of the Peebles-la Cour motor converter and the firm have actually supplied to the above authority sixty-nine motor converters with an aggregate capacity of well over 53 000 kW. They have also recently been successful in securing a further order for the supply of two 2 500 kW sets and a 500 kW automatically controlled set, thus bringing the total number of converters supplied and on order to seventy-two, and the aggregate capacity to over 58 000 kW.

Books Received.

"Der Drehstrommotor." By Julius Heubach. Second Edition. (Berlin: Julius Springer). Pp. xii + 599. 15s.

"A 130 000 Kilowatt Power Station." By G. Klingenberg. (London: Crosby Lockwood and Son). Pp. 154. 21s. net.

"Telefon Haandbogen. 1923." Finnish Communal Telephone Department. (Odense: Fyens Stiftsbogtrykkeri (Dreyer)).

"Proceedings of the Cambridge Philosophical Society." Vol. xxi. Part iv. (Cambridge: University Press). Pp. 433. 7s. 6d. net.

"X-Rays." By G. W. C. Kaye, O.B.E., M.A., D.Sc. Fourth Edition. (London: Longmans, Green and Co.). Pp. 320. 16s. net.

"The 'Rapid' Decimal Reckoner." By J. Gall Inglis, F.R.S.E. (London: Gall and Inglis, 31, Henrietta Street, Strand). 1s. 6d. net.

"Journal of the Institution of Electrical Engineers." February 1923. Vol. 61, No. 315. (London: E. and F. N. Spon, Ltd.). 10s. 6d.

"Electric Lighting and Starting for Motor Cars." By Harold H. U. Cross. Third Edition. (London: Crosby, Lockwood and Son.) Pp. xii. 328. 28s. net.

"Electric Brass Furnace Practice." By H. W. Gillett and E. L. Mack. Bulletin 202. Issued by the U.S. Department of the Interior, Bureau of Mines. (Washington: Government Printing Office).

"Natural-Gas Manual for the Home." By R. A. Cattell. Technical Paper 325. Issued by the U.S. Department of the Interior, Bureau of Mines. (Washington: Government Printing Office). 10 cents.

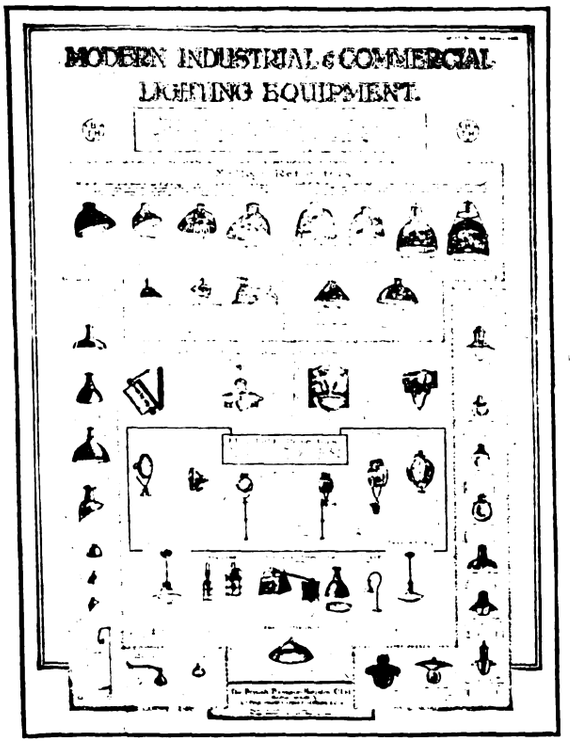
"Preparation of Light Aluminium-Copper Casting Alloys." By R. J. Anderson. Technical Paper 287. Issued by the U.S. Department of the Interior. Bureau of Mines. (Washington: Government Printing Office).

"British Engineering Standards Association." Publication No. 168—1923. B.S. Specification for the Electrical Performance of Industrial Electric Motors and Generators with Class A Insulation. (London: Crosby, Lockwood and Son.)

Industrial Lighting Equipment.

A Convenient Reference Sheet.

The BRITISH THOMSON-HOUSTON Co., Ltd., have issued a sheet (No. L.268) on "Modern Industrial and Commercial Lighting Equipment." This sheet illustrates, describes, and gives prices for the following material: X-Ray reflectors for shop window, showcase and factory lighting; Mazdalux metal reflectors; Mazdalux standards and workshop brackets; weather-proof and fume-proof lanterns; floodlight projectors; spotlight projectors; Mirolux trough reflectors; Lumina semi-indirect fittings for offices and workshops; Ace and Kedlon enclosed fittings for offices and shops; hand lamps; "Posterlite" units for the illumination of posters



B.T.-H. SHEET L.268.

and signs; "Trutint" colour matching units; and X-Colour-Ray attachments for coloured lighting iin shop windows, etc.

The sheet, which measures 40 in. by 30 in., is stiffened top and bottom, and provided with a cord for hanging. It does not claim to be a comprehensive list of B.T.-H. lighting products, but has been issued to enable the contractor or engineer to visualise in a fairly complete fashion the main items of available equipment for industrial and commercial installations. The sheet is at once a valuable means of reference, and a source of inspiration to contractors who want to be in a position to deal on the spot with any lighting inquiry, however urgent and unusual it may be. A copy will be sent to any contractor or engineer who applies to the Wiring Supplies Department of the B.T.-H. Co.

E.D.A. in Yorkshire.

Extensive Publicity Campaign Commenced.

The BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION have sent us particulars of a joint publicity campaign which they are carrying out on behalf of the electricity supply undertakers and other electrical undertakings in the Aire and Calder district. An impressive list of papers in which advertisements are to be inserted during the months of March, April, May and June is given, together with typical examples of the copy which is to be used. This copy, as might be expected, is exceedingly effective, but in order that it may bear the greatest possible amount of fruit it is essential that all in the district should support this joint advertising scheme by the circulation of literature, by suitable show window displays, by the use of posters and lectures, and by other means which will readily occur to those interested. We need hardly say that we support this appeal and we recommend all electrical people in the district concerned to get in touch with the E.D.A. at the earliest possible moment and obtain their marching orders.

The annual smoking concert of the FARADAY HOUSE OLD STUDENTS' ASSOCIATION will be held at the Hotel Cecil, London, W.C., on March 22nd, at 8 p.m. Before the concert members of the Faraday House Sports Club will dine at the hotel, and Old Faradians are invited to join them.

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Legal Intelligence.

B.T.-H. Patent Litigation.

In the Chancery Division on March 9th, Mr. Moritz, on behalf of the British Thomson-Houston Co., applied to Mr. JUSTICE EVE, *ex parte*, in two actions against Launcelot Booth and Wm. Collins and Son, for an injunction restraining the defendants from infringing plaintiff's patent relating to gasfilled lamps, and from parting with the infringing articles.

His lordship granted the injunction, *ex parte*, over to-day (Friday).

Mr. JUSTICE ROMER, in the Chancery Division on March 9th granted an injunction on the *ex parte* application of the British-Thomson-Houston Co., restraining L. M. Dou, of Great Alie Street, Aldgate, E., from infringing their patent of the gasfilled lamp.

Mr. TREVOR WATSON, for the plaintiffs, said he was asking for an injunction *ex parte*, as it had been found that as soon as a writ was issued which claimed delivery up of the infringing lamps defendants sent them back to their foreign principals. As a rule defendants had no assets other than the lamps, and the plaintiffs were, therefore, left without any remedy, and the lamps came back to another infringer.

Mr. JUSTICE ROMER, having read the plaintiffs' affidavit. said he thought they were right in moving *ex parte*, and he accordingly granted the injunction asked for.

On March 9th Mr. JUSTICE ROMER had again before him the motion adjourned from the previous week by the British Thomson-Houston Co. for an injunction restraining D. Rose and Co., of Osborne Street, Aldgate, E., from an alleged infringement of their patents for incandescent electric lamps.

Mr. J. HUNTER GRAY, for the plaintiffs, said that affidavits had been made by Mr. David Rose and Mr. Harry Zealander, his salesman, stating that they had never sold any such lamp as alleged. They said they bought their lamps from British Insulated and Helsby Cables, Ltd., and they always understood that those lamps did not infringe the plaintiffs' patents.—In reply the plaintiffs had filed affidavits by persons who swore that they bought gasfilled lamps from the defendant's shop which infringed the patent.

Mr. DAVID ROSE was present in court, and said they only sold "Spiralite" lamps, one of which was produced in court. He denied absolutely the statements in the plaintiffs' affidavits. He said he wanted to file evidence in answer.

HIS LORDSHIP accordingly adjourned the motion for another week, the *interim* injunction granted the previous week being continued in the meantime.

Master Printer's Electric Motor.

In the Shoreditch County Court, on March 8th, before JUDGE CLUER, Frank James Mackenzie, of 176, Glyn Road, Clapton, electrician, sued F. E. Goldspink, of Brown's Buildings, Brooksby's Walk, Homerton, master printer, to recover £24 18s., being the balance alleged to be due on the purchase price of a one H.P. electric motor, second hand, guaranteed to be in good working order. There was a counter-claim for £13 1s., being £12 for the damage suffered in business owing to being unable to use the motor, and £1 1s. for an electrician's report. The plaintiff, in evidence, said that he fixed the motor in March of last year, and it was passed by the borough engineer. The trouble was that the defendant had put too big a load on it, running two printing machines with it instead of one. He denied that it was not properly "earthed," and added that even if that were so it would have nothing to do with the mechanical breaking-down of the machine.

Mr. L. L. ROBINSON, borough electrical engineer at Hackney, said that whether "earthed" or not, a fuse would protect a machine, and so far as he could see "earthing" had nothing to do with the breakdown in this case.

For the defence, LEONARD PARRY, electrician, of Wood Green, ascribed the breakdown to the fault that the motor was not properly "earthed," and he declared that the fuse would not protect the machine if it were not properly "earthed."

Mr. QUASS (for the plaintiff): You are not a member of the Institution of Electrical Engineers like Mr. Robinson?

JUDGE CLUER: That is nothing; he may be better than the whole lot of them. James Watts was not, nor was Wm. Arkwright, or Geo. Stephenson. Scientific degrees only mean that you can pass examinations.

The defendant stated that the plaintiff told him the motor would drive two machines, but it actualy broke down on one. He had to refuse a lot of printing work because the machine was idle. The price was to have been £39 10s., but with extras the bill came to £51. Even that he did not object to if the motor would work.

JUDGE CLUER said he felt bound to follow the evidence of Mr. Robinson, and gave judgment for the plaintiff for £24 18s. and costs, and dismissed the counter-claim with costs.

On March 7th a social and concert arranged by the ELLIOTT SOCIAL ASSOCIATION for employees and friends of Elliott Brothers (London), Ltd., was held at Greenwich Borough Hall. The concert consisted of items given by the "Century Works" orchestra, conducted by Mr. R. O. Smith, together with vocal and dramatic items. Later in the evening Mr. L. W. Smith, a director of the company, paid tribute to the good work done by members of the Social Association, especially by the Committees.

Obituary.

Joannes Diderik van den Waals.

Prof. J. D. VAN DEN WAALS died at Amsterdam on March 8th. He was born at Leyden in 1837, and took the degree of Ph.D. at Leyden University. In 1877 he was appointed Professor of Theoretical Physics at Amsterdam University. His researches in thermodynamics are well known, and his work on the relation of gases to temperature pressure and volume led to his constructing the equation which bears his name. Later he turned to the study of the critical phases at which solids pass into liquids and liquids into gases, a line of investigation which led him deep into the consideration of the actual structure of matter. In November, 1910, the Nobel Prize for Physics, amounting to over £8 000, was awarded to him. He was a member of the Institute of France, hon. member of the Royal Institution of Great Britain, and hon. Fellow of the Chemical Society.

James Thomas Jervis.

Although the majority of his engineering work was in connection with railways, Mr. J. T. JERVIS, who died in London on Tuesday, was connected with several electrical undertakings. He was one of the originators, and had long been a director of, the Notting Hill Electric Lighting Co., and was a member of the Joint Committee of Management of the Kensington and Notting Hill Electric Lighting Co. for the regulation and working of the generating station at Wood Lane. He was also a director of the Mexborough and Swinton Tramways Co., Musselburgh and District Electric Light and Traction Co., National Electric Construction Co., Rhondda Tramways Co., Torquay Tramways Co., and Wisbech Electric Light and Power Co. He was a member of the Institution of Civil Engineers, and was responsible for the construction of railways in England, India, South America, and other parts of the world.

Personal Items.

MR. H. B. ADAMS has been appointed assistant electrical engineer on the North-Western (India) Railway.

SIR WILLIAM JOYNSON-HICKS has been appointed Postmaster-General in succession to Mr. Neville Chamberlain.

MR. C. H. HOOPER, jun., formerly of the Barnstaple Municipal Electricity Works, has been placed in charge of the new station at Warminster.

MR. HAROLD WILLIAM SIDLEY has been appointed general sales manager to A. C. Alexandra and Co., with entire control of the company's sales.

WILL.—The late Mr. GEORGE CROSLAND TAYLOR, a director of British Insulated and Helsby Cables, Ltd., who died on January 12th, left £45 187 (net personalty £43 910).

Plymouth Town Council has decided to increase the salary of the tramways engineer and manager, Mr. H. P. STOKES, from £800 to £1 000 per annum by two increments of £100.

MR. J. A. FORDE, manager and engineer of the Isle of Thanet Electric Tramways and Lighting Co., has been re-elected unopposed a member of the Broadstairs and St. Peters Urban Council.

MR. THOMAS BARTON, head of "The Electric Works," Ainsworth Street, Blackburn, has been presented with the Sunday School Long Service Medal for fifty years' work at Trinity Wesleyan School.

Mr. T. B. HOYLE, secretary and manager of Palmer, Riley and Co., is leaving that company at the end of March, and will be succeeded in the management by Mr. HARRY F. CLARKE, the present sales manager. Mr. Hoyle is leaving on April 7th for Los Angeles, California.

MR. C. H. JONES has resigned his position as assistant engineer to the Reading Corporation Tramways, consequent upon his having obtained an appointment with the Colombo Electric Tramways and Lighting Co. He has been a member of the Reading Tramways staff for ten years, during which time he occupied several positions on the engineering side. Mr. C. H. STAFFORD has been promoted to fill the vacancy.

Following the transfer of the Bootle Electricity undertaking to Liverpool, the Bootle Town Council, on March 7th, passed a resolution recording its appreciation of the work of Mr. T. DAWSON CLOTHIER, the electrical engineer, whose services are being dispensed with owing to the transfer. It was agreed that the sum of £425—equal to six months' salary, and £21 more than he had paid into the superannuation fund—be given him as an honora ium. This is in addition to £8 000 received by Mr. Clothier as compensation.

MR. J. A. ROBERTSON was entertained at dinner on March 9th by Salford Electricity Committee on the occasion of his retirement from the post of borough electrical engineer. The Mayor of Salford presented to Mr. Robertson, on behalf of the Committee, an illuminated address of appreciation of his services during the past nine years, during which time he entirely re-organised and modernised the electricity undertaking.

Mr. JOHN SPENCE has been presented with a desk, together with a silver dish for Mrs. Spence, by his friends in the Newcastle electrical industry, on the occasion of his retirement from the management of the Newcastle branch of the General Electric Co. Mr. Spence founded the branch over 30 years ago, and has been in charge ever since. The presentation was made by Mr. W. F. T. Pinking (Newcastle-on-Tyne Electric Supply Co.) on March 9th, on the occasion of the staff dance and whist drive of the Newcastle branch of the G.E.C.

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Imperial Notes.

AUSTRALIA.

Brisbane Tramways Taken Over.

The BRISBANE ELECTRIC TRAMWAYS, which have been owned and operated by the Brisbane Tramways Co. since 1896, have been taken over by the Brisbane Tramway Trust. Mr. J. S. Badger acted as manager during the whole of the Company's period of tenure, and brought the system to a high standard of efficiency.

Remission of Import Duty.

The Australian Commonwealth Government have decided to forego IMPORT DUTY amounting to £1 600 on STANDFORD RILEY STOKERS for the Western Australian Government's electric power house, because those stokers are not procurable in the Commonwealth. Other Australian importers and British makers of special types of plant might, reasonably, endeavour to obtain similar rebates.

CANADA.

Railway Electrification Plans.

The Ontario Government is stated to be considering plans for the ELECTRIFICATION OF THE TEMISKAMING AND NORTHERN ONTARIO RAILWAY at a cost of approximately $9 000 000. It is contended that with the enormous water power in the Northland, much of which is at present undeveloped, the substitution of electric power for steam power would effect a considerable saving. It is understood that the Provincial Ministers are favourable to the project and that the Lieutenant-Governor-in-Council will direct that the change be made.

EAST AFRICA.

Engineering Catalogues for Kenya Colony.

The Director of Public Works, Nairobi, is desirous of being supplied with PRICED CATALOGUES of the building and engineering trades for the Department of Public Works. He states that prices are required *as a guide* and not as a guarantee. Catalogues should be addressed to the Director of Public Works, Public Works Department Head Office, Nairobi. It would also be of great interest to His Majesty's Trade Commissioner at Nairobi (Colonel W. H. Franklin) to receive similar catalogues. In this latter case they should be addressed to His Majesty's Trade Commissioner (P.O. Box 220). Bonia Building, Government Road, Nairobi.

INDIA.

Electric Installations in Small States.

The Kathiawar States have of late been showing considerable interest in electric installations. The State of PORBANDAR has now taken a fresh step, and is making use of electricity not only for the lighting of streets and private houses but also for power purposes. In the case of the town electrification scheme, the preliminary work of the settlement of plans and the framing of estimates was done by the Tata Co., and the plan prepared by them was executed through the electrical engineer of the State. No special arrangements had to be made for the construction of a power house, owing to the harmonious co-operation of the Cement Company. To date the scheme has cost over two lakhs of rupees, and will cost more as it is extended. The example of Porbandar has stimulated other states, and Rajkot and Gondal have already placed orders with different companies for installations.

A Question of Telephone Charges.

The Bengal Telephone Corporation made a proposal some time ago for the introduction of a message or MEASURED RATE SYSTEM OF TELEPHONE CHARGES in Calcutta, and sent it for approval to the Bengal Government. The Bengal Government sent the proposal to the Bengal Chamber of Commerce for an expression of their opinion thereon. In the course of their reply the Chamber state that so far as they are informed, the system of message rate prevailing in the United Kingdom—which is presumably what the Telephone Corporation have in mind—has created great dissatisfaction there, and that the introduction of a similar system in Calcutta must prove unpopular. One source of complaint in the United Kingdom is understood to be the difficulty which large subscribers experience in checking the number of calls for which they are charged. If this be the case, it is obvious that very much more information is imperatively necessary before any change in the direction of the message rate can be considered in Calcutta. But even apart from the advantages or disadvantages of the message rate system, the Chamber protests strongly against any change being made except after the fullest investigation, and after subscribers have been given ample opportunity of examining and considering the proposed new method of charging. Further, it appears to the Chamber that the change would necessitate a modification of the terms and conditions of the Government license. The agreement which was signed last April, which is supplementary to and presumably a part of the license, provides for a flat rate. If there is to be any question of revising any of the clauses of the license, subscribers would unquestionably demand that the document should be reconsidered as a whole, and that they should be permitted to express their views upon its provisions generally. On all these grounds the Chamber urge that the Government of India should without hesitation decline to give their approval to the proposal.

SOUTH AFRICA.

The Colenso Power Station.

Work has been commenced on the power station at Colenso for the ELECTRIFICATION OF THE NATAL RAILWAYS. It will at first contain five Parsons turbo-alternators, space being left for the erection of a sixth set should it be required in the future. These alternators will have a normal capacity of 12 000 kW and will be capable of carrying 15 000 kW for short periods, and as much as 20 000 kW for two minutes at a time, so as to cope with short periods when an unusually heavy demand is made on the power. This amount of power is to enable industries along the line to be supplied. Steam for the sets will be provided by eight Babcock marine type boilers, each capable of a normal evaporation of 50 000 lb. to 60 000 lb. of steam per hour. The boiler-house is being arranged with a special view to its ultimate utilisation for the production of by-products such as motor spirit, fuel oil, tar, etc. It is estimated that the erection of the power station will occupy two years.

Foreign Notes.

LATIN-AMERICA.

Costa Rica Electric Light Co.'s Earnings.

The report of the COSTA RICA ELECTRIC LIGHT AND TRACTION Co. for the year ended June 30th, 1922, shows that the net earnings in Costa Rica were £21 997, a decrease of £3 729. As the net profit in Costa Rican currency is approximately the same as that for the previous year, the decreased result in sterling is due to the continued depreciation of the colon. The net profit is £2 495, against £3 709, and with £2 634 brought in, the total standing to credit of profit and loss is £5 189, which it is proposed to carry forward.

THE FAR EAST.

Railway Electrification Schemes in Java.

The "Netherlands Indies Review" states that plans are on foot for ELECTRIFYING THE RAILWAY between Weltevreden and Bandoeng *via* Tjikampek. It will be entirely a state railway affair. The existing railway is a masterpiece of engineering, but its electrification would greatly improve it and provide opportunities for British finance and industry. Electricity will be supplied by water-power in the neighbourhood of Buitenzorg. One generating station has already been erected, while the building of another has been temporarily suspended owing to the economy campaign. The reorganisation of the tramway system in the neighbourhood of Batavia has also been spoken of, but difficulty lies in the fact that many interests are involved. New rolling stock is urgently required.

U.S.A.

The Mackay Companies' Report.

The annual report of the MACKAY COMPANIES, dated February 15th, states that during the year the volume of traffic handled by the landline system was the largest in its history, and the net profits were quite satisfactory. The earnings from the ocean cables were not so good, partly owing to the volume of business being affected by trade depression during the early part of the year and partly by the interruption of the cables at Waterville, Ireland, during the month of August by the Irish Irregulars. The total net income available to the Mackay Companies from all sources, however, was so satisfactory as to warrant the trustees in increasing the annual rate of dividend from 6 per cent. to 7 per cent., beginning with the December quarter. In addition an extra cash dividend of 10 per cent. has been declared out of the accumulated reserves.

Forty Years Ago.

"The Electrician," March 17th, 1883.

BATTERIES AT THE POST OFFICE.—There are 87 221 Daniell, 56 420 Leclanché, and 21 846 bichromate cells at present in use in the British Post Office telegraph system.

EDISON'S 100-CANDLE LAMP.—In our Notes last week describing an exhibition of Edison's 100-candle lamp at Glasgow, its dimensions were accidentally enlarged to mammoth proportions. Those of our readers acquainted with incandescent lamps will readily recognise that the figures given should be reduced to inches instead of feet.

TELEPHONES AND TELEGRAMS.—Mr. Monk, M.P., as President of the Associated Chambers of Commerce, has forwarded memorials to the Postmaster-General urging a reduction in the charges for the use of telephones. Furthermore, the Government is requested to enter into negotiations with foreign countries for the purpose of cheapening and facilitating telegraphic communication.

The COOMBE MEMORIAL SCHOLARSHIP, which will be of the annual value of £60, and will be tenable in the Faculty of Engineering of the University of Bristol, will be offered for competition for the first time this year. It has been established by the Engineering and the National Employers' Federations (West of England Association) as a memorial to a former President, and will be open to candidates who habitually reside within the area of the Association, which includes the counties of Gloucester, Somerset, Wilts, Devon and Cornwall, as well as the city of Worcester and the towns of Hanley Castle, Malvern, Malvern Wells, Pershore and Newport, Mon. The examination will be held at the Merchant Venturers' Technical College on July 4th, and applications must be sent to Mr. A. Storey, director of the Association, not later than July 1st.

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Electricity Supply.

Extensions and Developments.

EXETER Electricity Committee is considering a scheme for bringing the cheapness of electricity before the public.

FAREHAM Urban District Council is sending a deputation to the Commissioners in the hope of securing approval for a scheme of plant extension.

NEWPORT Corporation is to apply to the Commissioners for sanction to borrow £150 929 for boiler and evaporator plant, transformers, etc.

WEST BROMWICH Town Council has approved a scheme for extending the generating plant at a cost of £33 500. Plant is to be purchased from the Disposal Board.

WALSALL Town Council is recommended to extend the electricity mains from Butts Road sub-station to Aldridge Colliery No. 1 plant, near Walsall Wood, at an estimated cost, including switchgear, of £9 000.

BIRKENHEAD Electricity Committee proposes to wire six houses, the property of the Corporation, in Craven Street, for electricity purposes at a cost of £56 9s. 4d., and to obtain tenders for the wiring of other houses of the Corporation under the control of the Committee in the vicinity of the electricity works, the cost to be defrayed in each case out of revenue.

BANGOR Corporation has decided to apply to the Commissioners for sanction to borrow the following sums: (*a*) For present and future requirements for mains and services, £3 000; (*b*) for present and future requirements for meters, £500; (*c*) for the equipment of Euston Road sub-station to enable the Council to supply the L.M. and S. Railway Co., £400; (*d*) for the expenditure required to lay the cables, etc., to supply Menai Bridge, £500; total, £4 400.

Alterations in Charges, Proposed and Actual.

The charge for lighting at FAREHAM is to be reduced from 10d. to 9d. per kWh as from April 1st.

DOVER Corporation has reduced the lighting charge from 10½d. to 8½d. per kWh, with a discount of ½d. per kWh for prompt payment.

ASCOT District Gas and Electricity Co. has reduced the price of electricity for lighting by 1d. per kWh, and for heating and power by ½d. per kWh.

Lighting charges at DARWEN have been reduced from 7d. to 6½d. for the first 500 kWh per quarter, and to 6d. per kWh beyond. Proportionate reductions have also been made in cooking and heating charges.

The following reductions are proposed at WORCESTER: Lighting, from 7d. to 6½d. per kWh; heating and cooking from 1½d. to 1d. per kWh; power, "additional charge" to be reduced from 60 per cent. to 40 per cent.

PORTSMOUTH Electric Lighting Committee is recommending the following reductions: Lighting from 6½d. to 6d. per kWh; power, from 1¾d. to 1½d. per kWh. It is proposed to reduce the minimum charge for lighting to £1 10s.

KENDAL Town Council has made the following reductions as from January: Lighting outside borough from 11d. to 9d. per kWh; lighting inside borough, from 10d. to 8d. per kWh; public lighting from 6d. to 5d. per kWh; power, 5d. to 4d. per kWh.

CANTERBURY Town Council has adopted the following scale of charges for electricity as from April 1st: Lighting up to 250 kWh per quarter, 7½d. per kWh, with proportionately lower prices down to 5½d. per kWh where the consumption is over 10 000 kWh; power, heating and cooking, from 2½d. to 1½d. per kWh, according to consumption.

Tapping New Areas.

Preparations for the installation of an electric plant are being made at STRANORLAR (Co. Donegal).

NORTH WALSHAM Urban District Council is negotiating with Norwich Corporation with regard to a supply of electricity.

PICKERING (Yorks) Urban Council is being urged by the local Labour party to establish an electric light supply for the town.

TIVERTON Mercantile Association has passed a resolution, impressing on the Town Council the urgency of dealing with the electric lighting problem.

SIDMOUTH Urban Council has decided to apply for a loan of £8 800 for carrying out an electric lighting scheme. The original estimate was £12 000.

WORKINGTON Town Council has decided to ascertain the probable number of consumers of electricity in the town, together with the quantity, and the price they would be prepared to pay.

FORMBY Electric Lighting Committee has approved the final draft of the agreement with the London, Midland and Scottish Railway Co. for the supply of electricity in bulk to the Council.

At a special meeting of the HENLEY-ON-THAMES Town Council last week it was decided to accept an offer by the Thames Valley Electric Supply Co. to distribute electricity within the borough.

OLDBURY Urban Council has instructed the Gas Manager to arrange with the Shropshire, Worcestershire and Staffordshire Electric Power Co. for a supply of electricity for power purposes.

ARDWICK-LE-STREET proposes to take a supply of electricity in bulk from a local colliery company at a cost of 1¼d. per kWh. It is stated that the price to consumers will not be more than 5d. per kWh.

LUTON Town Council has come to an understanding with Bedford Town Council as to the area to be included in the extension of the electricity undertaking area of supply. A line of demarkation has been agreed upon, which preserves for Luton an area including Woburn, Flitwick, Silsoe, Shillington, Hitchin, and the adjoining part of Hertfordshire, leaving in abeyance the ultimate allocation of Apsley Guise, Ridgmont, Ampthill and Arlesley.

Inquiries and Orders.

The section of the Provisional Order promoted by GREENOCK Corporation dealing with electricity matters is to proceed by way of a private Bill to be heard in London.

At a meeting of the SOUTHWICK (Sussex) Urban Council on March 5th it was announced that the application for an electricity order would go through unopposed, the Shoreham Company having withdrawn its application.

The Minister of Transport proposes to confirm Special Orders authorising the supply of electricity by (*a*) WELWYN Garden City Electricity Supply Co.; (*b*) LYME REGIS Corporation; also a Special Order amending the TEIGNMOUTH Electric Lighting Order, 1915.

Application is being made by a company for Parliamentary powers in regard to a large electricity scheme which is intended to supply many of the towns and villages throughout the LEICESTERSHIRE colliery district, and which has the support of the Coalville Urban Council.

Objections have been received by the Commissioners in respect of the GORSEINON Electricity Order from the Gowerton Gas Co., the Gowerton Parish Council, and the Llanelly and District Electric Lighting and Traction Co. Before the Commissioners come to a decision on the scheme, they will obtain the views of the promoters as to the objections.

The WEST GLOUCESTERSHIRE POWER COMPANY are applying to the Electricity Commissioners for a special order authorising the supply of electricity in Awre, Coleford, Nailsworth, Newnham, Stroud, and Westbury-on-Severn urban districts, West Dean, East Dean, Wheatenhurst, Dursley and Stroud, Thornbury and Lydney rural districts. Objections to the Electricity Commission by April 3rd.

ASHBY-DE-LA-ZOUCH Rural Council has received information that the Midland Electric Light and Power Co. are applying for a special order to enable them to supply electricity for lighting purposes in the Council's area. The Coalville Urban Council has asked the company to extend their mains to the town. The company at present have power to supply electricity in the district for power purposes only. Consent to the application had been deferred pending the arrangement of terms.

LANARK COUNTY COUNCIL have applied to the Electricity Commissioners for Special Orders authorising the generation and distribution of electricity in (1) the Lanarkshire Western area, including portions of the parishes of Glasgow, Cadder, Old and New Monkland, Bothwell, Cambuslang, Rutherglen and Carmunnock; (2) the Holytown, Carfin and Cleland area, including portions of the parishes of Bothwell, Old and New Monkland and Shotts; and (3) the Overtown and Law area, including portions of the parishes of Dalziel, Cambusnethan and Carlupe. Any objections must be sent to the Secretary, Electricity Commission, Whitehall, London, by March 22nd.

Applications for special orders have been made to the Electricity Commissioners by (1) the EGHAM AND STAINES ELECTRICITY COMPANY (extension of area so as to include Feltham and Sunbury urban districts, and East Bedfont, Hanworth, Shepperton and Littleton parishes in Staines rural district); (2) DERBYSHIRE AND NOTTINGHAMSHIRE ELECTRIC POWER COMPANY (to supply electricity in Matlock, Matlock Bath, and Scarthin Nick, North Darley and Wirksworth urban districts, Middleton-by-Wirksworth parish in Ashbourne rural district, Cr mford and Tansley parishes in Bakewell rural district, and Alderwasley, Crich, Dethick Lea and Holloway, Pentrich and South Winfield parishes in Belper rural district); (3) SOUTHAMPTON CORPORATION (to extend area of electricity supply to Eastleigh and Bishopstoke urban district). Objections to the Secretary, Electricity Commission, by March 26th.

Drake and Gorham to Handle American Electric Furnaces.

An arrangement has just been concluded between DRAKE AND GORHAM, LTD., and the ELECTRIC FURNACE CONSTRUCTION CO., of Philadelphia, U.S.A., under which the former has the sole right to handle in Great Britain and Ireland all types of electric furnace and auxiliary apparatus which have been developed in the United States by the Electric Furnace Construction Co. Drake and Gorham, Ltd., will, therefore, be able to supply either designs and specifications or complete furnaces of the arc, resistance and induction type for all industrial purposes, and, in addition, the "Electro" steam boiler constructed in accordance with the designs of Mr. F. T. Kaelin, chief engineer of the Shawinigan Power Co. Drake and Gorham, Ltd., have at the present time a representative in the United States, who is investigating the whole electric furnace position in that country in order that they may have complete and fully detailed information as to the recent progress which has been made in the industry.

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Tenders Invited and Accepted.

UNITED KINGDOM.

STOKE-ON-TRENT CORPORATION.—Four water-tube boilers. Specification, etc., from the Borough Electrical Engineer, St. Peter's Chambers, Stoke-on-Trent.

YORK CORPORATION, March 17th.—Wiring, fittings and lamps for Foss Islands Depot. Specification can be seen at the City Engineer's Office, Guildhall, York.

BRAMLEY GUARDIANS, March 19th.—Electric light wiring and fitting in the Board's offices. Specifications can be seen by applying to the Clerk, 1, Green Hill Road, Armley, Leeds.

STOCKTON-ON-TEES CORPORATION, March 19th.—Low tension, three phase, 4-wire switchboard. Specification from the General Manager, Electricity Works, Thompson Street, Stockton-on-Tees.

BRIGHTON GUARDIANS, March 20th.—Electrical fittings, etc. Tenders forms from the Clerk, Prince's Street, Brighton.

KEIGHLEY GUARDIANS. March 20th.—Connection to electric drive of lift at the Union Hospital. Forms of tender from the Clerk.

PURDYSBURN ASYLUM, BELFAST, March 21st.—Six months' supply of electrical fittings. Tender forms from the Clerk to the Committee of Management.

WEST SUSSEX MENTAL HOSPITAL, CHICHESTER, March 23rd.—Six months' supply of electric lighting sundries. Forms of tender from the Clerk and Steward.

DUBLIN CORPORATION, March 26th.—Open type flare lamp carbons and magazine arc lamp flame carbons, etc. Specifications from the City Electrical Engineer, Fleet Street, Dublin.

ROWLEY REGIS URBAN COUNCIL, March 26th.—Re-wiring in connection with alterations and extensions of the fire alarm system. Specifications can be seen at the Council House, Old Hill, Staffs.

DUBLIN PORT AND DOCKS BOARD, March 27th.—Nine months' electrical supplies. Tender forms from the Secretary, Westmoreland Street, Dublin.

EAST ASHFORD (KENT) RURAL COUNCIL, March 28th.—Electric light installation at the Isolation Hospital, Willesbrough. Tender forms from the Surveyor, Albemarle Road, Willesbrough.

MANCHESTER WATERWORKS COMMITTEE, April 7th.—Supply, and erection at Lastock booster house, near Bolton, of two 300 kW rotary converters, with static transformers, switchgear, etc. (contract No. 2), and four electrically driven centrifugal pumps to deliver 3 000/4 000 gallons per min. against a head of 40/90 ft. switchgear pipes, etc. (contract No. 3). Specifications from Secretary, Waterworks Offices, Town Hall, Manchester.

BELFAST CORPORATION, April 9th.—Continuous current switchgear for substation. Specification (No. 8) from the City Electrical Engineer, East Bridge Street, Belfast.

COUNTY OF LONDON ELECTRIC SUPPLY CO., April 10th.—Complete piping equipment for Barking power station. Specifications from Mr. F. C. McQuown, Manager and Secretary, Moorgate Court, Moorgate Place, E.C.

GREAT INDIAN PENINSULA RAILWAY CO, April 24th.—(1) Transformers, (2) cables, (3) switchgear and accessories, (4) converter sets. Specifications from the Secretary, 48, Copthall Avenue, London, E.C.2.

ARGENTINA.

ARGENTINE BOARD OF SANITARY WORKS, April 26th.*—Nineteen vertical centrifugal pumps, driven by electric motors, for various sewage pumping stations.

AUSTRALIA.

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, April 3rd.*—Wheatstone and other telegraph tape papers.

POSTMASTER GENERAL'S DEPARTMENT, ADELAIDE, May 16th.*—Telephone apparatus (Schedule S.A. 641).

BELGIUM.

SAINT GILES (BRUSSELS) MUNICIPALITY, March 24th.*—Armoured cables.

INDIA.

EAST INDIAN RAILWAY CO., March 28th.—(1) Electric overhead travelling cranes, (2) wheel lathes. Specifications from the Secretary, 73-76, King William Street, London, E.C.4.

SOUTH AFRICA.

JOHANNESBURG MUNICIPALITY, March 27th.*—5 000 yards three-core paper insulated, lead covered, steel tape armoured cable.

PORT ELIZABETH CITY COUNCIL, April 16th.—(*a*) 3 000 kW turbo alternator; (*b*) boilers, coal hoppers, coal conveyor, steam and feed water pipes, steam traps, etc.

CAPE TOWN CORPORATION, April 18th.*—Oil cooled transformers.

BURNLEY CORPORATION have accepted the tender of the Enfield-Ediswan Cable Co. for 3 600 yards of cable, £635 10s.

Mather and Platt have a contract for the supply of a 1 500 kW rotary converter to CARDIFF CORPORATION, at £4 436 4s.

YARROW AND CO. have a contract for water-tube boilers for the COUNTY OF LONDON ELECTRIC SUPPLY COMPANY'S Barking power station.

* Particulars from the Department of Overseas Trade.

The tender of the General Electric Co. has been accepted by BURY CORPORATION for an air filter for the 6 000 kW generator at Chamber Hall power station.

For electrical work at FARNHAM AND HARTLEY WINTNEY DISTRICT SCHOOL, Crondal, the tender of the Perfecto Electrical Co., £869 10s., has been accepted.

The English Electric Co. have secured a contract for equipment required for the electrification of the first section of the GREAT INDIAN PENINSULA RAILWAY.

ILFORD Urban Council have accepted the following tenders:—Hackbridge Cable Co., e.h.t. cables; Western Electric Co., l.t. cables; British Insulated and Helsby Cables, Ltd., feeder pillars.

The UNDERGROUND ELECTRIC RAILWAYS COMPANY OF LONDON have placed with James Carmichael contracts, amounting to £21 000, for construction of stations at Brent and Hendon, on the Edgware extension of the Hampstead line.

The tender of the General Electric Co. for a rotary converter transformer switchboard, etc., £1 575 15s.; and that of Callender's Cable Co. for low tension d.c. feeders, £757 8s. 4d., have been accepted by SUTTON COLDFIELD CORPORATION.

For a magnetic separator required in connection with clinker crushing plant by LEWISHAM (LONDON) COUNCIL the tender of the Igranic Electric Co. (£107 17s.) is recommended for acceptance. The Rapid Magnetting Machine Co. tendered at £148 15s.

The following tenders for annual supplies of materials are recommended for acceptance by LIVERPOOL CORPORATION:—Callender's Cable and Construction Co., cables and accessories; Liverpool Electric Cable Co. and Macintosh Cable Co., insulated cables and wires.

SALFORD CORPORATION are recommended to accept the following tenders: W. Rawson and Co., wiring and fitting at the Corporation's baths, £301; W. T. Glover and Co., 500 yards three core l.t. cable. £265; W. T. Glover and Co., 5 000 yards l.t. cable, £599, and 1 600 yards e.h.t. cable, £1 000.

ROCHDALE CORPORATION have accepted the following tenders:—British Electric Transformer Co., two 4 000 kVA bulk supply transformers and one main voltage regulator; British Thomson-Houston Co., switchgear and alteration to e.h.t. switchboard; Ferranti, Ltd., 100 kVA and 150 kVA three-phase transformer; G. L. Adamson, change over of d.c. motors to a.c.

TORQUAY CORPORATION have accepted the following tenders:—British Insulated and Helsby cables, e.h.t. transmission cables, from Newton Abbot Power Station to Torquay, £14 701 17s. 6d.; British Electric Transformer Co., three-phase to two-phase transformers, £1 967 2s.; Aiton and Co., pipes and valves, £2 595 10s.; Cole, Marchent and Morley, Ltd., circulating water pumps, £1 447.

Institution Notes.

The annual exhibition of students' work will take place at the BOROUGH POLYTECHNIC INSTITUTE to-morrow (Saturday) afternoon.

The annual dinner of the SCOTTISH CENTRE OF THE INSTITUTION OF ELECTRICAL ENGINEERS took place on March 5th, at the Central Station Hotel, Glasgow.

Mr. J. Bell, of the Metropolitan-Vickers Radio Research Department, is lecturing to-night (Friday) before the BIRMINGHAM AND DISTRICT ELECTRIC CLUB.

The sixth annual general meeting of the LONDON "SAFETY FIRST" COUNCIL takes place at the Mansion House this afternoon (Friday). The Lord Mayor is to preside.

The meeting of the LONDON STUDENTS' SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS, which was to have been held on March 23rd, has been posponed to a later date.

A paper on "Low-Head Hydro-Electric Plants of Moderate Capacity" was read last week before the Irish Centre of the INSTITUTION OF ELECTRICAL ENGINEERS by Mr. S. E. O'Grady.

Mr. G. Morgan, chief assistant engineer and manager of the Corporation Electricity Department, has been appointed chairman of the ELECTRICAL SOCIETY OF GLASGOW for the ensuing year.

The annual general meeting of the INSTITUTE OF PATENTEES will take place on March 21st, at 2.30 p.m., in the offices of the National Union of Manufacturers, 6, Holborn Viaduct, London, E.C.1. The annual dinner will be held on the evening of the same day.

The BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE recently acted in co-operation with a number of other "travelling" societies in requesting the railway companies to revert to the pre-war practice of granting return tickets at single fare and one-third to members attending meetings, on presentation of a voucher. The association has now been informed that in connection with its next annual meeting, in Liverpool, from September 12th to 19th, this concession will be made by the companies.

On Tuesday evening Mr. B. B. Dudding, of the General Electric Co.'s research staff, lectured on "Incandescent Electric Lamps" before the NATIONAL ASSOCIATION OF SUPERVISING ELECTRICIANS. Mr. Dudding dealt with the evolution of the modern electric lamp, and described the research work which has been, and is being, done on the materials used in its manufacture. He said that the limit in the development of the vacuum lamp had almost been reached, while in the gasfilled lamp the mechanical strength of the filament wires was the limiting factor.

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Electric Traction.

Tramway Extensions and Developments.

LINCOLN City Council has decided not to run trams on Sundays.

Trams are now running on the new route between HUDDERSFIELD and BRIGHOUSE.

EXETER Tramways Committee is recommending the doubling of the tramway track in the High Street.

ABERDEEN CORPORATION has been approached by the Aberdeen Suburban Tramways Co., with reference to the purchase of the undertaking. Negotiations took place previously in 1915 and 1916.

At BOLTON Town Council, on March 7th, reference was made to the decision of the Tramways Committee not to extend the Brownlow Fold trams for the present, but it was stated that the matter would be considered again six months hence.

The Town Clerk of SOUTH SHIELDS has been instructed to communicate with the Town Clerk of Sunderland and ascertain if the Sunderland Tramways Committee are willing to receive a deputation to discuss the question of extending the tramways from Cleadon to join the Sunderland tramway service.

A "Birmingham Post" correspondent states that the Birmingham trackless tram system has caused much discussion in Northern Lancashire, particularly in those districts in which the local authorities contemplate an extension of their tramway systems. It is likely that in the near future a number of towns will follow Birmingham's example. At BURNLEY the Tramways Committee has been authorised to draw up tentative proposals. At LYTHAM ST. ANNES the authorities have considered the Birmingham scheme, and though it is not likely to be adopted at present, the Tramways Committee is retaining the full report pending the renewal of the present track.

Fares, Receipts and Passengers.

As an experiment, ROTHERHAM City Council has decided to reduce tram fares from 1½d. to 1d. per mile for three months.

The receipts from the READING Corporation tramways from April 1st, 1922, to February 1st last were £66 678 4s. 11d., compared with £69 212 9s. 2½d. for the corresponding period of the previous year.

Penny fares are to be reinstated on certain sections of the WEST HARTLEPOOL Corporation tramways. The Corporation has decided to promote a Bill in Parliament empowering them to provide and work trackless trams in the borough and on certain routes in the neighbourhood of the borough.

A re-introduction of penny fares was suggested in debate on the READING Corporation Tramways last week, but the Council decided to postpone the matter until the manager's annual report is presented. It was stated that if the reduction was carried the trams would have to carry 3 903 477 additional passengers to get the same revenue.

Hours and Wages Questions.

At a meeting of the LEEDS City Council last week, some discussion took place on a proposal to reduce the tramwaymen's wages by a farthing an hour (or a shilling a week), the Labour representatives claiming that this had become recognised as part of the men's basic wages. Alderman Smithson, chairman of the Committee, said the extra shilling was an *ex-gratia* payment, outside the national award, given to the men because a number of other Yorkshire authorities had given it. Some of those authorities had now withdrawn it. An amendment to refer the subject back was defeated.

Electrically Driven Ferry Boats.

Experiments with electrically driven ferry boats on the Mersey are likely to be made by the WALLASEY Ferry Authorities, says the "Liverpool Daily Courier." Mr. James-Scott, chairman of the Bootle Electric Power and Lighting Committee, was recently invited to give an estimate of the cost of adapting one of the ferry steamers for propulsion by electricity. The machinery would be on similar lines to that installed in submarines.

A "Better Sales Association" has been formed at CARDIFF for the purpose of giving men and women, whose profession is selling, a better knowledge of window and counter display work and salesmanship in its various branches.

The fourth Bohemian concert of the ELECTRICITY SUPPLY COMMERCIAL ASSOCIATION (Greater London Division) will be held at Anderton's Hotel, Fleet Street, London, E.C.4, on April 13th, at 7.45 p.m. Mr. D. C. Clark will occupy the chair.

The second annual dinner and reunion of PAST EMPLOYEES OF R. W. PAUL, late of New Southgate, was held at the Prince's Salon, Holborn Restaurant, on March 3rd. An enjoyable evening was spent, and the musical programme was augmented by a wireless concert, the apparatus being kindly lent by H. W. Sullivan, Ltd., for the occasion. Past employees of R. W. Paul who were not notified on this occasion are requested to communicate with F. Stroude, 20, Lea Bridge Road, London, E.5, to ensure receiving notice of future events.

Wireless News.

Views on the Government's Wireless Decision.

Mr. Bonar Law's announcement of the Government's policy with regard to the IMPERIAL WIRELESS QUESTION appears to have given general satisfaction in the Empire. The Cape Town Correspondent of "The Times" says: "The announcement that the British Government have decided to issue licences for the erection of wireless stations to communicate with the Dominions, and also to erect a State-owned station capable of such communication appears to have completely satisfied local demands."

So far as Australia is concerned the Premier's announcement is welcomed because it removes uncertainty and does away with the necessity for further delay in the completion of the Commonwealth Government's scheme for direct wireless between Australia, America, Great Britain, and other countries. According to the Sydney correspondent of the "Daily Telegraph," Sir William Vicars, chairman of the Amalgamated Wireless Co., in which the Government holds a half interest, has expressed his delight at Mr. Bonar Law's announcement, since it brings a stage nearer the complete realisation of the scheme initiated by the Australian Government for uniting the different parts of the Empire by a system of wireless stations communicating for commercial purposes.

Re-Radiating Paris Time Signals.

The Manchester station of the British Broadcasting Co., now RE-RADIATES NIGHTLY THE TIME SIGNALS from the Eiffel Tower at 10.44 p.m. These signals are of great importance to the mercantile marine and others, and it has been felt for some time that to re-radiate them on a broadcasting wave-length would be a great convenience to the general public. The Paris station works on a wave-length of 2 600 m, and the Manchester station receives the messages on that wave-length and transmits them on its own wave-length of 385 m. This is done automatically by the electrical connection of the receiver to the transmitter. The delay introduced is very small, the re-transmitted signal being only 1/300 part of a second behind the original. The aerial used for receiving Paris is a small one running almost directly underneath the main transmitting aerial at Trafford Park. Furthermore, the receiver used is installed only a few yards from the high-power transmitter which is passing on the signals on the broadcasting wave-length. The engineers of the Metropolitan-Vickers Electrical Co., are to be congratulated upon what they have done in the way of achieving selectivity of reception.

The Manchester Exhibition.

THE MANCHESTER ALL-BRITISH WIRELESS EXHIBITION and Convention opens at the Burlington Hall to-morrow (Saturday) for a week. The exhibition has been organised at the request of the Manchester Wireless Traders' Association. The Convention is being held under the auspices of the Manchester Wireless Society. Some thirty firms are exhibiting and steps are being taken to appeal to the interests of the purchasing public by means of practical demonstrations, displays and lectures.

Miscellaneous Wireless Items.

The Scotland Yard "Flying Squad" is experimenting with WIRELESS TELEPHONY INSTALLATIONS on small motor vans.

High speed automatic receiving apparatus has just been fitted to the White Star Line "Majestic" by the MARCONI INTERNATIONAL MARINE COMMUNICATION CO. During the ship's first voyage to New York with the apparatus, messages were recorded at high speed over a distance of 700 miles.

We are informed by the STERLING TELEPHONE AND ELECTRIC CO. that the Capitol Cinema, Cardiff, has been equipped exclusively with "Magnavox" loud speakers. This cinema is said to be the largest in Great Britain, having a seating capacity of over 3 000, and owing to the efficiency of the equipment the wireless concerts can be heard in every seat.

A Wireless Joke.

On March 9th, the staff of the NEWCASTLE-ON-TYNE ELECTRIC SUPPLY CO. held their annual smoking concert in the Crown Hotel, Newcastle. Mr. J. S. Watson occupied the chair and some 200 members attended. The function proved a great success.

A feature of the evening was a pseudo nine-valve wireless receiving set, the equipment of which was very complete, if not very compact. Concertina expansion joints were provided in the aerials, a large diameter wooden pulley fitted with a weathercock served as a tuning coil, a large size grease cup was employed as a crystal holder, and the grid resistance was recorded on a converted ammeter, the movement of which appeared suspiciously mechanical. With the aid of a microphone, a power amplifier and a loud speaker, a speech from a gentleman in the next room was distinctly received except when most realistic representations of atmospherics and inductance intervened. The interference of the Cullercoats station spark set sending in Morse code was most pronounced!

A dinner to celebrate the twenty-fifth anniversary of the foundation of the RONTGEN SOCIETY was held yesterday (Thursday) at the Hotel Cecil, London, W.C.

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Companies' Meetings, Reports, etc.

METROPOLITAN-VICKERS ELECTRICAL CO.—Dividend recommended on the ordinary shares of 12½ per cent. less tax, for the year.

STEWARTS AND LLOYDS, LTD.—Dividend recommended of 2s., plus bonus of 6d., per share on the deferred shares, placing £100 000 to reserve, £10 000 to employees' benefit fund and carrying £150 000 forward. The sum of £70 000 is set aside for depreciation.

BRUCE PEEBLES AND CO.—Following the dividend announcement (10 per cent. plus 5 per cent. bonus), the accounts show that the profit for 1922 was £101 642, including £6 487 brought in. Appropriations include £25 000 to taxation reserve account, £6 000 to depreciation reserve account, £34 141 to goodwill account, with £7 025 carried forward.

Cables and Telegraphs.

DIRECT SPANISH TELEGRAPH CO.—Dividends recommended for 1922 of 10 per cent. on the preference shares, less tax, and 10 per cent. on the ordinary shares, free of tax.

BRITISH INSULATED AND HELSBY CABLES.—Final dividend on the ordinary shares of 6¼ per cent. and a bonus of 5 per cent., making a total distribution of 15 per cent. for the year (the same as for 1921). A sum of £95 000 is placed to reserves and depreciation (against £35 000), and £390 000 is carried forward (against £362 223).

EASTERN EXTENSION AUSTRALASIA AND CHINA TELEGRAPH CO. and EASTERN TELEGRAPH CO.—Owing to delays in obtaining the necessary returns from foreign stations and administrations, it will be impossible to issue the Accounts and Balance Sheet for 1922, in time for the annual meeting, to be held in May, but the Directors will convene the meeting as soon as the full accounts can be submitted. Meanwhile, the Directors of both companies have decided to pay a final dividend for 1922 of 2½ per cent. free of tax, making 10 per cent. free of tax, for the year.

Supply and Lighting.

NOTTING HILL ELECTRIC LIGHTING CO.—Final dividend proposed on the deferred shares of 6s. per share, free of tax, making 10s. per share, carrying forward £15 132.

MIDLAND ELECTRIC CORPORATION FOR POWER DISTRIBUTION.—Final dividend of 6 per cent. on the ordinary shares, making 10 per cent. for the year (the same). A sum of £44 000 (against £30 604) is to be carried forward after providing for depreciation and reserves.

NEWCASTLE AND DISTRICT ELECTRIC LIGHTING CO.—Dividend recommended of 5 per cent., less tax, for 1922, carrying forward £14 034. The net profit, after charging interest on debentures and loans, allowing £12 500 for depreciation and placing £4 000 to general reserve, was £11 279 plus £13 725 brought forward, making £25 004. A further sum of £4 480 of second mortgage debentures has been redeemed and loans amounting to £4 528 have been repaid. During the year £53 600 third mortgage debentures were issued and allotted

CITY OF LONDON ELECTRIC LIGHTING CO.—Dividend proposed of 2s. per share on the ordinary shares, making 15 per cent. for the year, less tax, compared with 14 per cent. for 1921, carrying forward £30 230. The available balance, including £29 844 brought forward, was £355 936, compared with £262 685 in 1921. After meeting debenture stock and other interest, the directors have placed to a dividend equalisation fund £30 000, to general reserve £100 000, against £85 000 last time, to alteration of consumers' appliances £15 000, to leasehold redemption £5 000, and to the benevolent fund £10 000.

CHELSEA ELECTRICITY SUPPLY CO.—The profit for 1922 amounted to £60 738 (as compared with £43 437 in 1921), while £415 was brought forward, which, together with £2 820 received as interest, makes a total of £63 973. After deducting debenture interest (£4 260) and allowing for interim dividends paid, there is a balance of £48 926. It is proposed to place £17 000 to reserve for renewals, depreciation, and contingencies, £10 000 to reserve fund, and to pay a final dividend on the ordinary shares of 6 per cent., making 10 per cent. for the year (against 6 per cent. in 1921), leaving £6 195 to be carried forward. At an extraordinary general meeting on March 21st, resolutions will be submitted authorising the sub-division of each of the existing £5 shares into five shares of £1 each.

COUNTY OF LONDON ELECTRIC SUPPLY CO.—The report for 1922 shows that the revenue, after deducting generation and distribution costs, rents, taxes, etc., amounted to £521 709 (against £342 201); the sum of £21 788 was brought forward, making £543 557 available. Loan charges, including £29 999 (against £25 000) written off expenses and discount of 1921 debenture issue, require £99 084, while reserve appropriations—£20 000 (unchanged) to reserve for taxation, £50 000 (against £60 000) to reserve for depreciation, and £242 500 (against £100 000) to general reserve—amount to £312 500, leaving £131 973. To this is added £5 226 interest on capital to "Banking supply." The preference dividend (including that in the partly-paid shares) will take up £30 443; the dividend of 10 per cent. (against 8 per cent.) on the fully-paid ordinary shares will absorb £55 739, while the proportionate dividend of 10 per cent. on the partly-paid ordinary shares will need £2 800, the total distribution leaving £48 218 to be carried forward. The report states that the number of units sold during the year showed an increase of 7 021 679 at 58 241 758.

New Companies.

W. A. C. SMITH, LTD.—Private. Reg. March 1st. Cap. £5 000 in £1 shares. Electrical and mechanical engineers, etc. Reg. office: 59, Bath Street, Glasgow.

THOMPSON MANUFACTURING CO., LTD.—Private. Reg. March 2nd, Cap. £1 000 in £1 shares (250 8 per cent. non cum. preference and 750 ordinary). Manufacturers of scientific instruments, electrical and other engineers, etc. Reg. office: Water Lane Works, Richmond, Surrey.

RADIO STOCKS, LTD.—Private. Reg. March 5th. Cap. £250 in £1 shares. Electricians, engineers, manufacturers and workers of and dealers in wireless telegraphy and apparatus, accessories and spare parts, etc. Reg. office: 7–9, Cranbourn Alley, Cranbourn Street, London, W.C.

LONDON UNIVERSAL ADVERTISING SERVICE, LTD.—Private. Reg. March 5th. Cap. £2 000 in £1 shares. Advertising contractors, particularly by means of electric and other illuminated signs, etc. Solicitors: Swepstone, Stone, Barber and Ellis, Broad Street House, New Broad Street, London, E.C.2.

T. C. GILBERT AND CO., LTD.—Private. Reg. March 6th. Cap. £5 000 in £1 shares. To take over the business of electrical engineers, carried on by T. C. Gilbert and P. A. Bennett at 36, Cheriton Road, Folkestone, and elsewhere as "T. C. Gilbert and Co." Reg. office: 36, Cheriton Road, Folkestone.

SHAFTESBURY WIRELESS AND ENGINEERING CO., LTD.—Private. Reg. March 7th. Cap. £500 in £1 shares (400 participating preference and 100 founders). The objects are as indicated by the title. H. R. Watson, 33, Lyndhurst Terrace, Effra Road, Wimbledon, S.W., electrical engineer, is a director.

ELLIOTT AND MCCARTHY, LTD.—Private. Reg. March 3rd. Cap. £100 in £1 shares. Consulting, radio and general engineers, manufacturers of and dealers in wireless apparatus and accessories, etc. A. J. P. McCarthy, 25, Dalebury Road, Wandsworth Common, S.W.17, electrical engineer, is a subscriber.

CRYSTAL ENGINEERING CO., LTD.—Private. Reg. March 8th. Cap. £5 000 in £1 shares. Manufacturing electrical engineers, makers of and dealers in electrical apparatus; instruments and accessories for medical, surgical, telephone, telegraphic, wireless and scientific purposes, etc. Reg. office: 1a, Adelaide Road, London, N.W.3.

SAMOILOFF'S LIGHTING SCHEME, LTD.—Private. Reg. March 6th. Cap. £1 000 in £1 shares. To adopt an agreement with A. Samoiloff and to carry on the business of installers and suppliers of lighting schemes for scenic, stage, bioscope, and cinematograph effects, and for advertising and publicity purposes, etc. Reg. office: Cranbourn Mansions, Cranbourn Street, London, W.C.2.

REFTY ELECTRICAL APPLIANCES, LTD.—Private. Reg. March 8th. Cap. £1 300 in 1 100 10 per cent. participating preference shares of £1 each and 4 000 ordinary shares of 1s. each. To acquire and turn to account certain patent or other rights relating to an electrical device known as "Refty's Terminals." Solicitor: K. E. Bartlett, 11-12, Fenchurch Street, London, E.C.

Business Items.

M. B. MACRAE AND CO., wireless dealers, have opened premises at 12, Friar Street, Reading.

The telephone number of L. G. HAWKINS AND CO. has been changed from Regent 2294 to Regent 6537 and 6538.

MR. W. J. MORAN, electrical goods dealer, of 98, Lansdown Road, Swindon (Wilts), has taken new premises at 150, Victoria Road.

MURKETT BROS., Huntingdon, have opened in connection with their business an electric lighting department under the management of Mr. P. Hippins.

A leaflet has been issued by HERBERT TERRY AND SONS describing their presswork. The firm intimate their willingness to undertake the manufacture of special parts in confidence.

A firm of agents in Christchurch desire the sole representation in NEW ZEALAND of British manufacturers of electric fittings and accessories, electric glassware and lamps. Particulars from the Department of Overseas Trade, quoting reference number 316.

The hydro-electric department of SIR W. G. ARMSTRONG, WHITWORTH AND CO., has been moved from 8, Great George Street, to 51, Victoria Street, London, S.W. The new telephone number is Victoria 1761, and the telegraphic address is Ubiquity, Sowest, London.

The Commissioners of Customs and Excise announce that, as from April 1st, traffic with the IRISH FREE STATE, whether by sea or across the land boundary between the Free State and Northern Ireland, will for all purposes be imports and exports subject to the Customs laws and regulations applicable to overseas trade.

H.M. Commercial Secretaries at Rome have compiled a report on TRADE OPPORTUNITIES IN ITALY. They state that electrical fittings, insulating cloth, iron alloys for transformers and motors, copper wire, silk and cotton for binding, and insulating varnish, sell in small quantities. German competition is dangerous, but in many cases it has been found that goods do not conform to sample. In electric fittings generally Italy can compete successfully, and in some cases sell as much as 20 per cent. cheaper.

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Commercial Intelligence.

Deed of Arrangement.

BAZLEY, George Edward, and BOLTSA, Sam Harry, trading as G. E. BAZLEY AND CO., 6A, Cromford Court, Corporation Street, Manchester, electrical suppliers. Filed March 8th. Trustee, A. T. Eaves, 15, Fountain Street, Manchester, C.A. Liabilities unsecured, £2 018; assets, less secured claims, £1 064. The following are creditors: Telga, N. V., Ltd., London, £87; Vulcan Electric and Mechanical Co., Ltd., London, £107; B.T.T. Lamp Co., Ltd., London, £99; Electric Heating and Hardware, Ltd., Birmingham, £113; Halkbridge Cable Co., Ltd., Halkbridge, £67; General Cable Manufacturing Co., Ltd., Leatherhead, £57; Metropolitan-Vickers, Ltd., Manchester, £59; O'Brian and Co., Manchester, £55; Reynard Electric Co., Manchester, £60; Underwood (Manchester), Ltd., Manchester, £78; Ashworth and Smith, Manchester, £282; British Thomson-Houston Co., Ltd., Rugby, £68; Cable Accessories Co., Ltd., Tipton, £128.

Mortgages and Charges on Limited Companies.

[NOTE.—**The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.**]

BARRON (ROBERT), LTD., Fleetwood, electrical engineers. Registered February 28th, charge, to bank; charged on property in Station Road, Fleetwood.

TRIUMPH ELECTRIC MANUFACTURING CO., LTD., Birmingham. Registered February 26th, £6,000 debenture, to W. L. Topple, Hermon House, Wylde Green, engineer; general charge.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

LEE (ALBERT) AND CO., LTD. (in voluntary liquidation), lighting accessories merchants, 8–9, New Zealand Avenue, London, E.C.1, and at Newcastle and Glasgow. Mr. Thomas Keens, of Keens, Shay, Keens and Co., the liquidator of the above company has issued the following circular to the creditors: "At the meeting of creditors held on July 24th last (see ELECTRICIAN, 28/7/22, p. 116), an intimation was made that a scheme was in contemplation and that active negotiations in respect thereof were in progress. The basis of the scheme was the sale of the lease and goodwill of the business at New Zealand Avenue to a new company in which a certain firm, for whom the old company acted as agents, were to be largely interested. The consideration was to include a large sum of cash to the Receiver, a further sum to the liquidator to provide a cash composition for creditors of £50 and under, and an allotment of deferred shares to creditors whose debts exceeded this amount in proportion to their claims, and entitling the holders to 60 per cent. of the profits of the new company. The promoters of the new company were quite willing at the time to enter into this scheme, although there were no obligations upon them, morally or legally, to do so. Owing, however, to the opposition of certain foreign creditors to the scheme, and the threat to oppose before the Court, considerable delays took place, and ultimately the firm who were to provide the money withdrew from the negotiations, and the scheme was finally abandoned. The present position is that the Receiver for the debenture holders is still in possession of the assets of the company. He has sold the lease and goodwill of New Zealand Avenue, for cash at a price which I consider a fair one to a new company called Albert Lee and Co. (1923), Ltd. The remainder of the assets are being disposed of by the Receiver in the ordinary course, but it is understood that the realisations are not likely to amount to a sum sufficient to clear the debentures of the company. Consequently, there is no prospect of a dividend for the unsecured creditors. For this reason it is a matter of deep regret to the committee of inspection and to myself, who have laboured whole-heartedly to bring about the scheme, that the arrangements have broken down.

RADIO SERVICE CO., LTD., wireless instrument manufacturers and dealers, 62, Oxford Street, London, W. At the statutory meeting of creditors the voluntary liquidation of this company was confirmed with Mr. Maurice Hyams, C.A., 60, Chancery Lane, as liquidator, and an informal committee was appointed consisting of the representatives of the Telephone Manufacturing Co. (creditors for £162), the L.P.S. Electrical Co. (£90), and the Sterling Telephone Co. (£84). The statement of affairs showed ranking liabilities of £1 079, and assets estimated to realise £465. The company was registered on August 15th of last year with a nominal capital of £1 000, of which £500 had been issued and was all subscribed for in cash. The present liabilities included claims by the directors for £225 for cash advanced, but they would not prove in respect of those amounts. Since its inception the company had traded at a loss of £1 114. It was feared that the stock would realise badly as it included many odd parts, and for the greater part the sets had not the B.B.C. plates on them. Mr. P. Houston, of Corfield and Cripwell, stated that proxies had been lodged for the appointment of Mr. W. A. J. Osborne as joint liquidator, but he thought it would be best if no application was made to the Court, but an informal committee of creditors appointed to investigate any matters with the liquidator.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-up.

ANODO WIRELESS AND SCIENTIFIC INSTRUMENTS, LTD.—Order made, March 13th.

Companies Winding-Up Voluntarily.

APEX ELECTRIC ACCUMULATOR SYNDICATE, LTD. H. T. McConville, 65, London Wall, London, E.C.2, appointed liquidator. Meeting of creditors will be held at 65, London Wall, London, on Wednesday, March 21st, at 12 noon.

STAR ELECTRICAL ACCESSORIES, LTD. H. J. Gittings, chartered accountant, 55, Temple Row, Birmingham, appointed liquidator.

Bankruptcy Information.

LETHERBARROW, Percy Charles, carrying on business as LETHERBARROW BROTHERS, 1, Church Lane, Banbury, electrical contractor. First meeting, March 21st, 12 noon, 1, Saint Aldates, Oxford. Public examination, April 6th, 3 p.m., Town Hall, Banbury.

Notice of Dividend.

HOGG, George James, trading as F. HOGG AND CO., 66, Waterloo Road, Smethwick, electrical engineer. First and final dividend of 1s. 0½d. per £1, payable March 19th, Official Receiver's Office, 191, Corporation Street, Birmingham.

Notice of Intended Dividend.

RIGBY, John Hall, 22, Higher Hillgate, Stockport, electrician. Last day for receiving proofs, March 28th. Trustee: J. G. Gibson, Official Receiver, Byrom Street, Manchester.

Bankruptcy Proceedings.

PARR, Harold, 2, Strawberry Dale Square, and 1, Back James Street, Harrogate, electrician. Receiving order made February 12th. The following are creditors:—Albion Electric Stores, Leeds, £57; Beardsall, W. E., and Co., Ltd., Manchester, £81; Concordia Electric Wire Co., New Lawley, £15; E G.S. Co., Ltd., Leeds, £125; Edison Swan Electric Co., Ltd., London, £47; England Robinson and Co., Harrogate, £21; Electrical Components, Ltd., Birmingham, £19; General Electric Co., Ltd., London, £43; Hart Accumulator Co., Ltd., London, £42; Metropolitan-Vickers Electric Co., Manchester, £56; Rileys, Harrogate, £49.

Prices of Metals, Chemicals, etc.

TUESDAY, March 13.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£75 10 0	—	£1 0 0
Electro Wirebars	,,	£80 15 0	—	£1 5 0
H.C. Wire, basis	per lb.	11¼d.	—	⅛d.
Sheet	,,	11 5/16d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 3¼d.	—	⅛d.
Brass 60/40—				
Rod, basis	,,	7½d.	—	—
Sheet, basis	,,	10½d.	—	—
Wire, basis	,,	11d.	—	—
Pig Iron—				
Cleveland Warrants No. 3	per ton	£6 7 6	7s. 6d.	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 0 0	—	—
Lead Pig—				
English	,,	£30 5 0	—	5s. 0d.
Foreign or Colonial	,,	£29 2 6	—	5s. 0d.
Tin—				
Ingot	,,	£224 15 0	£15 12 6	—
Wire, basis	per lb.	2s. 11d.	2d.	—
Aluminium Ingots	per ton	£105 0 0	£5 0 0	—
Spelter	,,	£36 7 6	—	10s. 0d.
Mercury	per bottle	£11 10 0	£1 5 0	—

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2⅞d.
,, (Roll-Brimstone)—,, £7 15s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.— ,, £26 per ton, £7 10s.
Boric Acid (Crystals). ,, £55 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 4¼d.; plantation 1st latex, 1s. 4½d. to 1s. 4⅝d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Patent Record.

APPLICATIONS FOR PATENTS.

February 26th.

5 483 E. H. Roberts. Safeguarding thermionic valves.
5 513 F. McNally. Electric connections for barometers and thermometers.
5 515 U. Bianchi and P. Smalzi. System for research of mineral electricity.
5 523 W. Howard and A. C. Sandy. Radio instruments.
5 527 Grigg Motor & Engineering Co. and H. Grigg. Incandescent lamps.
5 548 W. S. Dennett. Electric motors.
5 553 Western Electric Co. Public address system.
5 557 W. Dornig. Antennæ for wave signalling.
5 575 G. T. Southgate. Introducing electric energy into a space of action. (8/3/22, U.S.)
5 586 Aktiebolaget Birka Regulator. Thermostatic time switches. (10/4/22, Sweden.)
5 587 British Thomson-Houston Co. (International General Electric Co.). Temperature operated relays.
5 591 Igranic Electric Co. and A. H. Curtis. Motor starters.
5 597 American Radio and Research Corporation. Inductance devices. (24/2/22, U.S.)
5 599 D. D. Benton. Wireless tuner.
5 600 A. Portigliotti. Incandescent lamps.
5 604 General Electric Co., Ltd., and C. J. Smithells. Tungsten wire.

February 27th.

5 628 Switchgear and Cowans and G. H. Neep. Electric circuits on distribution systems.
5 646 Walsall Hardware Manufacturing Co. and A. E. Read. Combined interlocking switches, wall plugs, etc.
5 647 A. E. Davies and H. H. Thompson. Electric inspection lamp.
5 653 C. Bruymis. Switches for heavy currents. (29/7/22, Holland.)
5 690 R. C. Kay. Portable electric lamps.
5 694 E. F. Knight. Electric switches.
5 711 British Thomson-Houston Co. (General Electric Co.). Illuminating devices.
5 712 British Thomson-Houston Co. Selective control. (25/3/22, U.S.)
5 716 E. A. Ashcroft. Electrolysing fused salts of metals and recovering metals and acid radicles.
5 722 Fuller's United Electric Works and L. Fuller. Electric conductors.
5 740 E. K. Muller. Electro-therapeutic apparatus. (9/3/22, Switzerland.)
5 741 Igranic Electric Co., E. J. Brunning, S. R. Wright and A. H. Curtis. Transformers.

February 28th.

5 775 F. Cusworth. Cable armouring.
5 787 G. I. Harris. Inflammable gas testing device for use with miner's electric lamp.
5 790 F. W. Lanchester. Telephone receivers.
5 808 W. Cochrane. Electric advertising machines.
5 816 American Telephone Manufacturing Co. Railway signalling systems.
5 820 Radio Communication Co. and J. Scott Taggart. Signalling systems employing electric oscillations.
5 821 W. H. Deller. Wireless telegraph apparatus.
5 829 M. J. Williams. Electric light bulb.
5 833 H. P. Amphlett and J. E. Lewis. Electric burglar alarms.
5 839 C. Pressland. Wireless telegraphy, etc.
5 843 British Thomson-Houston Co. Frame aerials.
5 844 Western Electric Co. Magnetic measurements. (24/10/22, U.S.)
5 847 A. Della Reccia. Direct current rotary transformers. (27/4/22, France).
5 848 F. P. di Cassibile. Telephone receivers.
5 854 Fabrik Elektrischer Apparate Sprecher and Schuh A.G. Electric traction. (12/7/22, Switzerland.)
5 860 Hobdell, Way & Co. and M. Payne. Electromagnetic transmission of power on vehicles.
5 867 G. Shimadzu. Storage batteries. (1/6/22, Japan.)
5 869 E. Haefely et Cie., A. G. Machine for tightening and smoothing layers of wound insulating material. (9/3/22, Switzerland.)
5 872 H. Jezler and L. Heis. Treating substances in an electric field. (2/3/22, Switzerland.)
5 879 A. Edwards and O. E. Yeo. Holding means for tuning coils.
5 881 Canadian Battery Container Corporation and J. M. Ahlgren. Storage battery containers.
5 890 C. S. Marks (American Smelting, etc., Co.). Electrolytically refining tin bullion.

March 1st.

5 892 J. G. Statter. Time switches.
5 897 T. C. Winfield and R. J. Hall. Cable terminals.
5 908 H. E. Morrish. Telephone exchanges.
5 920 F. H. Elson and J. A. Newby. Wireless telephone receivers.
5 931 A. C. Hammonds. External electric water heater for washing appliances, etc.
5 934 D. Harvie. Electric junction boxes.
5 938 Elliott Bros. (London) and H. H. Elliss. Perforators for automatic telegraphy.
5 951 S. P. Smith. Rotary converters.
5 971 Igranic Electric Co. and S. R. Wright. Wireless apparatus.
5 972 British Thomson-Houston Co. Gas impervious containers.
5 973 Soc. Drault et Raulot-Lapointe. Multiplying tension and converting current of generator, etc. (3/3/22, France.)
5 975 Metropolitan-Vickers Electrical Co., B. Chapman and G. North. Transformers.
5 984 J. Lightfoot. Electric heating apparatus.
6 001 O. Bernfeld and R. M. Heidler. Electric liquid heater.
6 003 A. P. Pehrson and J. Prentice. Electric contacts for rotary electric furnaces, etc.
6 009 Internationalt Radiotelegraf & Telefon Compagni ved Wahnoe and Peters. Cryptographs. (4/3/22, Denmark.)
6 023 C. Seymour, T. E. Goldup and H. G. Hughes. Thermionic valves, etc.

March 2nd.

6 049 W. S. C. Glover. Commutators for ignition systems.
6 064 W. & T. Dickie. Windmill for driving electric generators.
6 066 R. Amberton. Electricity meters.
6 071 Siemens Bros. & Co. and A. Gordon. Automatic transmitters for telegraph systems.
6 072 Electrical Improvements, Ltd., and L. C. Grant. Electric protective systems.
6 075 C. F. Hilton and T. H. Reep. Electric reproducer for gramophones.
6 077 R. McKellen. Device for eliminating distortion of sound in wireless instruments.
6 083 Callender's Cable & Construction Co. and C. W. Kay. Insulated cables.
6 089 E. Mallett. Secondary batteries.
6 091 H. W. Parker. Crystal detector for wireless receiving apparatus.
6 095 F. Barker & Son and E. W. Barker. Crystals for wireless receivers.
6 106 E. G. Pyne. Locking device for incandescent lamps.
6 117 A. G. Langley. Container for wireless receiving apparatus.
6 123 P. W. Willans. Thermionic valve circuits.
6 124 Ges. fur Drahtlose Telegraphie. Loud speaking telephones. (24/8/22, Germany.)
6 126 L. Kamm. Arc lamps for projection.
6 141 Automatic Telephone Manufacturing Co. and R. Bowland. Automatic telephone systems.

March 3rd.

6 160 W. H. Hayes. Extensible mast for aerial wires, etc.
6 165 J. McPherson. Electric welding device for use under water.
6 171 A. Allen. Connecting multiple headphones to wireless receiving sets.
6 193 F. B. Cox. Mechanism for operating electric switches.
6 203 F. Vandenborre. Starting apparatus for motors.
6 207 A. G. Liddaman. Wireless crystal detectors.
6 208 A. G. Liddaman. Holding wireless crystals, etc.
6 213 H. D. Butler. Electric terminals.
6 219 and 6 220 S. O. Cowper-Coles. Manufacture of metallic objects by electro-deposition.
6 223 S. O. Cowper-Coles. Production of metallic tubes by electro-deposition.
6 228 S. O. Cowper-Coles. Electro-deposition of metals.
6 240 Western Electric Co. Electric discharge devices.
6 241 Western Electric Co. Automatic telephone switching. (3/3/22, U.S.)
6 250 A. E. Jones and O. Pordes. Battery units.
6 251 Woodall, Duckham & Jones, South Metropolitan Gas Co., and H. S. Hatfield. Electrostatic separation of particles.

Arrangements for the Week.

FRIDAY, MARCH 16th. (To-day.)

British Electrical Development Association.

12 noon. At the Hotel Cecil, London, W.C. Annual General Meeting.

Radio Society of Great Britain.

6.30 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Lecture on "Accumulators, Dry Cells and the Currents Used in the Reception of Radio Telephony," by Mr. L. F. Fogarty.

Birmingham and District Electric Club.

7 *p.m.* At Grand Hotel, Colmore Row, Birmingham. Lecture on "Radio-Telephony," by Mr. J. Bell. Illustrated.

Junior Institution of Engineers. (North Eastern Section.)

7.15 *p.m.* At Armstrong College, Newcastle. Special Meeting. Paper entitled "Steel Making," by Mr. Hewitson Hall.

Junior Institution of Engineers.

7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecture entitled "Comparative Power Costs." by Mr. C. H. Woodfield.

British Electrical Development Association.

7.30 *p.m.* At Caxton Hall, Westminster, London. Salesmanship Conferences. Lecture on "Showroom and Exhibition Work," by Mr. H. W. Gregory.

Institution of Electrical Engineers. (Scottish Centre). (Students' Section.)

7.30 *p.m.* In Room 149, Royal Technical College, Glasgow. Lecture on "Repairs to Electrical Machines," by Mr. W. Templeton.

SATURDAY, MARCH 17th.

Royal Institution of Great Britain.

3 *p.m.* At the Institution, Albemarle Street, London, W. Lecture on "Atomic Projectiles and their Properties" (Lecture V.), by Sir Ernest Rutherford.

Junior Institution of Engineers (North Eastern Section.)

Visit to Messrs. Hawthorn Leslie's, Newcastle.

MONDAY, MARCH 19th.

Institution of Electrical Engineers. (Western Local Centre.)

At the Public Library, Alexandra Road, Swansea. Lecture on "Domestic Load Building; a few Suggestions on Propaganda Work," by Mr. W. A. Gillott.

Institution of Electrical Engineers.

7 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London, W.C.2. Informal Meeting. Discussion on "The Need for Co-operation between Electrical Manufacturers and Contractors." (Opened by Mr. H. T. Young and a Manufacturer.)

Institution of Electrical Engineers (Mersey and North Wales (Liverpool) Centre).

7 *p.m.* At the Laboratories of Applied Electricity, The University, Brownlow Street, Liverpool. Lecture on "The X-Ray Examination of Materials," by Mr. A. G. Warren.

Institution of Mechanical Engineers. (Graduates' Section.)

7 *p.m.* At the Institution, Storey's Gate, St. James's Park, London. Lecture on "The Walschaert Locomotive Valve-Gear," by Mr. R. C. Bond.

Bradford Engineering Society.

7.30 *p.m.* At the Technical College, Bradford. Lecture on "High Speed Compressors," by Mr. J. M. Walshe.

TUESDAY, MARCH 20th.

The Newcomen Society.

5.30 *p.m.* At Prince Henry's Room, 17, Fleet Street, London. Paper on "The Early History of the Gas Process," by Mr. David Brownlie.

Institute of Transport.

5.30 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Lecture on "Town Planning and re-modelling in relation to Traffic," by Mr. W. S. Richmond and Mr. C. L. Pepler.

Institution of Electrical Engineers (North Western Centre).

7 *p.m.* At the Engineers' Club, Albert Square, Manchester. Lecture on "Permissible Loading of British Standard Paper Insulated Electric Cables," by Messrs. S. W. Melsom and E. Fawssett.

WEDNESDAY, MARCH 21st.

Universisty of London.

5.15 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Lecture on "The Control of the Speed and Power Factor of Induction Motors" (Lecture IV.), by Professor Miles Walker.

Women's Engineering Society.

6.15 *p.m.* At 25, George Street, Hanover Square, London. Lecture on "Scientific Studies of Manual Work" (Motion Study and Vocational Training), by Mr. R. S. Hutton.

Institution of Electrical Engineers (North Midland Centre).

7.30 *p.m.* At the Royal Victoria Hotel, Sheffield. Paper on "Electricity Applied to Mining, etc.," by Mr. E. P. Austin.

Industrial League and Council.

7.30 *p.m.* At Caxton Hall, Caxton Street, London, S.W.1. Lecture on "The Fallacy of Low Wages," by Mr. T. E. Naylor.

FRIDAY, MARCH 23rd.

Institution of Electrical Engineers (South Midland Centre). (Students' Section.)

Lecture on "Temperature Measurements with the Einthoven Galvanometer," by Mr. F. Adcock and Mr. E. H. Wells.

Edinburgh Electrical Society.

8 *p.m.* At Philosophical Institute, 4, Queen Street, Edinburgh. Questions and Answers Night.

Royal Institution of Great Britain.

9 *p.m.* At the Institution, Albemarle Street, London, W.1. Lecture on "Life History of an Alpha Particle from Radium," by Sir Ernest Rutherford.

The Editorial, Advertisement and Publishing Offices of "The Electrician" are at 8, Bouverie Street, London, E.C.4. Telegrams: Benbrotric, Fleet, London. Telephone: City 9852 (6 lines).

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THE ELECTRICIAN

ESTABLISHED 1861.

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CONTENTS.

Notes of the Week	295	The Empire Telegraph and Trade	315
Two Feasts	297	Imperial Notes	316
The Two "Faradays." Illustrated	298	Obituary	316
The Control of the Speed and Power Factor of Induction Motors. Illustrated	302	Personal Items	316
Atomic Projectiles and their Properties. Illustrated	305	Foreign Notes	316
Underfeed Type "F" Multiple Retort Stoker. Illustrated	307	Electricity Supply	317
East of Scotland Electricity District	308	The Socialist Debate	317
Theory of the Three-Brush Dynamo. By M. Bethenod. Illustrated	309	Tenders Invited and Accepted	318
Band Music Distribution at Olympia. Illustrated	310	Forty Years Ago	318
E.D.A. Salesmanship Conference	311	Institution Notes	318
High Speed Alternator Problems	312	Electric Traction	319
Correspondence	312	The B.E.A.M.A. Report	319
E.D.A. Luncheon	313	Wireless News	319
B.E.A.M.A. Dinner	313	Borough Surveyor Praises Electricity	319
Legal Intelligence	314	Companies' Meetings, Reports, etc.	320
Parliamentary Intelligence	314	New Companies	320
I.E.E. Summer Meeting	315	Business Items	320
The Second London Inquiry	315	Commercial Intelligence	321
Manchester Steam Users' Association	315	Prices of Metals, Chemicals, etc.	321
		Patent Record	322
		Arrangements for the Week	322

"The Electrician" "All-Electric" House Competition.

Competitors are reminded that all designs and specifications for "The Electrician" "All-Electric" House must reach this office not later than first post on Thursday next, March 29th.

Easter Holidays.

Owing to the Easter Holidays the Annual Spring Trade Promotion Number of "The Electrician" will be published next week on Thursday instead of Friday.

The Editorial, Advertising and Publishing Offices will be closed from 6 p.m. on Thursday, March 29th, to 9 a.m. on Tuesday, April 3rd.

Notes of the Week.

The Halifax Dispute—A Black Outlook.

Our hope that drastic action would not result from the Halifax Corporation's decision to reduce the wages of their power station staff has not yet been realised. At the end of last week the E.P.E.A. and the employers' representatives met to discuss the question which led to the dissolution of the National Joint Board—namely, whether the E.P.E.A. might enter into agreements with other unions. The employers maintained their former attitude and the negotiations broke down. A visit of a local member of Parliament and an official representing the E.P.E.A. to the Ministry of Labour was equally unsatisfactory in the cause of peace. It was pointed out by Sir David Shackleton that the arrangement between the E.P.E.A. and the workers was one which the employers could hardly be expected to recognise, that the existing salaries were very high, that the proposed reductions would leave them comparatively high, that the E.P.E.A. could expect no public sympathy, that the Corporation regarded the matter as closed and that the Ministry of Labour could only take action if grave inconvenience to the public was likely. We have commented on this extraordinary attitude of the Ministry before. Its effect is rather to help war than peace, and it forces precipitate action when the interventoin of an outside body might, and should, be towards seeking means of agreement. The ballot of the members of the E.P.E.A. has resulted in 86·6 per cent. of the possible number of ballot papers being returned and in 98 per cent. of those voting supporting the executive. As we go to press, we learn that a deputation from the E.P.E.A. was at the Ministry on Wednesday, and that the employers were due to meet there yesterday. We trust that negotiations will result.

Is It Worth It?

On the last occasion when a similar unfortunate situation arose between the E.P.E.A. and their employers we warned the former of the danger of flourishing the strike weapon. On this occasion we reiterate our warning, but add to it a grave adjuration to the employers. In our view a section of the employers are to blame for what has occurred. If extreme measures are taken they will be still more culpable. On a flimsy pretext an attempt was made to prevent the National Joint Board functioning when it was most required —an attempt which unfortunately succeeded. As a result of the stultification of this negotiating body the Halifax trouble has come about. But this dispute is only symptomatic of what may happen all over the country. It is stated that the employers' side of the District Joint Boards are being asked to put forward proposals for the reductions of salaries. These reductions will be considered and a figure will then be decided upon for national approval and enforcement. We hope that this is untrue; for any such policy would be most unwise. In our view drastic wages reductions are economically wrong. It is certain they will be manfully resisted and that as a result the electricity supply industry will be thrown into confusion and the development and recovery of prosperity, which is now being attained, will be severely checked. We ask both sides, Is it worth it? Is it yet too late to reach agreement without first pulling down all that has been so painfully built up?

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The "Faraday" Old and New.

On another page of this issue we give some record of the work of the famous cable ship "Faraday," which was launched nearly fifty years ago and, as we have already announced, has recently retired from service. We also give some details of the equipment of the new "Faraday," which was recently launched at the Jarrow yard of Palmers Shipbuilding and Iron Co., to take the place of her famous predecessor in Siemens Brothers and Co.'s fleet. Of this new ship little need be said. Her construction and equipment bear marks of the experience which was gained in her forbear, and her adventures and her difficulties are before her. We wish her and her owners success and luck, confident that if business enterprise has any influence she will secure both.

A Worthy Record.

At the launching ceremony, Sir William Bull gave a most interesting summary of the "Faraday's" work. Adventure was her lot. The first cable she laid in 1874 is still working under the Atlantic. She gave her name to a shallow spot which was discovered in laying two other Atlantic cables, and, indeed, her life is inseparably associated with the connection of this country with America; and all that that connection implies. In 1895 she transferred her attention to the Amazon, where adventures in shallows still attended her; and, after further work, in 1909 she laid the first Pupin cable across the English Channel. Her war work was as distinguished as her peace operations. In 1915 cables were repaired in the Atlantic, and in 1916, 800 miles of cable were carried to Japan, while two years later repairs were effected during the height of the submarine campaign. Finally, in 1921, she was engaged in work off Mexico and the Cuban coast. We hope that steps will be taken to preserve relics from this historic ship, and that they will be lodged where they can teach lessons both to electrical engineers and to the general public.

Interconnection Alternatives.

Some tests recently conducted on a replica of the main transmission line of the Pacific Gas and Electric Co. indicate that short-circuit currents of considerably greater magnitude than had been expected will be encountered when several large generating stations are interconnected. We have not yet reached the stage of using 110 kV or 220 kV in this country, but the same problem, though in a less degree, will soon have to be faced and the conclusions arrived at will therefore be of interest. Though switches can be built to interrupt the currents generated this is not considered so economical as to divide the system into sections, either operated entirely separately or interconnected at one point only. In the latter case means must be provided at the point of interconnection to localise the trouble and the number of "short-circuit" switches can be materially reduced. To operate the system in independent sections is to sacrifice a certain proportion of economy, and for that reason the former method seems preferable, especially as, except under very extraordinary conditions, it should be possible to ensure continuity of supply practically everywhere.

The Voltage Regulation Question.

Another interconnection problem is, of course, that of voltage regulation and it is obvious the more this can be effected without dealing with very high pressures or handling large amounts of power the greater will be both the mechanical and electrical advantages. An ingenious method of performing this regulation is that adopted by the Clyde Valley Electric Power Co. on the 33 000 V interconnection which joins the two portions of their system which are separated by the Glasgow Corporation's area. This consists of an auxiliary transformer the primary of which is a tapping of a few turns for the main transformer. The low tension secondary of the auxiliary transformer is provided with a regulating switch and with a reversing switch and is connected to a step-up transformer so that pressure can be added to or subtracted from the main voltage to give the equivalent of a 10 per cent. regulation in five steps. The actual regulation is affected by foolproof automatic equipment and the current is limited to 300 A.

Corporation Profits Tax.

Every inhabitant of this country is looking forward with expectation and apprehension to the Budget. It is known that Government expenditure has been reduced and the revenue returns are satisfactory. Will these movements result in an alleviation of taxation? We certainly hope they will, and that the earliest possible opportunity will be taken to abolish the Corporation Profits Tax. This tax cannot be defended in principle, its incidence is unfair, and it allows the affairs of private bodies to be interfered with by bureaucrats. In a time of boom it prevented depression being allowed for by the usual business methods, and owing to the general restriction of trade it has caused it is altogether bad. We see that Mr. W. Clare Lees, president of the Manchester Chamber of Commerce, while admitting that the Corporation Tax is unjust and inequitable, would prefer a reduction in income tax rather than an abolition of the Corporation Tax; that is if he cannot have both. We cannot agree. The income tax falls upon all with the exception of a few privileged bodies such as co-operative societies, the Corporation Tax operates only against one class of the community, a class, too, which in the present state of the country's trade deserves every encouragement.

Clashing Events.

It was most unfortunate that the joint meeting of the Institution of Electrical Engineers and of the Royal Institute of British Architects and the annual dinner of the British Electrical and Allied Manufacturers' Association should have been fixed for the same evening. For ourselves, long experience has led us to regard with resignation this avoidable clashing of important functions; nevertheless, we still look forward to the time when it will not be necessary at this time of year for the editorial staffs of technical papers to divide themselves into small pieces, so that meetings, dinners, and other gatherings which take place on the same evenings may be adequately covered. Fortunately, owing to the long list of speakers at the joint meeting, it was found advisable to adjourn the discussion until yesterday, and a full account both of the papers themselves and of the remarks thereon will therefore appear in our next issue. We look upon co-operation between the electrical engineer and the architect as being essential to proper domestic electrical development. Co-operation for this purpose may be defined as appreciating each other's difficulties. Writing before the event we hope that the discussion will be directed to this end. It rather fell short of it the other night.

The Salesmanship Conferences in Retrospect.

The last of the Salesmanship Conferences arranged by the British Electrical Development Association was held on Friday. The last, that is, for the present session; next year we are promised an improved and more extended programme whose results we hope will also be improved and extended. The subjects dealt with were varied, ranging from lighting to relations with the Press, and from cookers to salesmanship, *qua* salesmanship, as an art. Some excellent suggestions were put forward, and some of the best of them, and some of the worst, too, were repeated more than once. We do not object to this, for has it not been said that reiteration is the soul of propaganda? The point, however, we wish to make is this: These conferences are not yet attracting in sufficient numbers those for whom they are primarily designed. They have been well attended by heads of firms, by sales managers, and by those whose interest in electrical salesmanship is theoretical rather than practical. But they have not attracted the salesman himself as they should have done. This is not the fault of those who have arranged the conferences or of the conferences themselves. It is the fault of the salesman. Seeing the good that these gatherings can effect we hope that next session this fault will be corrected.

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Electrical Hot Water and a Warning.

THE judges, Mr. J. HORACE BOWDEN and Mr. C. G. NOBBS, have met this week to decide upon the conditions for the second ELECTRICIAN competition. These conditions will be published in our issue of April 6th. In the provision of an electric hot water service some interesting problems must be solved, and more than one of these is rather a matter for the hydraulic than the electrical engineer. Though that is not, of course, our "pidgeon," we all of us know houses where the arrangements for the water supply are neither adequate nor well designed. In THE ELECTRICIAN house they will have to be both to secure the prize. In addition, attention will have to be paid to securing the best electrical equipment for the end in view. Also once again, and for the last time, we would remind our readers that solutions for the "All-Electric" House problem must be in our hands not later than first post on Thursday morning next, March 29th. We are still receiving applications for plans and conditions. But the problem is not an easy one to solve; and we see a great deal of midnight oil or electricity being consumed during the next few days by these late comers in the field.

Two Feasts.

Last week there took place in London two of those gastronomical functions with which it is the custom in this country to celebrate all sorts of occasions, policies and occurrences. The electrical industry not being exempt from the dictates of this fashion, it was with a certain appropriateness that the annual dinner of the British Electrical and Allied Manufacturers' Association and the annual luncheon of the British Electrical Development Association were fixed for adjacent days. The end of these two bodies is one, though their methods of approach are necessarily and sometimes strikingly different. The speeches made at the two functions did not directly reflect that end, though there were many allusions to it that were covert and many whose implications were fairly clear. Prosperity and optimism, we were glad to see, were in the ascendant in both cases, and last, but not least, the space given in the Daily Press to what took place is an indication that the presence of the electrical industry and its civic and imperial possibilities are beginning to be recognised. Besides the interesting connection between the two bodies to which we have alluded there is a connection between what was said on these occasions about which a word or two may be written.

The Need for Empire Development.

The object of the British Electrical and Allied Manufacturers' Association may be said to be to sell electrical plant. Sir JAMES STEVENSON struck the right note, therefore, in insisting upon the need for Empire development, the opportunity for which has been missed, and upon the necessity for making this country self supporting. Lord DERBY was in harmony when he said that it was good for trade that the Empire should be developed, so that it might be dependent on itself and not on others. A reciprocal movement of goods between the Mother Country and the Dominions was required. Not less important was the insistence of Sir RICHARD GLAZEBROOK on the need for research, the need, that is, for building up knowledge of phenomena and materials so that a better and better use can be made of both. The same point was made more epigrammatically by Lord HALDANE at the British Electrical Development Association lunch when he said, "It is not true that labour creates wealth. It is the mind that creates wealth." We have in this country a very rich store of potential creative ability of different kinds. It should be one of our chief duties to see that that store is properly developed.

The Advice of Lookers-on.

But prosperous though the electrical industry is, if appearances at these two gatherings are not deceitful, there is still a paramount necessity for recognising and acting upon these truths which have been defined for us so concisely, not by electrical engineers but, by friendly onlookers. The object of the British Electrical Development Association is to sell electricity and, incidentally, of course, to sell the apparatus by which electricity is used, From that point of view its activities are of use to and are rightly encouraged by the B.E.A.M.A. But it does not touch, and is not required to touch, the problem of selling the larger plant, and there are many reasons why the electrical industry should set itself seriously to work to discover how this may best be done.

The Disadvantage of Diversity.

It has often been pointed out that fully to load, say a 15 000 kW turbo-generator will require that many times that number of kilowatts of consuming apparatus, whether it be motors, lamps, cookers, furnaces or fires, shall be connected to the mains. To take one instance, the diversity of the cooking load is often held up as being an advantage. But to the manufacturer of heavy electrical plant and mains it is a positive disadvantage. The work that the British Electrical Development Association is doing towards the electrification of all branches of life and work, good as it is, and the annual report shows how successful it has been, will have to be very much more accelerated and will have to be crowned with very much more success before the demands of electricity supply authorities can satisfy the capacity of those whose duty it is to manufacture generating as distinct from consuming plant.

Abundance More Necessary than Cheapness.

Speaking at the B.E.D.A. lunch, Mr. W. B. WOODHOUSE was optimistic both about the present and the future. We do not want to modify that optimism. But even if the demands for electricity do increase as rapidly in the near future as they have done in the near past we do not, for reasons we have just advanced, see British manufacturers of heavy plant being so embarrassed with orders as to require no further outlet for their activities. Home orders will not keep their shops on full load or bring about that reduction in price which is only secondary to, if it does not equal, the need for an abundant electricity supply. As Mr. WOODHOUSE well said, abundance and cheapness can only come if the industry is prosperous.

The Electrical Industry Requires Scope.

That is a reason, therefore, why the electrical industry of this country cannot be self-contained or can only be self-contained if the heavy engineering side is curtailed in scope and efficiency. As that is a solution which must never be entertained, the only other alternative is in the development of trade elsewhere. Electrical manufacturers have laid the foundation for that development, the superstructure should be erected without the least possible delay. Not only in the Empire, but in other countries of the world it should be the aim of B.E.A.M.A. to secure for its members that recognition which alone can lead to prosperity. The methods of the British Electrical Development Association have shown how such a recognition can be built up at one end of the wedge, and the success that has attended its efforts leaves us to suppose that similar methods would be successful in tackling this not less important and more difficult problem. At present in this country the electrical industry is living on the great advertisement given to it by the war. But though the use of electricity is increasing more and more rapidly from the very nature of things, it cannot be expected that the demands for heavy plant will do the same. Here we disagree with Mr. WOODHOUSE. The electrical industry has come better than most through a time of great trade difficulty. But unless it takes energetic steps to ensure the contrary it may shortly have to face a slump or at least a diminution in activities of its own.

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The Two "Faradays."

What the Old One Did—The Launching Ceremony—Some Details of the Equipment of the New.

As already announced in THE ELECTRICIAN, on February 16th there was launched at the Jarrow Yard of Palmers Shipbuilding & Iron Co. the cable ship "Faraday," the second vessel of this name to be owned by Siemens Brothers & Co.

The new vessel was named by Mrs. G. Mure Ritchie, and amongst those who were present at the launch were the following:—Mr. G. Mure Ritchie, the chairman of Siemens Brothers & Co., and of Palmers Shipbuilding & Iron Co., Ltd., Mr. and Mrs. E. S. Heurtley, Mr. J. G. Murray (All America Cables, Ltd.), Mr. and Mrs. R. J. Hughes, Sir William Bull and Lady Bull, Gen. Sir Hubert de la Poer Gough and Lady Gough, Mr. C. Birch Crisp, Sir Ernest and Lady Roney, Mr. P. T. Houston, Mr. and Mrs. F. Hird, Mr. and Mrs. W. Wheeler, Mr. and Mrs. A. E. Foster, Mr. and Mrs. A. J. Stopher, Mr. R. H. Peet, Mr. and Mrs. F. H. Leonard, Hon. Robert James, Mr. A. B. Gowan (managing director of Palmers Co.), and Mrs. A. B. Gowan, Miss Ritchie, the Mayor and Mayoress of Jarrow, Capt. Gange and the Rev. John and Mrs. Gray.

Success to the "Faraday."

After the ceremony, Mr. G. MURE RITCHIE proposed "Success to the "Faraday" and her Owners and Good Luck to All who Sail in the Ship." He said that this was not the occasion on which to refer at length to Palmers' contribution

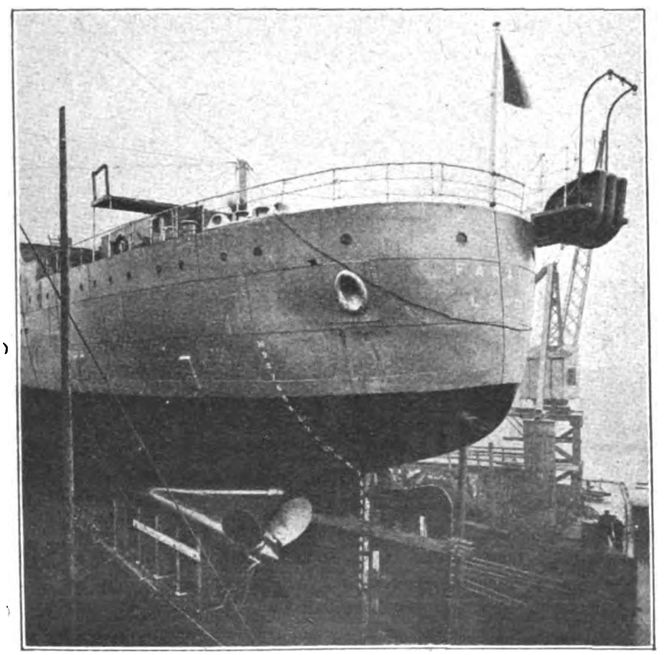

FIG. 1.—STERN VIEW OF THE NEW "FARADAY" ON THE STOCKS.

to the nation's naval power, but mention might be made in passing—because cable-laying steamers also performed national or international service of the best sort—that out of 900 ships launched by the firm in the last seventy years over 100 had been vessels for H.M. service. It was 70 years ago since they built their first screw collier, the historic "John Bowes," a vessel which was still running. She was the first of a long list of steamers which had touched the life of the nation in a most intimate way and contributed largely to the improvement in the material well being of the population during the past two generations. It might be safely prophesied that the "Faraday" would in a not less important way serve millions of people yet unborn through her work of cable laying, which by linking up continent with continent made it possible to keep in touch with events in all parts of the globe and permitted of that rapid interchange of views which frequently did so much to dispel misunderstandings.

The Work of the Old "Faraday."

In replying to the toast on behalf of Siemens Brothers & Co., Sir WILLIAM BULL gave an interesting account of the work done by the old "Faraday" which was launched on the Tyne 49 years ago almost to the day.

The c.s. "Faraday" sailed on her first voyage in connection with the laying of the Direct United States cable in May, 1874. That cable was now the property of the British Government and, according to latest information, was still in good working order. Between June and December, 1879, the c.s. "Faraday" laid the French Atlantic cable.

Faraday Hills.

In 1881 the American Telegraph and Cable Co. was formed, under the guidance of the late Mr. Jay Gould, who sent a cablegram to Siemens Brothers & Co. asking their price for two Atlantic cables. The estimated price, exceeding a million sterling, was communicated by cable and within a few days a reply was received "Make and lay two cables. Fifty thousand pounds at your bankers." These two cables were laid by the "Faraday" in 1881 and 1882. It was during the laying of these cables that a comparatively shallow spot was discovered in about 29° W. where the depth of water changed very rapidly, varying in one case from 625 fathoms to 1 216 fathoms in a distance of about 1½ miles. Previous to the soundings taken by the "Faraday" it was assumed that the depth was over 1 400 fathoms. This shallow region is now known as Faraday Hills.

Two Atlantic Cables.

In 1883 a contract was made with the Mackay-Bennet Co. (now the Commercial Cable Co.) for the manufacture and laying of two Atlantic cables between Ireland and Nova Scotia with connections to Weston-super-Mare, Havre, Boston and New York. In connection with this contract over 6 000 miles of cable were made and laid by the "Faraday" in twelve months. In 1889 a cable was laid for the Mexican Telegraph Co. between Galveston, Texas, and Coatzacoalcos in Mexico. In this year two cables were also laid for the Western Union Telegraph Co. between Canso, Nova Scotia, and New York, and a deep sea repair was afterwards undertaken. In 1890, in addition to three Atlantic cable repairs, a cable was laid between Bacton (Norfolk) and Borkum (Germany) for the British Post Office.

News in Mid-Ocean.

In 1894, a third Atlantic cable was laid for the Commercial Cable Co., and while the "Faraday" was in mid-ocean news was received through the cable—whilst it was being laid—of the birth of the present Prince of Wales. A congratulatory message was sent to the then Duke and Duchess of York by Mr. A. Siemens who was on board, and a gracious acknowledgment was received within a few hours. At that time it was considered remarkable that a ship in mid-ocean should be kept informed of the notable events occurring on shore, and copies of these telegrams appeared in newspapers in many parts of the world.

After laying the Commercial Co.'s cable, the "Faraday" was for the latter part of 1894 and for several months in 1895 engaged in deep sea repairs to the Western Union and French Atlantic Companies' cables.

Work in the Amazon.

In December, 1895, the "Faraday" left London for Para and from there laid a cable up the River Amazon. This voyage was quite a new departure and was full of incident. The depth of water as a general rule was quite sufficient to accommodate the ship, but owing to the constant changes in the river bed it was not at all uncommon for the ship to be aground. Fortunately the bottom was soft, and although the delays were unwelcome, no material damage was done, and she eventually reached her final destination at Manaos, about 900 miles from the mouth of the river, having connected the cable to various intermediate stations on her way. The deep-water channel was frequently found to be quite close to the river banks and at times the "Faraday's" yards were brushing the trees as she steamed along. On one occasion the anchor was let go at night time and next morning it was found to have gone through the roof of a rubber gatherer's hut built close to and projecting slightly over the edge of the river. Fortunately the hut was unoccupied. This cable was frequently broken by debris brought down when the river was in flood, and was even buried by the changing river bed, and in 1897 the upper portion of about 400 miles in length was renewed by a cable laid as far as possible in the tributaries and backwaters of the Amazon. The "Faraday" was engaged on this work but did not leave the main river, the bulk of the

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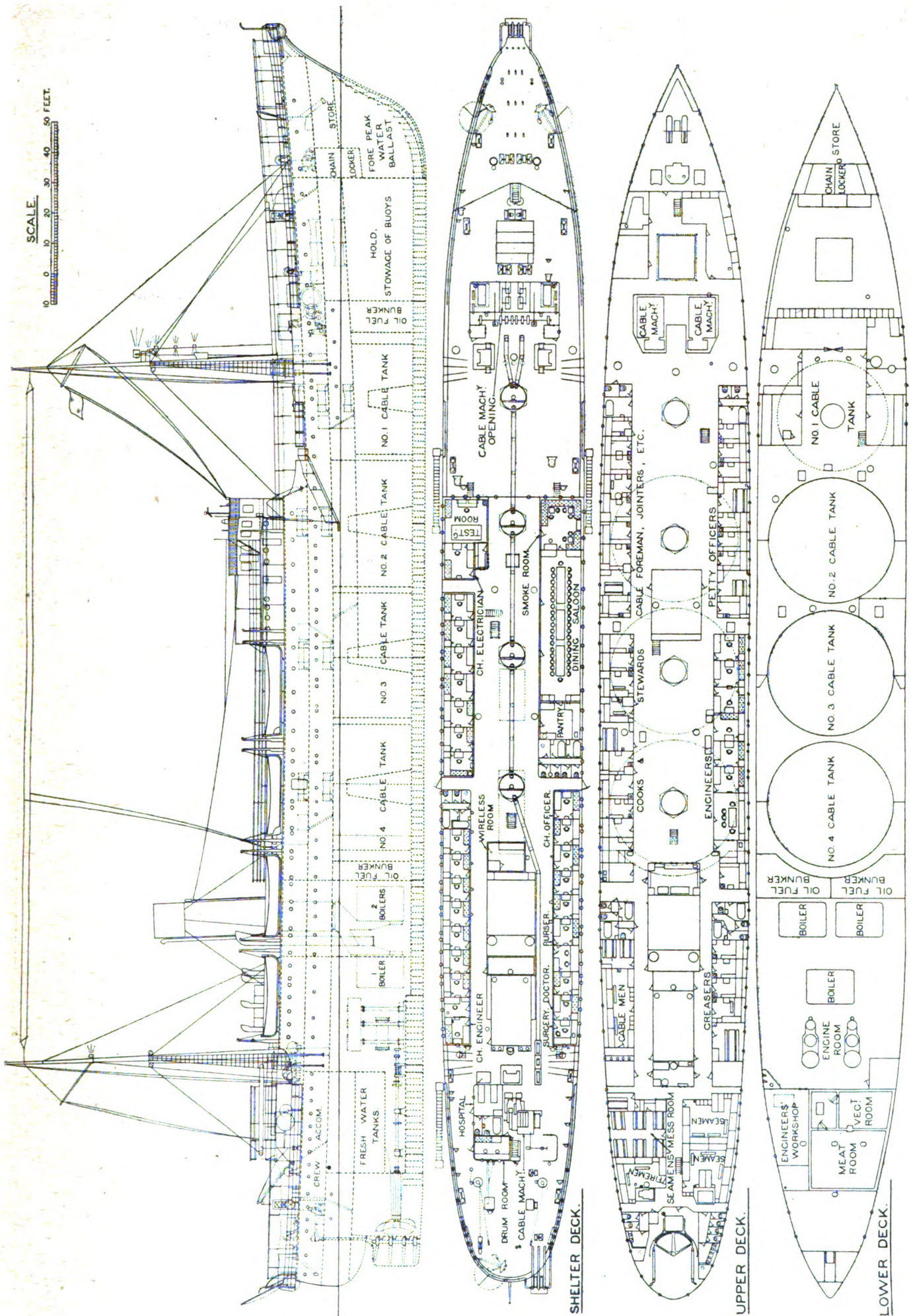

FIG. 2.—ELEVATION AND CROSS SECTIONS OF THE NEW CABLE SHIP "FARADAY."

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work being carried out by tugs and lighters which were loaded with cable, as required, from the "Faraday's" tanks. During the second expedition the "Faraday" found newly-formed islands, where on her previous trip deep water existed.

In 1899 the islands of Grenada, St. Lucia, and Sta. Cruz were connected by a cable for the West India and Panama Telegraph Co. In 1900 a cable was laid from Canso, Nova Scotia, to the island of Fayal in the Azores, and in 1901 another cable from Ireland to Fayal, both cables being for the Commercial Cable Company. In 1903 and 1904 several repairs were carried out in the Atlantic. In 1905 a further cable was laid from Galveston to Coatzacoalcos, and in November, 1905, the "Faraday" left with a load of about 1 800 nautical miles of cable which she laid for the Central and South American Telegraph Co. between Valparaiso, Iquique and Callao. On completion of the laying operations the "Faraday" was chartered as a repair ship and remained on the West Coast of South America for about six months. On her return in August, 1906, she called at Valparaiso for coal and the great earthquake occurred on the evening of her arrival. Although badly shaken, the ship was uninjured, and she eventually proceeded to another port for coals, dry docking, etc. In 1908 a cable was laid in the Black Sea from Varna (Bulgaria) to Sebastopol.

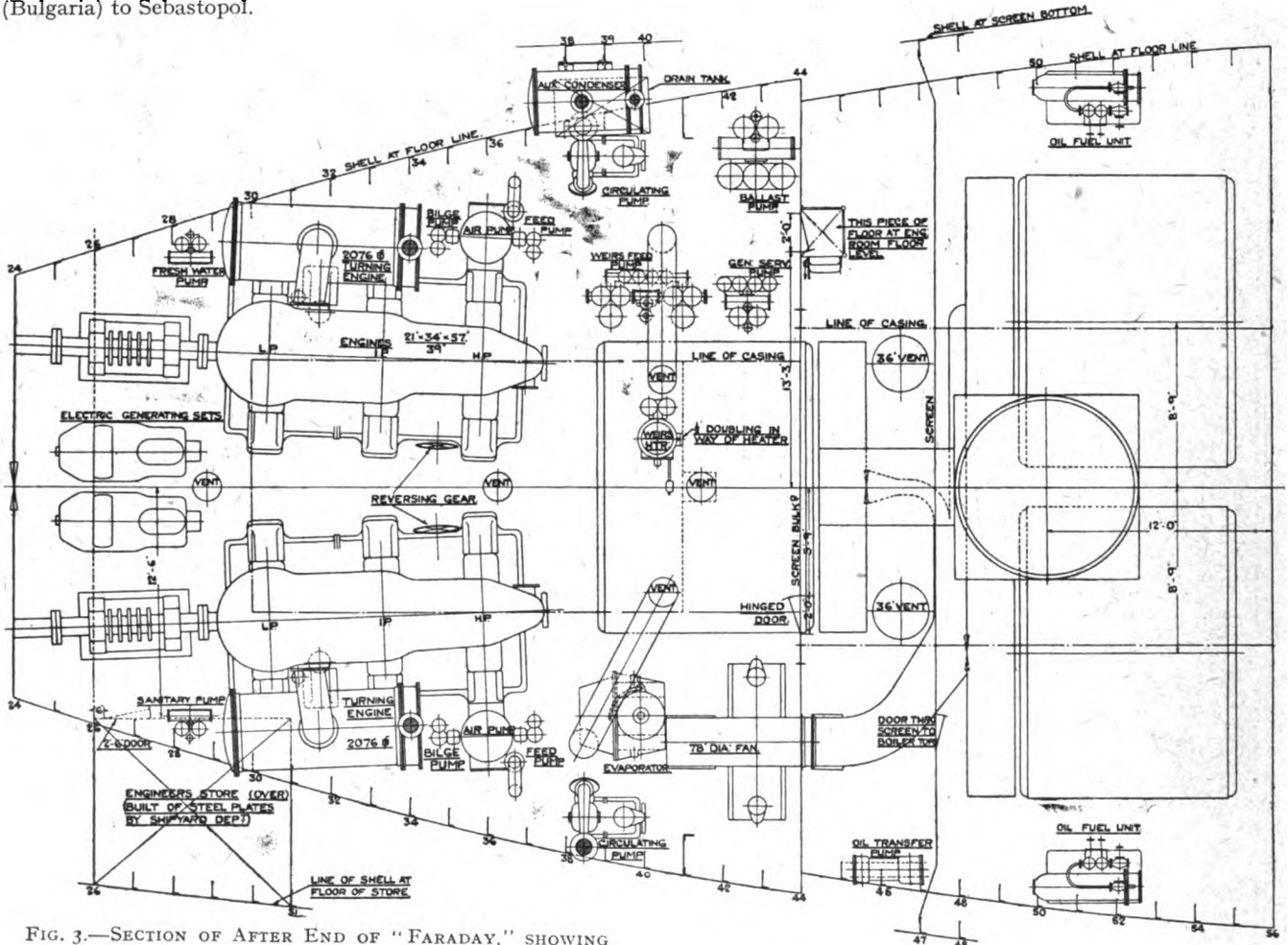

FIG. 3.—SECTION OF AFTER END OF "FARADAY," SHOWING ARRANGEMENT OF PROPELLING MACHINERY.

The First Pupin Cable.

The "Faraday" received a thorough overhaul and partial reconstruction in 1909.

In 1910 she laid the first Pupin coil-loaded telephone cable across the English Channel for the British Post Office. This cable was of a special, and at that time novel, construction and modifications of the paying-out machinery were made which proved to be eminently successful. This cable has had far-reaching effects on long-distance telephony. In May, 1910, the "Faraday" left London, successfully completed deep-sea repairs to two Atlantic cables and returned to London in August, 1910, without having had to call at any port to replenish stores.

In October and November, 1910, a cable was laid from Newbiggin (Northumberland) to Arendal (Norway). In 1911 the Anglo-Belgian Pupin coil-loaded telephone cable was laid. In 1912 the repair to the Direct United States Cable in deep water was undertaken. In 1913 the "Faraday" was engaged in laying cables in the Dutch East Indies in the neighbourhood of Sumatra, Java and Celebes.

Work in the War.

During the late war, in the summer of 1915, the "Faraday" was engaged for several months in deep-sea repairs, and diverted one cable into Newfoundland which involved the laying of 500 miles of cable. In 1916 the ship carried a length of 800 miles of cable to Japan, where it was transferred and laid by a Japanese vessel. In 1917 the "Faraday" was engaged in laying a cable for the British and Russian authorities connecting the Russian winter port of Murmansk with Archangel, which, in connection with a cable laid by another company, gave direct communication from Archangel to England.

Cable Renewals in Submarine-Infested Areas.

In 1918, during the height of the enemy submarine activities, the "Faraday" carried out the partial renewal of one of the Atlantic cables, which involved the laying of about 800 miles of cable, and was afterwards engaged in repair work—being absent from England for 6½ months, during which time all operations had to be carried out without showing any lights. Much credit was due to Capt. Gange and the gallant crew for carrying on their difficult work during the war, facing death daily from submarines. At one period Lord French reported that the shortage of cables was more serious than the shortage of shells.

In 1919 further deep-water repair work was undertaken in the Atlantic. In 1920 a cable was laid from Colon (Panama) and Cartagena (Columbia). After passing through the Panama Canal, another cable was laid from Sta. Elena (Ecuador) to Callao, and later in the year another Pupin coil-loaded telephone cable was laid from the Island of Gotland to the main land near Stockholm.

Her Last Voyage.

In 1921 the ship was absent fron England, on her last voyage, for about four months, engaged in laying a cable from

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Porto Rica to Cuba, and then undertook further work in the Gulf of Mexico and off the Cuban coast.

The "Faraday" was one of the earliest twin-screw vessels, was said to be the first vessel equipped with electric light, and carried one of the first of Kelvin's compasses. Her two funnels abreast gave her a very distinctive appearance.

The Application of Experience.

Mr. F. HIRD, general manager of Siemens Brothers & Co., also replied to the toast, and remarked that he took the association of his name with it as a compliment to the staff of Siemens Brothers & Co., who had been so largely responsible for the work which Sir William Bull had indicated and who had also been zealous in applying the experience they had gained in the old "Faraday" to the more up-to-date cable steamer they had just seen launched. They appreciated the skill and conscientious work which Palmers had put into the vessel, and, having done all that was possible to produce the best ship, he was confident they would not lack work for her to do.

Description of the New "Faraday."

The present cable-laying and repairing steamer "Faraday" of which we give illustration and drawings, is one of the largest and most modern vessels of her type afloat. She has been designed to carry about 4 500 tons of cable, has a steaming radius of 10 000 miles, and is fully equipped with the latest appliances for laying and repairing cables. The hull has been constructed of steel, under special survey to class 100 A1 with

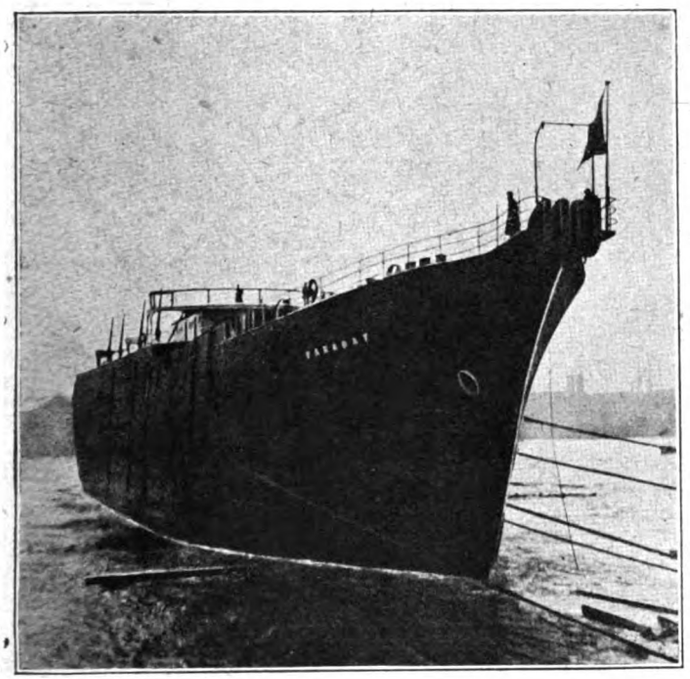

FIG. 4.—THE NEW "FARADAY" IMMEDIATELY AFTER THE LAUNCH.

Lloyd's Register of Shipping, shelter deck type with freeboard.

The leading particulars are as follows :—

Length over bow and stern sheaves	415 ft.
Length between perpendiculars	380 ft.
Breadth extreme	48 ft. 3 in.
Depth moulded	29 ft. 3 in.
Draught designed	27 ft. 3 in.
Gross tonnage	5,370
Net tonnage	2,640
Water ballast capacity	2,200 tons
Fuel oil capacity	1,500 tons
Speed	12 knots

The general arrangement of the ship is shown in the accompanying drawings, from which it will be seen that she has a clipper stem adapted for carrying three cable sheaves, a cruiser stern with two sheaves fitted on starboard side, two masts with schooner rig, double bottom all fore and aft with oil tight middle line division, adapted for carrying either water ballast or oil fuel. Oil fuel is also carried in the cross bunker at fore and aft end of the cable tanks and separated from these by spaces, which can be used for additional water ballast to ensure ample immersion of the vessel when her cable is discharged.

Cable Tank Arrangements.

There are four cable tanks arranged *en bloc*, each having a watertight steel cone, the internal surfaces of these tanks being all finished flush to prevent damage to the cable. A large hold forward is fitted up for stowing buoys and other gear incidental to cable work. The ship has two complete decks designated, shelter and upper respectively; above the shelter deck is a long boat deck, and there is also a lower deck beneath the upper deck outside the limits of the machinery space.

On the boat deck at the forward end is a large steel house containing a suite of rooms each for the captain, cable engineer, and cable representative, and also a drawing office; above this house is the navigating bridge with chart room and special rooms for the captain and the navigating officer, contained within the teak and glazed encasement. The total number of ship's officers, cable staff and crew will exceed 150. There are five lifeboats, two working boats, and two motor lifeboats, with patent mechanical davits to each.

The shelter deck is the working platform for cable repairing, testing, jointing, etc.; at the bow are three cable sheaves. Immediately forward of the main cable machinery hatch is a dynamometer for registering the pull of the cable, and abaft this hatch is a steel house and shelter for the control gear to the picking-up machinery.

Cable-Laying Machinery.

Situated on the after-end of this deck is the paying-out machinery with its attendant dynamometer, jockey gear, stern sheaves and handling gear. Under the boat deck abreast the cable hatches is the accommodation for the cable staff, electricians, officers and other leading members of the crew; also a large dining saloon, smoke room, testing room, radio room, etc.

The upper deck in the forward watertight compartment contains a steam windlass and engines for the capstans on the deck above, and further aft is situated the main cable machinery, which is of Siemens Brothers & Co.'s latest design and constructed by Palmers Shipbuilding & Iron Co. Abreast of this machinery are the store, paint and lamp rooms. The stern compartment of this deck is fitted up for the steam steering gear of the Wilson-Pirrie type, controlled from the navigating bridge by telemotor. With the exception of the working spaces over the cable tanks, the remainder of this deck is fitted up with rooms for engineers, cablemen, petty officers, stewards, seamen and firemen; also culinary and various store rooms.

Workshops and Stores.

The lower deck over No. 1 cable tank is sub-divided into workshops for blacksmiths, jointers, electricians and carpenters. The boatswain's stores are also arranged on the deck between Nos. 2 and 3 cable tanks. Aft of the main machinery room on the starboard side are cold chambers of sufficient capacity to store provisions for long periods at sea, whilst on the port side of this space is fitted a CO_2 type refrigerating machine and an engineers' workship.

Details of the Engines.

The engines are of the twin-screw, triple expansion, surface-condensing type, arranged to work on three cranks placed at equal angles. The engines will develop 2 960 i.h.p. at sea when running at about 88 revs. per min. The cylinders are respectively 21 in., 34 in. and 57 in. in diameter and the stroke is 39 in. The cylinders are supported on cast iron columns of box section. The main condensers, which are cylindrical and constructed of steel plates, are supported on the main engine columns. The circulation is maintained by separate centrifugal pumps. The usual separate pumps are provided for feed, ballast, bilge and sanitary services and heater and filter for feed water.

Steam is supplied at a pressure of 180 lb. per sq. in. by three single-ended boilers 15 ft. 3 in. dia. by 11 ft. 3 in. long, each having three furnaces and fitted with Howden's system of forced draught, the furnace fronts being arranged for burning oil exclusively.

The engines are arranged so as to be capable of working at very low revolutions in order to drive the vessel, when necessary, at the low speed of about three-quarters of a knot.

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The Control of the Speed and Power Factor of Induction Motors.

In the third lecture of the course which he is delivering before the University of London, Prof. Miles Walker dealt with various devices for altering the speed, including frequency and pole changing, cascade connection and Hunt's and Creedy's motors. These arrangements are all discussed at length from the theoretical point of view.

Lecture III.

III.—Change of Frequency of Supply.

In cases where the motor to be controlled forms the chief load on the generator it may be possible to change the speed of the latter so as to give a frequency suitable for the motor at the required speed. Thus the electric generators on a ship driven by Diesel engines or steam turbines can have their speed adjusted over a certain range in order to make the induction motors driving the propellers go fast or slow according to the required speed of the ship. If a generator is fully excited and its armature is connected to the stator of the driving motor the motor can be brought up to full speed at full-load torque by bringing up the generator from rest. If two terminals of the stator are reversed the motor can be brought up in the reverse direction. It is the ease in reversing that gives the electric drive an advantage over mechanical gear.

As this method of starting and reversing cannot, however, be relied on in an emergency, provision must be made for reversing while the generator is still running, and this involves the introduction of resistances into the rotor circuit.

Where two such speeds as the " cruising " and " fighting " speeds are to be provided, the fact that so much more power is required at the higher speed calls for extra prime movers and generators. A very simple solution is the provision of a low-frequency generator for the low speed and entirely separate and more powerful generators of higher frequency for the higher speed.

Speed Variation Arrangements.

If it is desired to make use of all generators at full speed then another motor or motors can be provided having a number of poles adapted to give the higher speed at the lower frequency. Thus suppose it is desired to run two propellers A and B at 133 revs. per min. for cruising and 200 revs. per min. for fighting, each propeller shaft can be provided with two motors A_1 and A_2, B_1 and B_2. Motors A_1 and B_1 can be made with 36 poles and motors A_2 and B_2 with 24 poles. Four steam turbo-generators can be provided T_{1A}, T_{2A}, T_{1B}, and T_{2B}. Turbo-generator T_{1A} and T_{1B} can be designed to give a frequency of 40 cycles at their most economical speed and either one or the other may feed the two 36-pole motors in parallel giving a speed of 133 revs. per min. to the propellers. Turbo-generators T_{2A} and T_{2B} can be designed for a frequency of 60 cycles at their most economical speed. For the speed of 200 revs. per min. the power of all four generators is required. T_{2A} and T_{2B} can be connected to the 36-pole motors and T_{1A} and T_{1B} to the 24-pole motors. By working on this principle and changing somewhat the running speeds of the steam turbines almost any ratio of speeds can be obtained under very economical conditions and without pole changing.

IV.—Pole Changing Devices.

This is such a very large subject that it cannot be more than touched upon in this lecture.

The student is referred to the book " Electric Motors and Control Systems," by A. T. Dover, in which the matter is very ably treated. Figs. 22 to 30 are taken from Mr. Dover's book with his permission.

It should be pointed out in the first place that if a Gramme ring winding could be used upon the stator of an induction motor any number of pairs of poles could be produced by the simple expedient of making the number of equally spaced tappings per phase equal to the number of pairs of poles desired. The Gramme ring winding, however, is not practicable for large motors on account of the losses produced by the return conductors in the frame and the poor facilities for ventilation.

When a stator is wound with a drum winding the pitch of the coil is fixed and a given coil pitch can only be used with advantage for a limited number of poles. If the pitch of the coil is one-eighth of the circumference it will give a full-pitch coil for an eight-pole machine and a 50 per cent. pitch coil for a four-pole machine. A 50 per cent. pitch is about the smallest fractional pitch that can be employed with advantage. If the pitch of the coils is one-sixth of the circumference giving a full-pitch coil for six poles, it gives a $\frac{2}{3}$rds pitch for four poles and a $1\frac{1}{2}$rd pitch for an eight-pole machine, both of which are satisfactory. A pitch of one-quarter of the circumference cannot be used at all for an eight-pole winding as the two coil sides would be in direct opposition but if the pitch is made greater than quarter, its e.m.f. comes to have a certain component which could contribute to an eight-pole field, but such a large pitch would not be efficient in practice.

In designing a winding, the pitch of the coil for any given number of poles may be fixed so as to give the required differential factor. This factor is equal to $\sin\frac{1}{2}\theta$, where θ is the pitch of the coil in electrical degrees.

Pole Changing in Ratio 8 to 4.

If the pitch of the coils is suitable both for eight and four poles the change from 8 to 4 is carried out by reversing some of the windings so that instead of the succession of poles

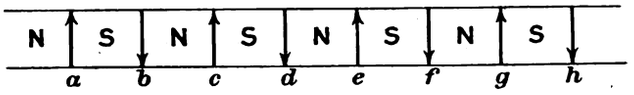

FIG 18.—EIGHT POLES.

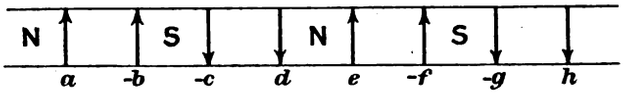

FIG. 19.—FOUR POLES.

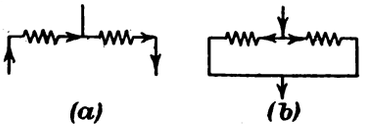

FIG. 20.

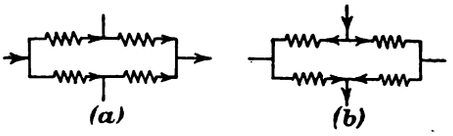

FIG. 21.

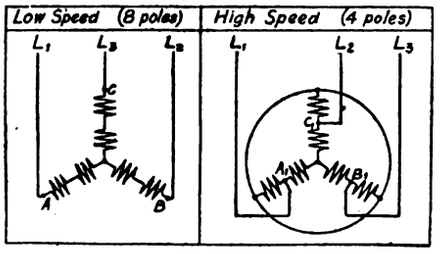

FIG. 22.

as in Fig. 18 there is produced the succession of poles as in Fig. 19.

Fig. 18 shows diagrammatically eight conductors carrying current in the direction of the arrow heads and producing the polarity shown by the letters N S N S, etc. If the currents in the conductor *b*, *c*, *f* and *g* are reversed in direction as indicated in Fig. 19 there is produced the desired change to four poles. Let *b* and *c* form the two sides of one coil connected with another coil whose sides are *f* and *g*. Then the reversal of the current in the one circuit which comprises half the coils in one phase, brings about the change in the number of poles. Figs. 18 and 19 only relate to one phase. In a polyphase motor the reversal of half of the coils must occur in all phases, and, moreover, care must be taken that the coils reversed are

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chosen so that the direction of rotation of the field remains in the same direction.

A simple method of reversing the current in half a winding is illustrated in Fig. 20. If instead of bringing the current in at one end of a series of coils as in Fig 20 (*a*) we tap into the middle of the series (see (*b*)) and take out the current from both

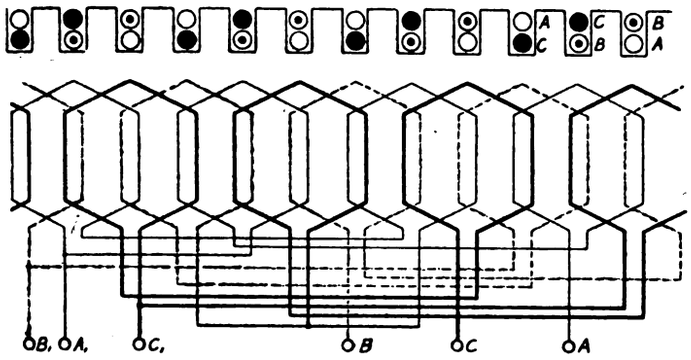

FIG. 23.—DEVELOPMENT OF 3-PHASE 8/4-POLE FRACTIONAL PITCH. DOUBLE LAYER WINDING. (A. T. DOVER.)

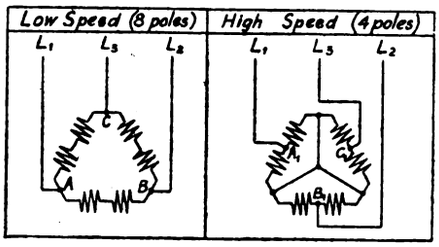

FIG. 24.

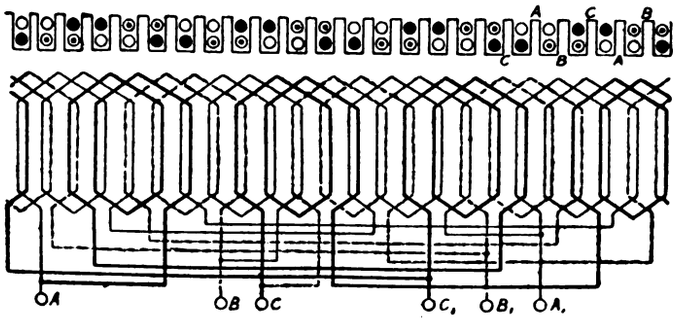

FIG. 25.

ends, the current through one half is necessarily reversed. If we wish to preserve the same number of coils in series in each case we may adopt the plan shown in Fig. 21 (*a*) and (*b*).

This principle can be combined with mesh and star connection as shown in Fig. 22, so as to obtain eight poles or four poles on a three-phase motor.

Fractional Pitch Double Layer Winding.

Fig. 23 shows a simple development of a three-phase 8/4-pole fractional pitch double-layer winding. One turn per coil is shown for the sake of simplicity. The pitch of the coils is $\frac{3}{4}$rds of full-pitch for the four-pole case and $1\frac{1}{3}$rd pitch for the eight-pole case, so that the coils have the same differential factor. Each phase of the winding consists of four coils of which alternate coils are connected in series. The two pairs so obtained are again connected in series, a tapping being brought out from the centre point of the phase. To get eight poles the terminals *A B* and *C* are connected to the line wires, and currents pass through four coils in series to the star point. To get four poles the terminals A_1 B_1 and C_1 are connected to the line wires and *A B* and *C* are short circuited. (See Fig. 22). With this winding the flux per pole for the four-pole case is twice that for the eight-pole case so that the flux density in the gap is the same in both cases, but the density in the core is double for the four-pole case.

Another arrangement of connections employed in traction motors is shown diagrammatically in Fig. 24. Here the coils

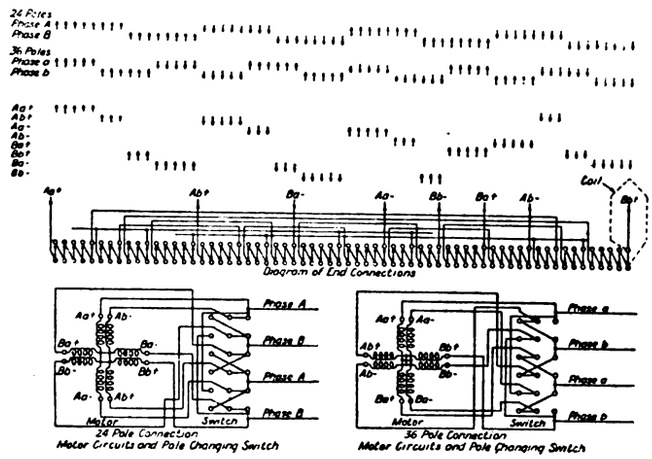

FIG. 26.—SCHEME FOR CHANGING FROM 24 TO 36 POLES. ("General Electric Journal.")

are connected in delta for the eight-pole case and in parallel star for the four-pole case. A development for a winding arranged for these connections is shown in Fig. 25. For eight poles the terminals *A B* and *C* which form the corners of a delta are connected to the line wires. To get four poles the line wires are connected to A_1 B_1 and C_1 and *A B* and *C* are short circuited (see Fig. 24.)

Pole Changing in Ratio 6 to 4.

A good example of pole-changing in this ratio is found in the motors of the "New Mexico," already referred to and described in the "General Electric Journal," vol. xxii, p. 229. In this motor the number of poles is changed from 36 to 24. The winding has two phases and the principle upon which it is designed is easily followed from Fig. 26.

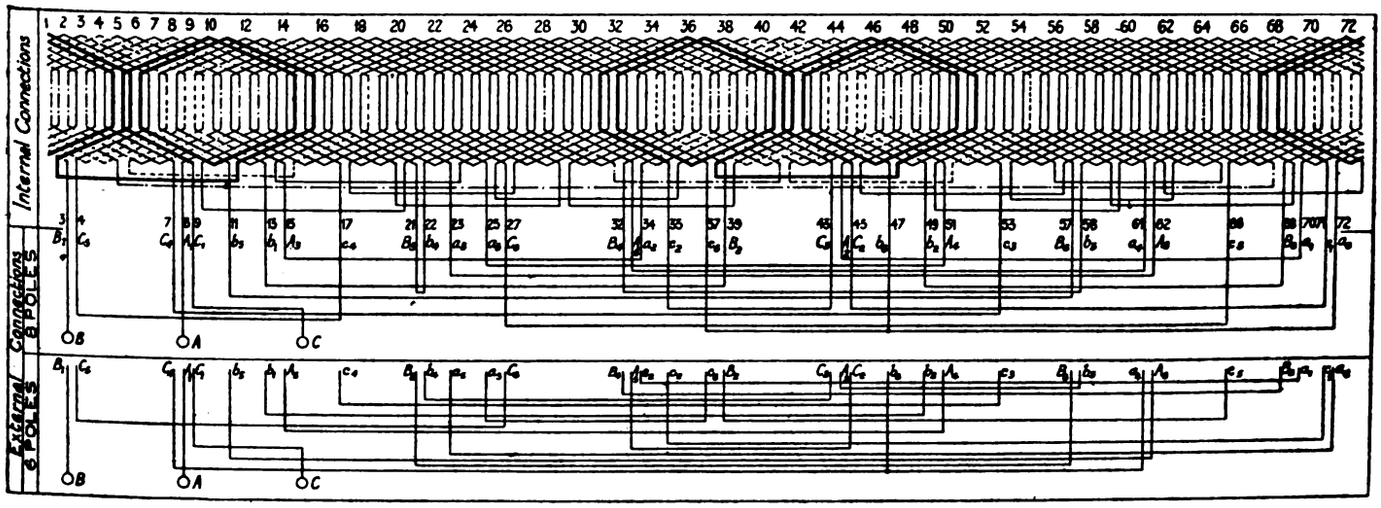

FIG. 27.—CONNECTIONS AND DEVELOPMENT OF THREE-PHASE WHOLE-COILED POLE CHANGING WINDING FOR 8 AND 6 POLES DESIGNED BY A. T. DOVER.

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There are 32 slots per pair of poles for the 24-pole case—that is to say, eight slots per pole per phase. These slots contain a double layer winding. but it is simplest to consider the winding as consisting of one conductor per slot as shown in Fig. 26. On this assumption the 32 conductors for a pair of poles making four-phase bands for the 24-pole case. have to be changed to six-phase bands opposite three poles for the 36-pole case. Four of the phase bands are in five slots and two of them in six slots. It is only necessary to consider the arrangement in the 64 slots shown in the figure as the other parts of the winding are a mere repetition of the arrangement shown. The method of design is to put down the two top lines in the figure, one showing the final arrangement required for the 24-pole case and the other the one required for the 36-pole case. A comparison of these two lines shows that

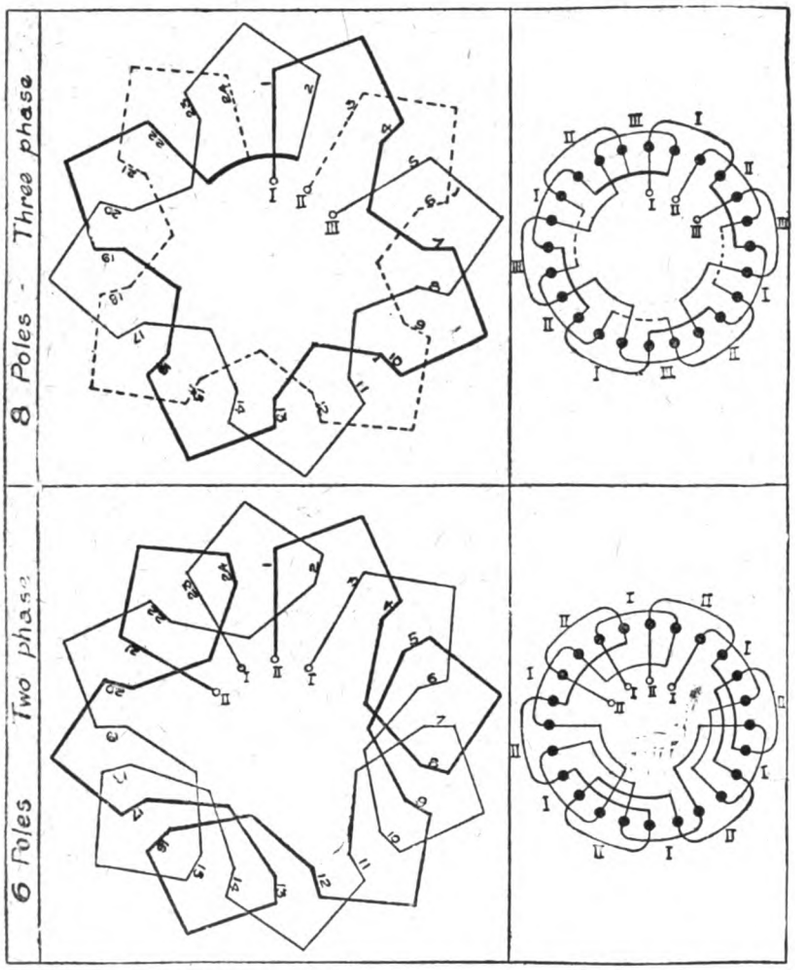

FIG. 28. FIG. 29.

CONNECTIONS OF SINGLE-LAYER POLE CHANGING WINDING TO GIVE 8 POLES, THREE-PHASE, AND 6 POLES, TWO-PHASE.

there are certain belts of conductors which can be put into eight class. Using capital letters *A* and *B* for the phases in the 24-pole case and small letters *a* and *b* for the 36-pole case, we have the class *Aa* in which a belt of conductors is in the same phase and with the same polarity in both 24-pole and the 36-pole cases. Then we have the class *Ab*, in which the conductors of one phase pass to the other phase when the number of poles is changed. In class *Aa* the conductors remain in the same phase but have to be reversed and so on.

All that is necessary is to connect all the conductors of the same class together and then arrange a set of switches for switching over the classes in accordance with the scheme shown at the base of the figure.

By this method of design we can after choosing a suitable number of slots, switch over the connections for one number of poles to those for another number of poles with the fewest possible switches.

Pole Changing in the Ratio of 8 to 6.

Mr. A. T. Dover has worked out a complete diagram for a three-phase double-layer winding lying in 72 slots which can be switched over from 8 to 6 poles. Each coil has a full pitch throw for the eight-pole case and 0·75 pitch throw for the six-pole case. Fig. 27 is produced by his permission from his book on "Motor and Control Systems." The winding has been worked out by the method of putting certain belts into one or other of four classes.*

Another type of winding for changing from eight to six poles as given by Mr. A. T. Dover is given in Fig. 28 and Fig. 29. The winding in this simple diagram lies in 24 slots, three slots per pole for the eight-pole case and four slots per pole for the six-pole case. The eight-pole connections give us a three-phase

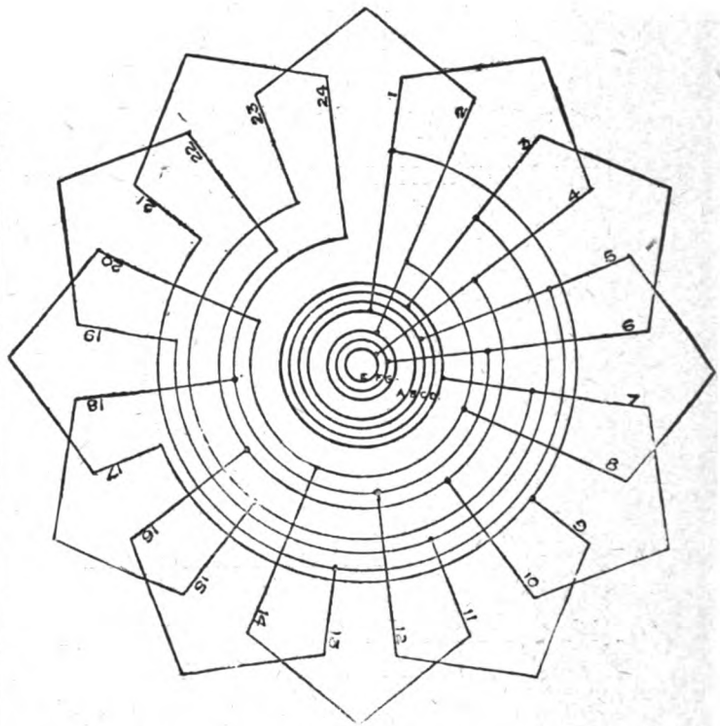

FIG. 30.—CONNECTIONS OF ROTOR WINDING SUITABLE FOR THE POLE CHANGING.

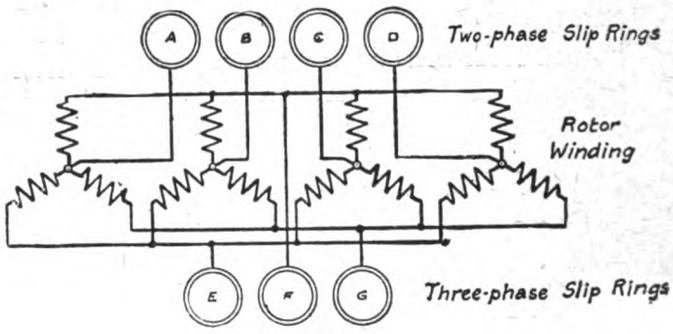

FIG. 31.—DIAGRAM OF CIRCUITS FOR THE WINDING SHOWN IN FIG. 30.

winding and the six-pole connections a two phase winding. A practical application of a winding designed on this principle is found in the cascade equipments, for the four-speed passenger locomotives built by the Societa Italiana Westinghouse for the Italian State Railways.† The two-phase winding may be supplied from a three-phase system by means of Scott connected transformers.

The rotor winding, if it is to be employed in cascaded motors, must also be suitable for either eight or six poles. A suitable winding is shown in Figs. 30 and 31. It consists of four star-connected three-phase windings connected permanently in parallel. When the motor has eight poles each of the three star-connected legs differs from its two colleagues in the star-connected group by 120 degrees of phase, and there are four parallel connected legs in phase *A*, four in phase *B*, and four in phase *C*.

(To be continued.)

* *Ibid.*, p. 135.

† See "Revista Tecnica delle ferrovie Italiane," vol. 10, p. 213. Also "Tramway and Railway World," vol. 42, p. 387. Also "Electric Journal," vol. 12, p. 51.

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Atomic Projectiles and their Properties.

The subject of the course of six lectures which Sir Ernest Rutherford, F.R.S., of Cambridge, is delivering, as Professor of Natural Philosophy to the Royal Institution, is "Atomic Projectiles and their Properties." We give below a summary of first two lectures.

Conception of Collision.

Our conception of what occurs in collisions, Sir Ernest remarked in his introduction, was coloured by our practical knowledge of the impacts of billiard balls, bullets and shells. That experience was serviceable when we considered projectiles of much higher speed, though we then passed into a new world. The average velocity of a molecule of hydrogen was 1·84 km./sec. when at 0° C.; as the speed increased with the square root of the absolute temperature, the atom of the dissociated molecule of hydrogen would have a speed of 269 km./sec. in a star at 2 730 000° C., which was now considered quite a possibility.

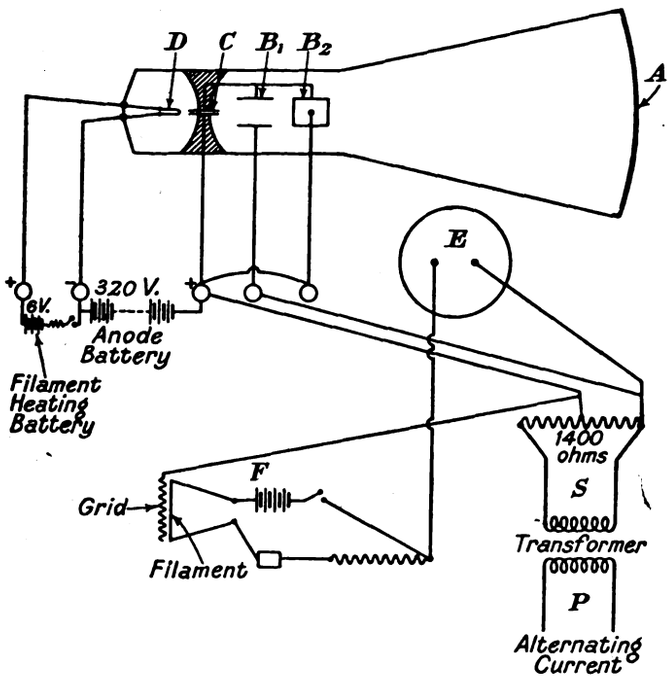

FIG. 1.—NEW TYPE OF KATHODE RAY OSCILLOGRAPH.

The mercury atom, 200 times heavier than the hydrogen atom would require 10 000 V to attain a speed of 100 km, which 0·4 V would impart to an electron. The energy of the particle was the same for all atoms carrying a simple charge, depending only on the volts and the charge. Those laws had been worked out for kathode rays by J. J. Thomson by deflecting the particles in electric and electromagnetic fields. In the magnetic field the deflection A was inversely proportional to mu/e, in the electric field the deflection B inversely proportional to mu^2/e (where m, e, u were the mass, charge and speed of the electron); hence $B/A = u$, and $e/m = A^2/B$; in this way e/m was found to be $1{\cdot}7 \times 10^7$ electromagnetic units.

A New Type of Kathode Ray Oscillograph.

In demonstrating these phenomena, Sir Ernest made use of a new type of low-voltage kathode ray oscillograph (Fig. 1), just presented to the Cavendish Laboratory by the Western Electric Co. A tubular glass (about 15 in. long altogether) opens out into a cone, which is closed by a curved screen A, made of calcium tungstate and zinc silicate with water glass as binder. The Wehnelt filament D (coated with some oxide) is heated by a battery of 6 V; the electrons emitted pass through the platinum tube C (1 cm. long, 1 mm. diameter) successively into the two electric fields formed by the pair of horizontal plates B_1 and the pair of vertical plates B_2; the plates of a pair are 4·7 mm. apart, and C is the anode of the tube battery of 320 V. The undeflected rays would hit the screen A at the centre. A magnetic field can be applied by placing the coils E on the sides of the tube at the level of the deflector plates.

In one of the demonstrations the fluorescent spot was driven round in a circle by rotating a permanent bar magnet (turned by an electric motor) in a vertical plane parallel to the longitudinal axis of the horizontal bulb. When 40 V from the alternating supply mains (at 83 periods) were superposed on the bulb circuit by means of the transformer $S\,P$, the spot was drawn out into a straight line, the

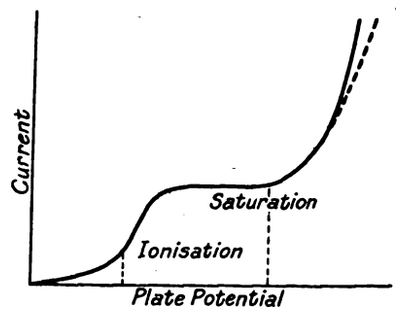

FIG. 2.

length of the line marking the extreme deflections of the spot to the right and left. With simultaneous electric and magnetic excitation a peculiar oscillograph curve was seen, a circle on which an ever-changing hump was travelling round.

Relatively Slow Speed Electrons.

In the second lecture Sir Ernest dealt with relatively slow speed electrons and particles. When an electron was accelerated by a potential difference of 1 V, it moved at nearly 600 km. per second; at 25 V the speed was $\sqrt{25} = 5 \times 600 = 3\,000$ km./sec. What effect would such an electron (projectile)

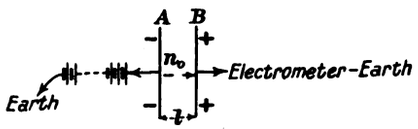

FIG. 3.

have upon an oxygen atom? That atom had close to the nucleus two inner K electrons, moving in orbits in planes at 120° to one another, and further out six more electrons. When the projectile approached an outer electron (the target), both would repel one another, and the target might either be knocked out to infinity when the atom was called "ionised," or it was merely "jumped." The lecturer first discussed the former case, referring to J. S. Townsend's studies (1900) of ionisation by collision. Supposing X-rays entered a gas confined between two charged electrodes. The atoms would be ionised into electrons and positive residues which were impelled towards

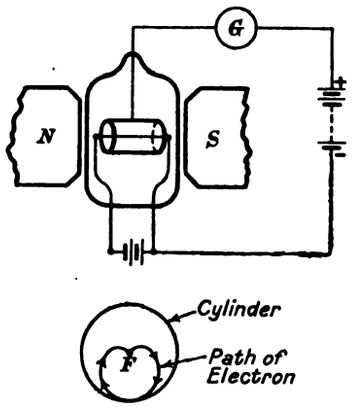

FIG. 4.

the two electrodes. Plotting the equivalent current passing through the gas against the volts between the electrode plates, we obtained the curve Fig. 2. The current depended upon the number of ions reaching the plates; at first new

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ions would be produced as fast as the old ions were being discharged on the electrodes, and the current was hence proportional to the potential, until a steady " saturation " stage was attained. On further increasing the potential, however, the

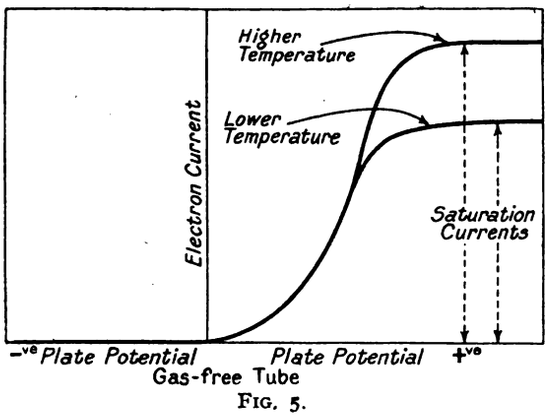

FIG. 5.

current was once more seen to rise, finally on a very steep curve, ending with a spark discharge. To explain all these features we had to consider, not only the electrons but also the positive ions. When the potential was sufficiently strong, the positive ions also acquired sufficient velocity in the interval between encounters with molecules, to cause ionisation. The electrons being smaller would not collide so frequently and had hence a longer free path, during which they would be accelerated by the field.

The Use of Thermionic Valves.

The speeds involved could be studied with the aid of thermionic valves, Fig. 4. A wire filament was heated as negative electrode within a cylinder which was joined to the positive pole; no current would pass between the cylinder and wire when the wire was positive, nor would it pass when the electrons emitted by the hot wire were deflected in a circular or heart-shaped path round the cylinder so as to skirt, but not to touch the cylinder. This was demonstrated; the galvanometer G first showed a strong current, but when the filament was less hot or the magnetic field too strong, the current stopped altogether. In a gas-free tube the saturation

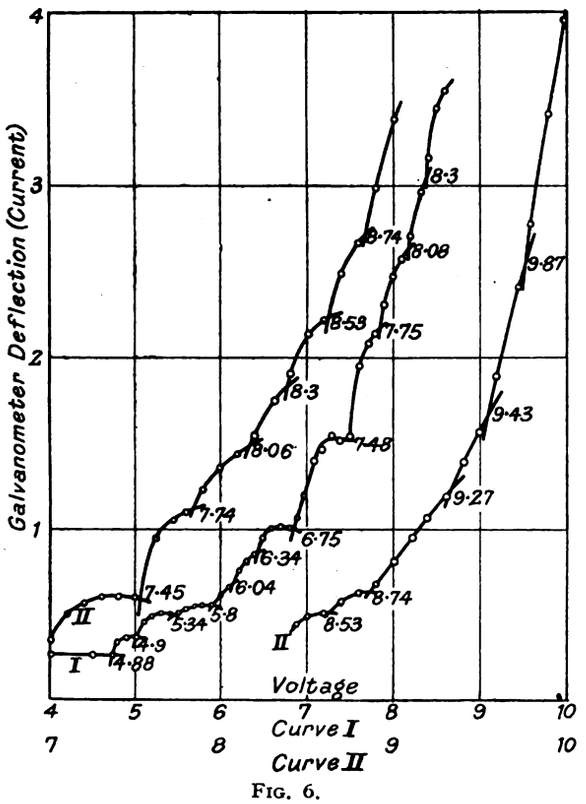

FIG. 6.

current was stronger at higher filament temperature than at lower temperature, Fig. 5. In a tube containing a little gas the curve was of the type of Fig. 2; beginning ionisation was marked by the point where a sharp rise set in; that point indicated that the field strength was now sufficient to impart to the electrons a speed necessary for ionisation by collision. The exact determination of this ionisation potential was very important, because light was emitted when the electron returned to the position or level from which it had been removed, and the electrical energy E required for this removal and for the excitation of light of frequency ν, could be deduced from this potential. The two quantities were connected by Planck's quantum relation $E=h\nu$. But the determinations by Franck and G. Hertz and their collaborators, Horton and Davies and others seemed contradictory until it was recognised that the target electron need not be knocked out completely (ionisation), but might only be displaced (jumped, excitation potential) to fall back almost immediately giving rise to a characteristic single-line spectrum. That latter spectrum was known as the " resonance spectrum," but the term " excitation spectrum " was preferable. Studying the excitation potentials in mercury vapour at a pressure of 0·014 mm. and a temperature of 50° C. J. Franck and Einsporn

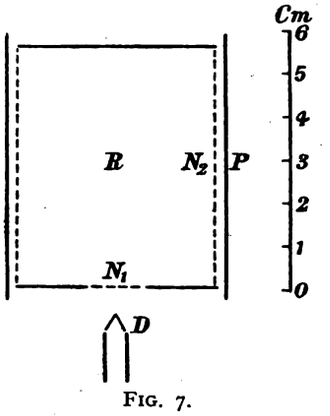

FIG. 7.

obtained the curves, Fig. 6, in which each jump corresponded to the appearance of a new line in the ultraviolet. G. Hertz measured the speeds of the electrons with the device, Fig. 7, in which D is the hot wire and the N are gauge grids inside the cylinder P; between P and N a potential of 0·1 V was maintained. A slow electron colliding with an atom would not have sufficient momentum left to cross the space PN, and no (or a weak) current would pass. At the right speed and energy the current curve rose suddenly.

As the current increased, some atoms might be hit more than once, and the effects of this " cumulative " ionisation became very complicated, especially when the atomic electrons were far out from the nucleus and easily removable. Investigating

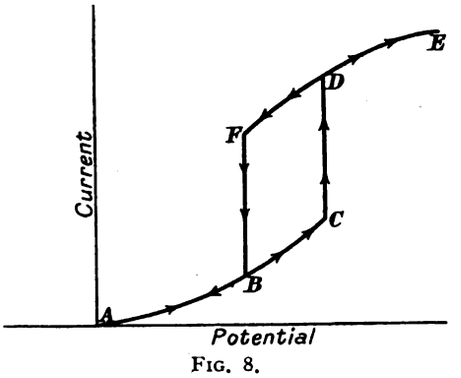

FIG. 8.

these phenomena in valves with cylindrical anodes, helical grids and straight axial filaments G. Stead and B. S. Gossling observed curves as in Fig. 8. The current rose at C suddenly to D by a very big jump, and then increased slowly again on further increasing the potential. Moreover on inverting the process by decreasing the potential, the current did not trace back the path $E\ D\ C\ B\ A$, but went *via* $E\ D\ F$ to B and A. With cumulative ionisation two current values might correspond to the same potential.

These features were demonstrated with the aid of the new discharge bulb which was combined with a plain cylindrical glass tube F (Fig. 1), containing a hot filament and a grid close to it. As the current was varied by means of the rheostat the electron emission in F and the deflecting currents in B_1 B_2 were simultaneously changed, and the curve, Fig. 8, was seen to grow and to develop in a striking manner.

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The Underfeed Type "F" Multiple Retort Stoker.

(From a Special Correspondent.)

The Underfeed Stoker Co. are already well known to readers of The Electrician as manufacturers of a complete range of mechanical stokers, including the self-contained travelling grate stoker with independent motor-driven forced draught fans embodied in the casing of the stoker and compartmented air supply, the special "E" type of stoker for smaller water-tube boilers which has been successfully applied to marine conditions, and the Underfeed screw feed stoker for cylindrical boilers, in addition to a long list of other specialities for steam raising, particularly the "Lopulco" system of pulverised fuel firing, the "Detrick-Usco" flat suspended firebrick arch, the "Usco" sluicing method for ash handling, the "Usco" air heater, and the new "Usco" non-oxidisible metal for fire bars.

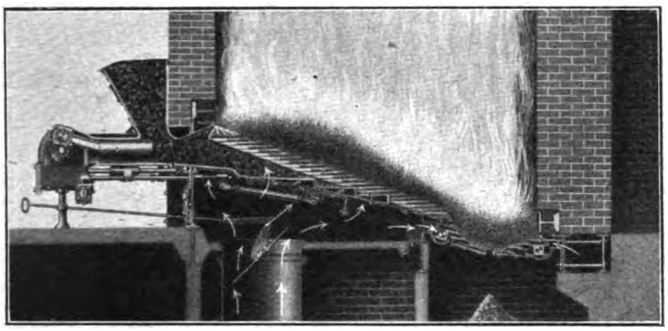

Fig. 1.—The New Underfeed Stoker, showing the Fire and Indicating the Air Flow.

Going still further, the Underfeed Stoker Co. have celebrated the opening of their new works at Derby by adding to this wide range the multiple retort stoker, Underfeed "F" type, which has been in use for many years in the United States. This stoker has been adapted by the Underfeed Stoker Co., so that they will be in a position to supply to their clients the exact type of stoker required for their particular conditions, since their products now cover practically the whole range of mechanical stoking.

Details of the "F" Type Stoker.

The new Underfeed "F" type, as seen from the illustrations, is on the most modern lines. The general principle of the multiple retort stoker will already be familiar, and as seen more particularly from Fig. 2, "F" stoker is on the usual plan of a number of interchangeable retorts or troughs placed side by side, about 21 in. from centre to centre, and inclined downwards at an angle of 20° to the horizontal, forming therefore a composite stoker which may be of almost any desired width. The coal is contained in one long coal hopper common to all the retorts, this hopper being bolted on the top of the outer casing of each retort. The coal falls down in front of slowly reciprocating rams, one to each retort. As the rams are withdrawn, an aperture in the bottom of the hopper is uncovered, and this allows the charge of coal to fall out, and on the forward motion push the charge of coal into the retort in front. Each of these slow-moving rams is actuated by a connecting-rod and crank-shaft forming part of the main driving shaft in front of the stoker, as seen in Fig. 4. For wide stokers the retorts are arranged in groups of three or four, each of which is driven by an independent crank-shaft, also seen in Fig. 4, these crank-shafts being actuated by a chain or other suitable drive either from the side or from underneath, one small separate motor or steam engine supplying the whole of the retorts for one boiler, or, if required, for a number of boilers. The drive is so arranged that each of the short crank-shafts can be varied in speed as required, so as to have the amount of coal supplied to each retort under perfect control. This driving mechanism also includes in front of the stoker a safety shearing pin, so that any undue obstruction in the retort, such as a piece of iron in the coal, simply breaks the pin and disconnects the working of the feed rams instead of breaking the stoker driving mechanism, the position of this pin being indicated in Fig. 2.

The Use of Auxiliary Pushers.

An important feature of the "F" type of stoker is that in addition to the main small feed ram or pusher for each retort there are also provided smaller auxiliary pushers actuated by cross-pins and steel yokes. The latter are carried on guide-rods so as to assist in conveying the coal forward uniformly in the retorts. The speed of these lower or auxiliary rams can be adjusted independently of the main rams by means of a small shaft situated in front of the coal hoppers, seen in Fig. 2, which engages or disengages with pawls on a moving rod. This independent adjustment of the travel of the auxiliary rams enables the depth of the fire in the front of the retorts to be varied as compared with the back or lower parts, whilst another practical advantage is that after dumping the ash and clinker the lower parts of the retort can be very rapidly filled again with coal, by allowing these auxiliary rams

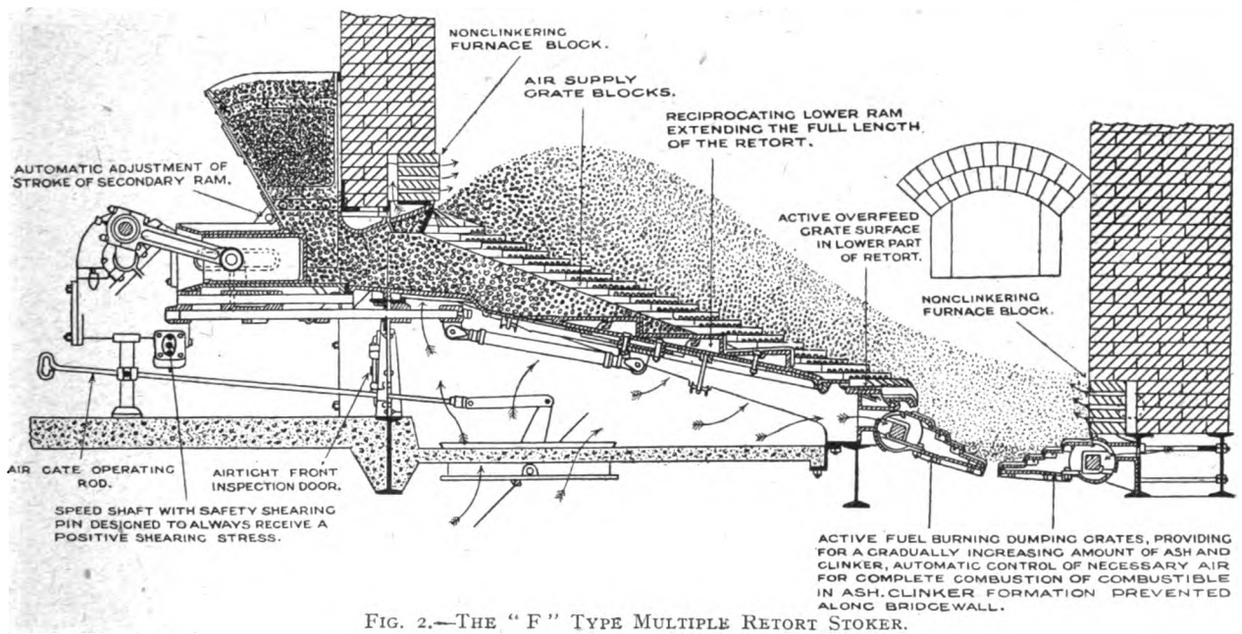
NONCLINKERING FURNACE BLOCK.
AIR SUPPLY GRATE BLOCKS.
RECIPROCATING LOWER RAM EXTENDING THE FULL LENGTH OF THE RETORT.
AUTOMATIC ADJUSTMENT OF STROKE OF SECONDARY RAM.
ACTIVE OVERFEED GRATE SURFACE IN LOWER PART OF RETORT.
NONCLINKERING FURNACE BLOCK.
AIR GATE OPERATING ROD.
AIRTIGHT FRONT INSPECTION DOOR.
SPEED SHAFT WITH SAFETY SHEARING PIN DESIGNED TO ALWAYS RECEIVE A POSITIVE SHEARING STRESS.
ACTIVE FUEL BURNING DUMPING GRATES, PROVIDING FOR A GRADUALLY INCREASING AMOUNT OF ASH AND CLINKER, AUTOMATIC CONTROL OF NECESSARY AIR FOR COMPLETE COMBUSTION OF COMBUSTIBLE IN ASH. CLINKER FORMATION PREVENTED ALONG BRIDGEWALL.

Fig. 2.—The "F" Type Multiple Retort Stoker.

to work at full speed for a short time, and the same applies when breaking up the fuel bed after a very long banking period.

Operating Details.

The stoker is worked on the usual general lines of multiple retort stokers with forced draught, and the arrangements for this are indicated in detail in Fig. 1. The forced draught is conveyed from the fan along the main underground trunk and to each stoker by vertical trunking, as shown in the

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illustration. The amount of air delivered can be varied by altering the speed of the fan itself, and secondly by adjusting a flap damper by means of the long handle projecting in front of the stoker, as shown in Fig. 1 and also in Fig. 2.

Air Distribution.

The forced draught then passes into the stoker and between the retorts, through the tuyeres or blowers, and down the side of each retort, as shown more clearly in Fig. 3, which is a rear view of the installation. A special feature, however, of the "F" type is the equal air distribution round the entire tuyeres, and the large cooling surface. Another item in the design is the row of hollow non-clinkering furnace blocks placed, as seen in Fig. 2, at the bottom of the front wall of the installation and also at the bottom of the back wall of the installation. Through these hollow blocks is circulated a supply of cold air from the forced draught chamber underneath the stoker, which very effectively prevents undue wear and tear of those parts of the brickwork most likely to be affected by heat, whilst in addition adding combustion in the furnace. This cooling arrangement also prevents clinker from adhering to the brickwork, a very vital point in the effective working of any mechanical stoker, and particularly of the multiple retort type.

Dumping Grates.

The arrangement of the dumping grates for the ash and clinker is also particularly efficient, and is illustrated in detail in Fig. 2. As seen, the ash and clinker is allowed to gradually accumulate at the end of the stoker over the dumping grates, so as to prevent the passage of any excess air, and at intervals —by means of a suitable lever—the hinged dumping bars are opened momentarily, and the charge of ash and clinker allowed to fall down into the ash hoppers below, or direct into the "Usco" water sluicing arrangement for automatic quenching and carrying away of this material. For very large installations an automatic arrangement can be provided motor driven, in which this dumping is carried out independently of the boiler attendants, the periods of dumping being adjusted as required by altering the driving mechanism of the motor.

Some Criticisms.

In view of the long experience that the Underfeed Stoker Co. have had in this direction, it will not be without interest to give their opinion as to the relative merits of the multiple retort stoker as compared with the improved travelling grate stoker. It is obvious of course that no one stoker is perfect

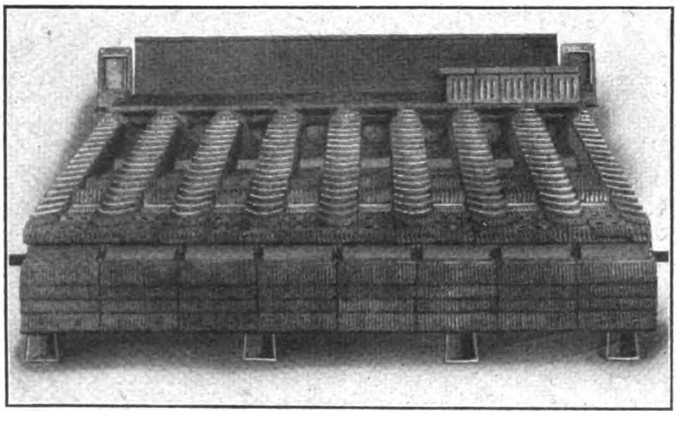

FIG. 3.—REAR VIEW OF STOKER WITH DUMP GRATES DOWN.

and exactly suited to all conditions, any more than any other mechanism. A multiple retort stoker has a number of disadvantages, or rather limitations, in its sphere of usefulness. In the first place, a stoker of this type must work with a short deep fire, which tends to the formation of large masses or blocks of coked material, especially with coal of high coking quality. This tendency is apt to result in two difficulties, first that of uneven distribution of the air through the fuel bed, the lumps, of course, being more impervious than the rest of the retort contents, and also that of completing the combustion of these lumps right through to the middle before the dumping bars are reached, that is to say, the difficulty of unburnt material in the ash and clinker.

Again, when absolutely non-coking coal is used, especially in a fairly fine state of division, a deep layer such as is necessary in a multiple retort stoker tends to form "channels" through the bed of the fuel, giving inefficient combustion and causing intense heat and wear and tear, besides blowing a considerable amount of dust and ash into the boiler tubes and even behind the ash pit. Another common trouble with the multiple retort stoker is that if the ash is fairly fusible, then the stoker is apt to be more difficult than other types, since the ash, because of the high temperature, is more easily melted at this point, forming a non-conducting layer at the top of the retorts

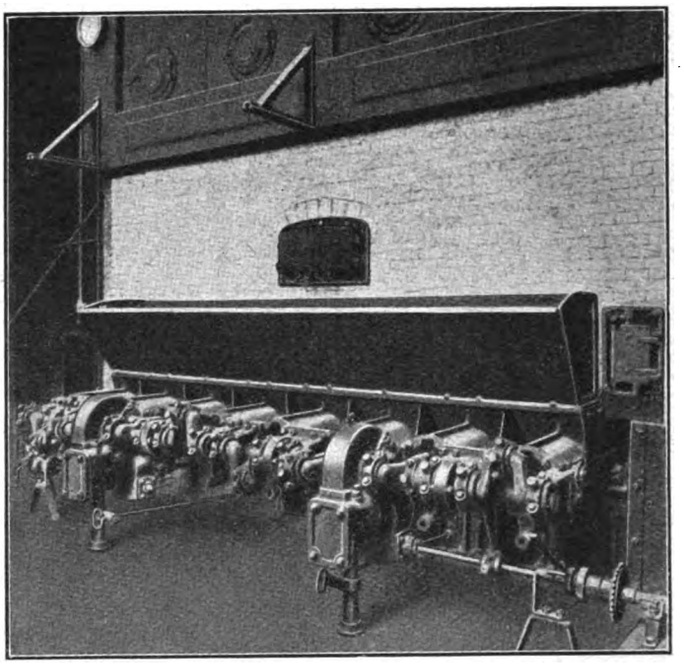

FIG. 4.—VIEW OF STOKER SHOWING DRIVING MECHANISM.

which prevents the maximum passage of air necessary for the most efficient combustion. It is for this reason that the multiple retort stoker has to be worked with high-water gauge air pressure underneath the retorts.

In general it can be stated that this type of stoker is best suited for moderate coking coals or practically non-coking coals, although the stoker is of the coking type, and also that such coals are not "smalls" or in too fine a state of division, whilst further the quality of the ash should be as good as possible as regards fusibility. On the other hand, the multiple retort stoker has a number of advantages. In the first place, the movement of the whole mechanism is slow and not subject to excessive wear and tear in this respect. Also there is not much tendency to the passage of excess air from the back of the stoker, but the particular advantage is the entire absence of firebrick arches with the consequent absence of wear and tear for this reason, and the direct emission of radiant heat on the boiler tubes themselves.

East of Scotland Electricity District.

No Joint Authority Appointed.

The Electricity Commissioners have issued a provisional scheme for the EAST OF SCOTLAND ELECTRICITY DISTRICT into which an inquiry was held last December. The area provisionally determined is confirmed subject to two small exclusions, and it has been decided that the name of the district should be changed to the Edinburgh and Lothians Electricity District.

The proposals that the new generating station of the Corporation of Edinburgh at Portobello should be utilised for providing bulk supply in the district and that the distribution in the district outside Edinburgh should be undertaken by the International Electric Construction Co., are approved subject to formal agreements being entered into between the Corporation of Edinburgh and the Lothians Electric Power Co. and between the County Councils of Midlothian and East Lothian and the Lothians Electric Power Co. The Lothians Electric Power Co. will also have to make application to the Commissioners for distribution powers, and will be required within two years to submit to the Commissioners a scheme for the distribution of electricity in other portions of the district.

It appears to the Commissioners that the position in this district is exceptional, as the generation will be centralised in the hands of an existing public authority, and that two other public bodies are prepared to charge themselves with the supervision of the development of distribution outside Edinburgh. In these circumstances the Commissioners have come to the conclusion that the setting up of any other body, even of an advisory character, is unnecessary.

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Theory of the Three-Brush Dynamo.*

By M. BETHENOD.

The industrial importance of the dynamo with three brushes in motor car equipment has already been established. Before proceeding to the theory, consider the bipolar armature in Fig. 1 with the normal brushes BB_1 and an auxiliary brush b. When the armature is rotated and a current I sent through it, then, if the angle $\theta=O$, the voltmeter V across the brushes B and b measures simply the ohmic drop in the armature, whatever the speed. This holds even if an iron ring is provided for the flux produced by the armature ampere turns. If, however, b is rocked away from B_1, the voltmeter records an additional pressure, which passes through a maximum and falls again to zero when $\theta=\pi$. This additional pressure is induced by the rotation of the conductors between B and b in the field produced by the current I flowing from B to B_1. With sinusoidal flux distribution, angular velocity ω, and permeability μ, this e.m.f. $\propto \mu\omega I \sin\theta$.

Passing on to the actual machine, Fig. 2,

let e=pressure of the battery A,

R_1=armature resistance between the exciting brushes bB, R_2=resistance of the load circuit, including R_1, r= resistance of exciting winding, traversed by i, m=the coefficient which, multiplied by the angular velocity ω, gives the e.m.f. between the brushes BB_1 when the exciting current $i=1$ A. The e.m.f. between the brushes bB is then $km\omega i$, where $k<1$.

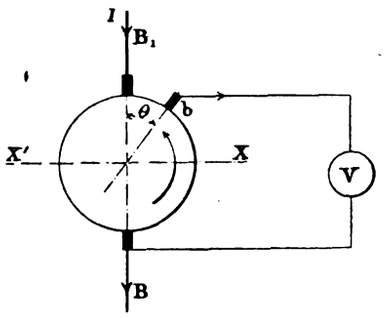

FIG. 1.

It will be assumed that the magnetic circuit is unsaturated—a permissible assumption since i falls rapidly with the speed. All dynamos that have to work over a wide range of speed must have low saturation, and it is therefore assumed here that the flux is proportional to the exciting current. (To take saturation into account is not difficult.)

The polar arc is usually about 120 electrical deg.; in consequence k is approximately unity so long as $\theta>30$ deg., that is, so long as the brush b is not pushed too far under the pole. Within this limit, the flux due to i is always cut by the same number of active conductors in the arc $boB=Ti-\theta$.

It will also be assumed that there is a differentially connected series winding which produces the e.m.f. $M\omega I$ between BB_1 and the e.m.f. $kM\omega I$ between bB.

We can then write

$$R_1(I+i)+ri=km\omega i-kM\omega I-\mu\omega I \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

$$R_1(I+i)+R_2I+e=m\omega i-M\omega I+\mu^1\omega i \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

From these equations we get, by removing i:

$$I=\frac{e\{km\omega-(r+R_1)\}}{\omega^2(m\mu+kM\mu^1+\mu\mu^1)+\omega\{(1-k)(M+m)R_1+Mr+\mu^1R_1-kmR_2\}+rR_1+rR_2+R_1R_2} \quad (3)$$

We thus get the load current I in terms of the several variables, particularly the angular velocity ω.

For lighting a car by means of a dynamo driven by the motor or the shaft, it is interesting to examine how I varies when ω is very low or very high. When the speed is less than

$$\omega_0=\frac{r+R_1}{km} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

the current I is negative—*i.e.*, the battery drives the dynamo. This critical speed is analogous to that which occurs when the machine acts an ordinary shunt dynamo, and is not very different from the latter for the same excitation.

* Abstracted from Bulletin de la Société française des Electriciens, Vol. II, No. 14.

As the speed increases, I rises rapidly, but the presence of ω^2 in the denominator shows that I reaches a maximum for a certain value of ω and then falls off as long as the speed continues to rise. This singular phenomenon, which lends to the three-brush dynamo its most essential characteristic, is due to the e.m.f. $\mu\omega I$ produced by the armature cross field, referred to at the outset. This feature is just what is wanted for car lighting—for town service.

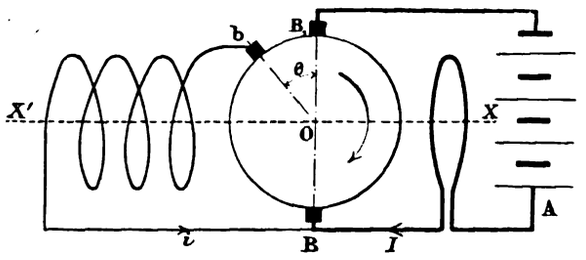

FIG. 2.

In practice, the first term of the denominator in equation (3) soon preponderates after the critical speed ω_0 has been passed, at least when the armature resistance is low and the machine has no series turns ($M=O$). The maximum value of I then occurs approximately at the speed

$$\Omega=2\frac{r+R_1}{km}=2\omega_0 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

That is to say, that a three-brush dynamo working on a battery gives its maximum current at a speed about double the speed at which the current is zero. The actual value of Ω can be found from equation (3), but test curves show that equation (5) gives a fairly correct average value for the speed at which maximum current occurs. The presence of a series winding enables us to modify the curve $I=f(\omega)$ at will, the case $k=1$ and $\mu^1=o$ corresponding to the two-brush machine with simple decompounding. The value of M can even be such that the ω term in the denominator of equation (3) can be zero at all speeds. In this case equation (5) is nearly true.

It is seen from equation (3) that the current I increases with the battery voltage e—a troublesome matter for properly charging the battery. Nevertheless, overcharging the battery on a car is scarcely to be feared, while the life of the battery is usually determined by other causes. For car work cost is of chief importance, and a dynamo with inherent regulation is a great advantage.

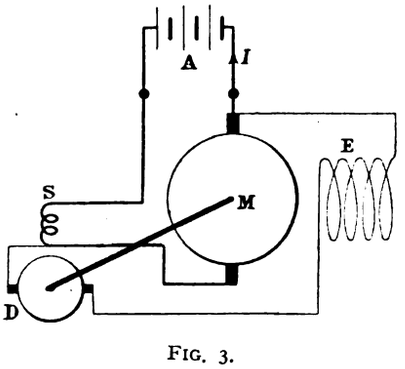

FIG. 3.

From an electrical point of view the action of the three-brush dynamo is identical with the arrangement in Fig. 3. A machine M, feeding the battery A, has its field E in series with the armature of negative-boosting dynamo D, the two machines being mechanically coupled and the battery connected across E and D, as shown. The exciting winding S is traversed by the load current I. At *constant* speed such an arrangement (often employed, for example, with the generators of a Ward-Leonard set for driving reversible mills) functions like a single machine with a differentially-connected series winding; but at *varying* speeds, owing to M and D being mechanically coupled, the current supplied to the battery follows a law similar to eq. (3).

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Band Music Distribution at Olympia.

Interesting Use of the Public Address System.

A feature of considerable interest at the Ideal Home Exhibition is the amplifying and distributing of the band music throughout the whole of the Exhibition.

This is made possible by the use of the WESTERN ELECTRIC Public Address System, details of which have already been given in THE ELECTRICIAN. By the aid of this system the music from the bandstand in the gallery of the Main Hall can be reproduced not only in the restricted corner of the large Main Hall, but also in the New Hall, the Gardens, the Pillar Hall, and the vestibules.

As is well known this system has been primarily designed to aid public speakers and the introduction as a means of distributing orchestral music at the Ideal Home Exhibition is therefore an innovation worthy of note. We understand that never before in this country has the music of a single orchestra been distributed over so large an area.

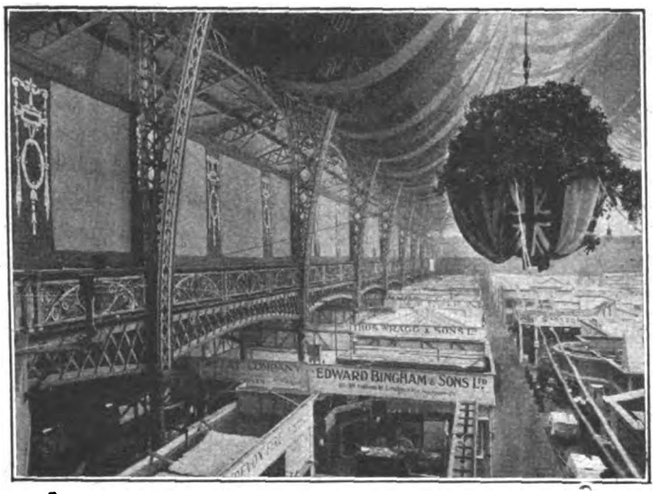

FIG. 1. ONE OF THE PROJECTORS IN THE MAIN HALL AT OLYMPIA.

The Microphone

The microphone, which is very sensitive, is mounted on a small bracket in front of the orchestra, and picks up with great faithfulness the sound of every instrument, maintaining the exact timbre of each. The microphone itself is designed so that the natural period of vibration of the diaphragm is well above speech and music frequencies, so that resonance of the diaphragm at these frequencies is avoided. This results in exceptionally pure reproduction of music or speech. The diaphragm actuates two microphone buttons, connected in a special way in the input circuit so as to eliminate any distortion of the speech or music currents generated in the buttons by the vibration of the diaphragm.

The microphone is sensitive to speech at distances from 3 to 8 ft. from it. It is even more sensitive to music, owing to the fact that music, whether singing, orchestral, or bands, is generally louder than speaking, so that the microphone may be placed further away from the source of sound.

Amplification Arrangements.

The amplifier increases without distortion the very small currents generated in the microphone so as to produce the required volume of sound in the loud speaking projectors. The amplifier, together with the associated batteries and power board, are situated on the balcony just to the rear of the orchestra. The amplifier consists of four stages of amplification, the first two stages being voltage amplification, the third stage current amplification, and the final stage power amplification. The power valves in the final stage are connected in a special differential circuit to eliminate distortion.

The amplifier is constructed in panels, the cabling from the microphones being brought on to one panel, which is provided with means of switching to any desired microphone.

Another panel contains the apparatus associated with the first three stages of amplification, that is, two stages of voltage amplification and a stage of current amplification as explained above. It is on this panel that the total output from the system is regulated by means of a potentiometer, situated between the first and second stages. An additional panel contains the necessary measuring instruments, and is provided with plugs and cords, so that the current in any part of the system may be measured by plugging into jacks, provided on the amplifier for this purpose.

Volume Detector.

The volume indicator is a valve detector device which measures the alternating current power in the system by means of a deflection on a galvanometer, and enables the proper transmission level of the system to be maintained. The power amplifier receives the output from the first amplifier and increases the power available to such a valve as to operate the projectors at the required volume to cover the area served by the projectors. Finally, there is a control panel provided for adjusting the volume in the individual projectors to the desired value. This also contains keys for cutting in or out of the circuit any desired projector, and a master key for switching out all projectors simultaneously.

Projector Arrangements.

The arrangement of the projectors for serving the entire exhibition is as follows: Four projectors serve the main hall. These are suspended above and slightly in front of the orchestra. The two centre projectors are provided with medium size wooden trumpets, the outer projectors being small fibre horns. The smaller horns are installed in these positions for the reason that the area they cover is not great enough to warrant the larger wooden trumpet. A single fibre horn serves the garden, and is mounted in the corner nearest the orchestra. The new hall is covered by two fibre horns mounted in the centre at one end. A single projector with fibre horn serves the Pillar Hall.

At the Hammersmith Road entrance, and also at the Addison Road entrance, a projector with a small curved horn is fitted, the total volume required in these cases being much less than in the main buildings.

The loud speaking projectors operate upon the principle adopted by the Western Electric Co., and used by them in their wireless loud speaking equipments. They are of the balanced armature type, combining great sensitiveness with the ability to handle comparatively large voice currents without distortion.

Control of the Installation.

The equipment is under the control of one operator, and the degree of loudness from any one projector can be adjusted according to circumstances. To enable this to be accomplished to the best advantage a system of telephones is arranged whereby a person listening in a remote corner can communicate with the operator and arrange for the apparatus to be adjusted as desired.

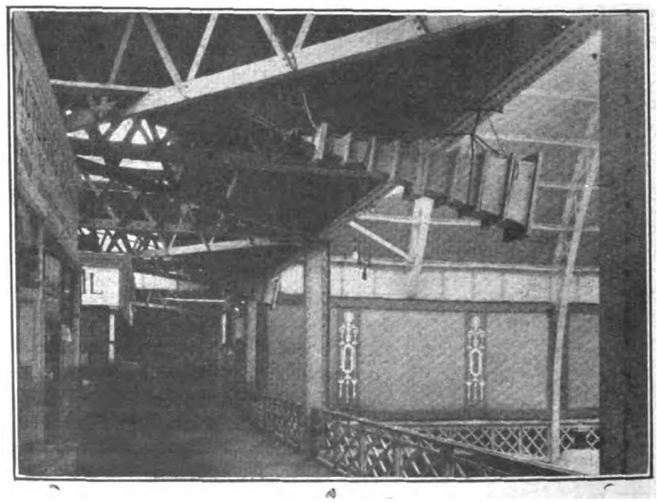

FIG. 2. ANOTHER SET OF PROJECTORS IN THE NEW HALL.

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E.D.A. Salesmanship Conference.

The final B.E.D.A. SALESMANSHIP CONFERENCE of the session was held on Friday, when Mr. H. W. GREGORY, of the North Metropolitan Electric Power Supply Co., lectured on "The Relative Possibilities of Electricity in Different Trades and Classes of Customers." Mr. A. G. Beaver, Chairman of the Electrical Wholesalers' Federation, presided.

Mr. GREGORY said his remarks were addressed chiefly to engineers of small undertakings whose responsibilities for load development did not end with the mere appointment of a salesman, and in whose department the principles of salesmanship could be studied with equal benefit as by the salesman proper. He divided the consumers in any district into two classes, those who consumed current to live, such as factories, workshops, electric vehicles, shops, cinemas, theatres, etc., and those who lived to consume, such as private houses, clubs, public buildings, etc.

Factories and Good Service.

As regards factories, emphasis was laid upon the need for good service, any deficiency in which could not be made up for by improvement in salesmanship. The need for this good service was specially important in connection with cooking apparatus. The factory user with a large amount of capital locked up in a private plant was a difficult person to deal with, and very often it was necessary to wait for a breakdown or the need for large extensions before any impression could be made. In some cases it might be policy to recommend the use of a private plant, but care should be taken to see that the voltage and general equipment was such that it could easily be changed over to the public supply when it became available. Cooking and occasional heating in factories required special attention. Even if the electric canteen was turned down, the electric warming cupboard for the workmen's meals was a sound proposition. The occasional radiator in the commissionaire's box should not be overlooked, whilst special attention should be paid to forms of industrial heating on a small scale. Much business could be obtained by a judicious adjustment of tariffs, which need not cause a dangerous precedent.

Shopkeepers and Sheep.

In the case of shops, one shopkeeper would follow another. In such trades as jewellers, bootshops, drapers, grocers, ironmongers, butchers, bakers, dairies, confectioners and greengrocers, the amount of business, once started, increased in subsequent years until in about the third year it had been found in two suburban districts, practically all the business available from these trades had been obtained. Some of the instances mentioned in which development had been made and could be extended were radiators for pay desks in shops, and electric signs. Difficulties arose in the general heating of a shop unless an attractive rate was offered. All authorities had found that a general purpose rate, consisting of a fixed charge and a low follow-on price per unit, was both popular and satisfactory in developing domestic load, but the same fixed charge would be found to cause many anomalies in the case of the shop consumer, and would generally give too high an average rate to encourage other uses. These other uses were even more desirable in the case of shops with their bad load factor, and some solution might be found in a reduction of the fixed charge compared with that for private houses. If this were done, then there would be great encouragement for cooking in lock-up shops, fans, window-heaters for the prevention of condensation, and so on.

The Domestic Consumer.

Coming to the second category—viz., those who lived to consume, Mr. Gregory dealt with the matter much on the lines of previous lecturers, and suggested that persistent advertising would be found to be a big factor.

Speaking generally on the sales problem, Mr. Gregory said that whether a contracting department was run or not, a salesman was essential, but he must be chosen with the proper qualifications. The second necessity was a showroom which should be kept illuminated after closing time, and there should, during the hours it was open, always be apparatus in operation. One important point emphasised was that supply authorities should lay mains to the confines of their districts, and another was that the hiring of apparatus in the poorer districts would be found to be more profitable than many imagined. At the same time he was not enamoured of hiring systems, except where the apparatus concerned was in process of development and is not yet sufficiently popularised. He also spoke in favour of demonstrations, in the summer time, of apparatus by means of motor vans sent round to the quieter roads, and said he intended to try something on these lines himself.

During the summer period main-laying should be got on with, and attacks made upon apathetic consumers by the salesmen by personal visits. The sending regularly of pamphlets to all householders on the route of mains was an essential and should be persevered with, and the summer was the best time to push electric cooking.

DISCUSSION.

There was the usual lengthy discussion in which many points of interest were brought up. Perhaps the most important—or one of the most important—was that of the manner in which showrooms should be stocked. Some manfucturers felt that they were practically blackmailed into supplying apparatus on sale or return, as suggested by Mr. E. SHARP; but, generally, there was no agreement as to the best means to go to work in this matter. Mr. MORTON thought it was wiser for the retailer to select the best apparatus, after personal inspection, and then to stock it in the ordinary way, so as to be able to assure his customers of its quality. Other speakers took a similar view, and suggested that much apparatus on sale or return was not good selling stuff or it would never be obtained in that way. On the other hand, Mr. H. T. YOUNG said it was difficult to resist the temptations of the manufacturers in this matter, and the point was left without any suggestion of a concerted policy on the part of the manufacturers.

Showrooms a Necessity.

Showrooms formed a prominent topic. It was universally agreed that every undertaking should have a showroom, but some speakers—for instance, Mr. YOUNG—would have an electrical showroom of some kind, even if only a retail shop, in every thoroughfare. An example of how not to do things was mentioned by Mr. SHARP, who said that the electricity supply people in his district sent out very few leaflets, and people were then asked to apply to the electricity works for further information. It so happened that the electricity works were in a somewhat unsavory part of the district. close to the refuse destructor. Another speaker deprecated the tendency to place showrooms as near to the boiler-house as possible, and generally it was the opinion that showrooms should be as numerous as possible and kept lighted well after the usual closing time.

Hotels as Consumers.

A strong campaign in regard to hotels was recommended by Mr. YOUNG, and in this connection mention was made by him and Mr. SELLEY of a tally-meter for electric heaters to overcome the difficulties in relation to hotel bedroom heating. The scheme was that the visitor asked the chambermaid for a tally which allowed a certain amount of heat to be obtained for a small price. This was charged against the visitor and obviated lighting a coal fire and its costs. It was claimed that this tally-meter overcame the difficulty of a change in tariff on the part of the supply authority inasmuch as the hotel proprietor could vary the charge for the tally according to the prevailing tariff.

Signs as Business Getters.

Among the miscellaneous matters mentioned was that of signs. Mr. SHARP suggested developments locally on the lines of Piccadilly Circus in regard to signs, on the part of the big national advertisers, on a smaller scale, of course, or even the illumination of the large local hoardings and posters. Mr. BEAUCHAMP pointed out that one reason why signs had not developed locally as much as they should was the local regulations, which in many cases had not been modified or changed in any way since 1852. Then considerable attention was devoted to the need for developing working-class districts for electric cooking, it being urged that the revenue would be greater than many imagined, especially if slot meters were installed. There were still differing views as to hiring and hire-purchase, and it seemed that each undertaking must decide this for itself. Demonstration of apparatus, however, was agreed upon by all, experience showing that where small apparatus was lent for a short time to be operated in the home, it seldom came back but was bought, whilst the need for having plenty of apparatus at work in the showrooms was also made much of.

E

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High Speed Alternator Problems.

DISCUSSION at CARDIFF.

In the course of the discussion on Mr. J. Rosen's Paper on "Some Problems in High-Speed Alternators and their Solution" which took place at Cardiff, Mr. J. W. BURR wished to know whether it would be cheaper to run a machine say of 5 000 kVA capacity through reduction gearing than direct coupled. The question of generating at higher voltages had been neglected. In these days of long transmission schemes it would certainly appear less expensive to generate at higher voltages rather than to use transformers.

Exciter Difficulties.

Prof. R. G. ISAACS said one minor defect with exciters was the failure to excite when starting up again when the set had been shut down with the fields closed. Probably the main field held its magnetism longer than the exciter, and weak alternating currents were generated in the rotor windings by the varying flux caused by heating which of course might demagnetise the exciter field. If this explanation was correct, then a series winding would help, and it appeared, as in the case of sets which have to be brought into service quickly it would be worth while to provide separate excitation.

Major E. I. DAVID preferred open to closed slot machines. The latter necessitated more joints in the conductors and he would prefer to eliminate joints rather than multiply them as was the case in the Parsons machine.

Mr. H. ELLIS thought it was unfortunate that the speed of most alternators was limited to 3 000 revs. per min. He would like to know the limits in size of the geared machines. He considered the closed air system for ventilation of alternators would lead to the solution of many difficulties—dry air filters were a source of annoyance.

Flexible Insulation Unnecessary.

Mr. G. A. JUHLIN joined issue with the Author in his findings on the question of insulation. Mr. Rosen laid down a condition that insulation must be flexible. There were in this country some millions of kVA with mica steam pressed insulation operating without any difficulty. Eddy currents had been overcome by the useof laminated conductors. It would be impossible to construct machines to-day with solid conductors, the temperatures would be so enormous that the stator windings would be destroyed. It was not possible to obtain materials for insulation which did not finally harden. It was difficult and perhaps not always wise to dogmatise on any particular type of insulation.

DISCUSSION at LEEDS.

Mr. J. Rosen's Paper was also discussed at Leeds, when Messrs. J. W. J. TOWNLEY, Mr. G. B. MELTON, Mr. HENZEL, Mr. MATHER, and Mr. JONES spoke and communications were read from Mr. S. E. FEDDEN and Mr. MAXWELL BUIST.

Practically the whole of the speakers concurred in the advisability of the adoption of the closed system for the ventilation of alternators, though there were some speakers who deprecated the use of an external fan as being another auxiliary. The advisability of using some fire-proof insulation or construction on end windings was brought up.

DISCUSSION at NEWCASTLE.

At Newcastle Prof. W. M. THORNTON showed some interesting oscillograph records taken twenty-one years ago, comparing the sine waves of the first alternator installed by the Newcastle-on-Tyne Electric Supply Co., which was a foreign built machine, and a Parsons alternator, which was installed very shortly after. The comparison was strongly in favour of the Parsons machine, the oscillogram of which showed an appreciable improvement in the elimination of ripples.

Mr. H. W. CLOTHIER said that switchgear manufacturers had to endeavour to provide apparatus which would prevent the development of a fault on a machine, and in the event of a fault occurring which would cut out the machine as quickly as possible. A record of total faults amounting to only 1 per cent. however did not give switchgear manufacturers much to do. He did not see much difference in the space occupied by present-day machines and those built 30 years ago, although the capacity had been increased 100 times and the speed about 10 times. He preferred to have the field switch in the main exciter circuit instead of in the exciter field circuit, because it was essential to reduce the field flux to zero in the minimum of time. It was extremely important to break the main field current as quickly as possible, otherwise there was a danger of damaging the stafor core. He recommended that the main field circuit should be broken on an oil switch, although the circuit was inductive, because an oil switch could interrupt the circuit in 0·018 secs., whilst with a knife switch the time at best was bound to be two or three times as long. It was possible to reduce the danger of puncturing the winding by the installation of relays. He thought the interlocking between the field switch and the main oil switch should be such that the field switch would close first and open last, the field switch would only open automatically when there was a fault on the stator, the field switch would not open on overload faults or hand tripping. If the field switch did trip out it should be possible to close it again without opening the main oil switch and no shunt field switch should be provided.

Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

THE PROBLEM OF EFFECTIVE HEIGHTS OF AERIALS.

To the Editor of THE ELECTRICIAN.

SIR,—There is a very general impression that Prof. Sommerfeld's (albeit very valuable) work completely solves the antenna problem. Nothing was farther from his thoughts. It is very distinctly stated (see p. 669, "Ann. d. Phy.", 1908, vol. 28) that nothing could be deduced as to antenna conditions at the source. By employing the Hertzian potential function π a *sine qua non* is that the waves must be considered already set up at a very great distance from that at which the function is considered applicable.

The nearest approach (so far published) to dealing with the radiation loading of an antenna power line is the writer's article in the "Journ. I.E.E.", London, April, 1921. The solution of Hertz is indeed very far from satisfactory. Moreover, if the subject is pursued farther two things will be seen to follow—the one is that along the antenna there must be hyper-velocities of the Ludwig Silberstein type (see "Proc. Royal Soc.", A. 91, 1915; secondly, such hypervelocities are due to magnetic screening and leaky dielectric effect at high frequencies, tending to diminish the effective L and C. At low frequencies the earth's resistance preponderates, but at high frequencies the leaky dielectric acts rather as a condensance factor than as a resistance contributor. It is for this reason that the "surface wave" velocity $v=(L_1C_1)-1$ is greater than that of light. (See also Sommerfeld, *loc. cit.*, p. 727, for somewhat analogous effect). However, I have prepared a paper on the subject which no doubt will appear in THE ELECTRICIAN in due course. The antenna earth is truly important, but Hertz's potential function won't indicate it.

Radio theorists appear to ignore the fact that Sarasin and De la Rive proved long ago that the Hertz detector when placed near a metallic screen (ground) did all the radiating. Poincaré and J. J. Thomson agreed. (See Fleming "Princip. Elec. Wave Tel.", first edit., p. 313). The metallic box of the Fleming set up surrounding the spark balls (see his Fig. 7, p. 315, *loc. cit.*). was at the basis of the necessary hypervelocity, in accordance with the above.—I am, etc.,

A. PRESS.

Rantoul, Ill.
March 4th.

MANUFACTURER—FACTOR—RETAILER.

To the Editor of THE ELECTRICIAN.

SIR,—Every credit and acknowledgment is due to the initiators of the debate which took place at an informal meeting of the Institution of Electrical Engineers on Monday.

The debate was a failure. Everyone wore kid gloves, and beyond a mere recital of all that has been said and gone before nothing was contributed in the way of constructive suggestion as to how the evils are to be remedied. I am convinced they can be remedied, but not by a mere parrot-like recital of the conditions. We all know the conditions.

What, then, is the next step? It is obvious that no further discussions of this sort, even if they are worth while (which I doubt) will be held under the I.E.E. roof; also it is no secret that the E.D.A. hesitate, for reasons which can be appreciated, to take any steps to call a conference to discuss a *constructive programme*. Again I ask, what is the next step?—I am, etc.,

X. Y. Z.

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The Electrical Development Association.

Lord Haldane on Research and Service.

The third annual luncheon of the BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION was held at the Hotel Cecil on Friday, under the presidency of Mr. W. B. Woodhouse, who had earlier in the morning been elected President of the Association for the coming year. About 200 were present.

The Mind Creates Wealth.

In proposing "The Electrical Industry," the RT. HON. VISCOUNT HALDANE said the electrical industry was dependent and growingly dependent upon research, and upon the services which it could render to the community. In dealing with the first point he referred to the patent actions that had taken place in connection with electric lamps and used these as an argument for proving that research was the very foundation of the success of the electrical industry. Dealing with research generally, he said the moral of past experience was that the industry must keep in touch with the universities, those guardians of the knowledge of the industry. The industry was also dependent upon the service it could render to the community and on the understanding of the public of electricity. It was often argued that labour created wealth. His own contention was that neither labour nor capital created wealth. It was the mind which created wealth, and the electrical industry was establishing the domination of mind in the utilisation of the wealth of the earth. The difficulty was that there was a very imperfect understanding as to the advantages of electrical power. What was wanted was for the manufacturing industries to appreciate that electric power could do for them the same work now effected by the wasteful steam-engine, but at a fraction of the cost, whilst another important factor in the development of this idea was the appreciation of the workmen that their own position would be immensely improved if there were an abundance of electrical power available at cheap rates.

A Prosperous Electrical Industry Essential.

The CHAIRMAN, in reply, said it was notable that while industry generally had been having a bad time, the electrical industry had been relatively prosperous. That had a very important bearing upon other industries, because the very fact that the electrical industry had remained relatively prosperous meant that prosperity was gradually coming back to the other trades. The more prosperous the electrical industry the more rapidly would the advantages of electricity be extended to other industries. In short, the prosperity of the trade of the country generally meant that the electrical industry must be made prosperous and the conditions under which it was working must be such that there was ample working capital available. The present outlook, as a matter of fact, was that unless the supply industry expanded very rapidly during the next few years it would be over-run with demands for electricity which it could not meet. That demand for current also meant much work for the manufacturers of the machinery and for the installation work. The work which was being done by the Association had been of the utmost importance in bringing the various sections of the industry together. He was greatly in favour of specialisation, and he believed it was the proper business of the electricity supply authority to supply electricity; the proper business of the manufacturer was to supply the machinery and the proper business of the contractor was to do the installation work. This aspect of the matter had been greatly helped by the work of the E.D.A. In another direction the Association had done good work in regard to electric cooking, but in order that this development should be as widespread as possible, it was necessary to hire out apparatus. In this matter the supply authority, the manufacturer and the contractor, would have to work together, because by co-operative working they would be able to do very much more than they possibly could do individually. Therefore, in addition to specialisation, co-operation was required to deal with these special cases. At the same time development was largely dependent upon an abundant supply of electricity, and it was more important that that supply should be abundant to begin with, than that we should strive to make it extremely cheap. The work of the Electricity Commissioners in that respect was bearing fruit, and if those engaged in the supply business could be assured of a reasonable return, then they would be assured of getting capital on reasonable terms, and the final result would be the cheapening of supply coupled with an abundance.

Preaching the Electrical Doctrine.

Mr. LL. B. ATKINSON proposing "Our Guests and the Press" (a subtle distinction this!), referred to the early days of the industry when technical questions absorbed the whole of the energies of those engaged in the industry, with the result that the position which it was hoped to achieve had not been attained. Then the Electrical Development Association was formed, and its function was to take up the work where it had previously been left and preach the doctrine of the use of electricity for all purposes, in the form of publicity of the widest possible nature. During the forty years the industry had been in existence the consumption of electricity had risen to a certain figure by 1921, but the Commissioners had made the definite statement, based upon their investigations in the industry, that that amount would be doubled by the year 1926. The industry need not be despondent with that outlook before it. As to the lack of appreciation of the public of the advantages and uses of electricity, he felt the industry had very largely to blame itself, inasmuch as when it addressed itself to the public it did not do so in the best manner. If the industry gave the press unbiassed and sound information, it was always thankfully received. The E.D.A. was doing valuable work now in that direction, and the industry, as a result, was receiving very great advantage and help which the press was giving it.

Sir KENNETH GOADBY, K.B.E., replied to the toast, and referred to the many ways in which electricity was now called in to aid the medical profession. He made special reference to an apparatus by means of which it was possible to trace an outline of the human heart, and so enable an examination to be made more thoroughly, and to another instrument by which it was possible, he said, if suitable questions were put to the patient, to determine what the patient was thinking about. Then with the Einthoven galvanometer it was possible to register the electrical changes which take place with the heart-beats, and so determine in what manner the heart is damaged. In the domain of hygiene, electricity had played and was playing a most important part, and no piece of apparatus had ever been invented which had done more to prevent disease than the electric fan. Reference was made to electric cooking and the use of labour-saving appliances in the home, at the end of all of which, however, was the great nuisance, the dust cart. How that was to be done away with at the moment he was not prepared to say. From the point of view, he was pleased to see that the work of the Association was not to do away absolutely with the open fire in the home, which, after all, was a means of destroying the kitchen and other refuse. We seemed to be getting towards what he might term the half-electrical house.

The B.E.A.M.A. Dinner.

Lord Derby on Trade Within the Empire.

The annual dinner of the BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION was held at the Hotel Victoria on Friday. The President (the Earl of Derby, K.G.) was in the chair, and about five hundred members and guests were present.

The Prince of Wales and the B.E.A.M.A.

In proposing the toast of "Our President," Mr. B. LONGBOTTOM, Chairman of the Council, paid a tribute to Lord Derby's services to the State.

In reply, LORD DERBY said it was a memorable occasion for him to be for the first time as their president. Later that year there would be a still more memorable occasion for him and for them, as he had a letter from the secretary to the Prince of Wales intimating the Prince's acceptance of an invitation to dine with the members of the Association on November 15th. He was glad that the Prince, deeply interested as he was in the British Empire Exhibition, was coming to a dinner to be given by those who could contribute so largely to the success of the Exhibition.

Stimulating the Nucleus of Industry.

Sir JAMES STEVENSON, vice-chairman of the Executive Council, British Empire Exhibition, submitted the toast of "The Industry." It seemed to him, he said, that when they were spending so many millions on the various arms and services of defence they should do something to encourage and stimulate the nucleus of industry itself. They must not only have a cadre for the men but also for the material. He believed that the day was coming when the electrical industry of this country would embark upon a great and new era. For three years he had been hammering away at Empire development. They had been missing their opportunities in that direction, but he was sure the Association could do a great deal towards fostering the movement and making this country self-supporting.

Mr. P. J. PYBUS, in reply, referred to Sir James Stevenson's scheme for the stabilisation of the price of rubber, an arrangement which had saved an industry from bankruptcy.

Empire Development.

The EARL OF DERBY, in proposing "Our Guests," referred to the great necessity for Empire development. It was good for trade that the Empire should be developed so that they should be dependent upon themselves and not upon others. He was a tremendous believer in Empire development. He thought that they should see developed under the British flag markets for goods from the Mother Country and that the Mother Country should receive what she required and could not provide for herself from the Empire beyond the seas. He was a firm believer in that policy, and he held that the only race capable of colonising hardy and honest stock, and on a scale that would last, was the British. The development of the British Empire must come from the encouragement by the Dominions of men from this country to go out to their Dominions and there plant the root from which a great and sturdy growth of Britishers will spring. It was fitting in a meeting such as that, representing the great trades and industries of the country, that they should honour the representative of a great Dominion.

Sir JOSEPH COOK and Sir RICHARD GLAZEBROOK acknowledged the toast.

According to the "Board of Trade Journal" extremely satisfactory business was done by exhibitors of SCIENTIFIC INSTRUMENTS at the British Industries Fair.

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Legal Intelligence.

B.T-H. Patent Litigation.

In the Chancery Division on March 16th, Mr. JUSTICE ROMER granted a perpetual injunction on the motion of the British Thomson-Houston Co. restraining L. M. Don, Great Alie Street, London, E.C., from infringing their patent for the gasfilled lamp.

His Lordship also granted a similar injunction restraining D. Rose and Co., Osborne Street, London, E.C.

In the Chancery Division on March 16th, Mr. JUSTICE SARGANT heard a motion by the British Thomson-Houston Co. against Lancelot Booth, Finchley Road, to restrain the defendant from infringing plaintiff's letters patent relating to leading-in wires. Mr. Trevor Watson said he moved *ex parte*, the evidence in support showing that the articles complained of came from foreign infringers and the practice of the importers was to send the goods back when they got timely notice that writs were out, and before an injunction could be obtained. The plaintiffs now wanted an injunction which would tie the goods in the hands of the defendants here, and prevent them parting with possession of them. His Lordship granted an injunction as asked; and similar orders were made at the instance of the same plaintiffs against Collins and Sons, Kingsland Road, and J. M. Branders, Whitechapel.

Alleged Fraud on Electrical Firm.

At Leeds on March 14th, Harry Ingleson (58), of Back Devonshire Place, Harrogate, was committed for trial at the Sessions on a charge of obtaining goods by false pretences, and on three further charges of obtaining credit by fraud.

Mr. ARTHUR WILLEY prosecuted, and stated that it was a glaring case, involving large sums of money, and he understood it had been going on for about two years. Every kind of commodity had been obtained by the prisoner on his representation that he was carrying on a legitimate business at 10, Devonshire Place, Harrogate. The evidence would show, however, that the premises merely consisted of a garage, which the prisoner took at a rental of 10s. a week, and, so far as they had been able to ascertain, there had never been anything stored in the garage except empty cases and tins. The prisoner, it was alleged, had obtained goods worth several hundreds of pounds without the slightest intention or possibility of paying for them.

It was alleged that on January 11th the prisoner called at the warehouse of John Russell and Co., wholesale electrical dealers, Wellington Street, Leeds, and asked to be supplied with six dozen electric bulbs, but he was told by the manager that he would have to pay for the goods before they left the premises. Shortly afterwards Ingleson returned to the warehouse, and told the stockkeeper he had called for the six dozen bulbs. Prisoner said: "I have seen the manager. It is all right; I can take them away." The stockkeeper allowed Ingleson to take away the bulbs, and nothing had been seen of them since.

Evidence corroborating Mr. Willey's statement regarding the transaction with Russell and Co. was given, and other evidence to show that the prisoner obtained goods in a similar way from other firms.

Appeal by Postmaster-General Dismissed.

In the Court of Appeal, before the MASTER OF THE ROLLS and Lords Justices WARRINGTON and ATKIN, on February 28th, the case of the Postmaster-General *v.* W. H. Pearce, E. J. Pearce, and W. R. Moon was heard upon the appeal of the Postmaster-General from the judgment of the Railway and Canal Commissioners, dismissing his application of an order which was equivalent to a contract by the landlords of Morsland Mansion, Maida Vale, to retain in the premises telephone wires which ran through the storeroom, and which the landlords had given the P.M.G. three months' notice to remove.

The ATTORNEY-GENERAL, in support of the appeal, said that it raised a question under the Telegraph Construction Act, 1916. It raised two points: first, as to the construction of the Act and the circumstances under which, and the principles to which consent ought to be given by the Commissioners to the P.M.G.'s motion to be allowed to retain in Morsland Mansions telephone cables; and the second point raised was whether the Commissioners had jurisdiction to make an order for costs against the P.M.G. in the circumstances.

The three respondents to the appeal were then questioned as to who were interested in Morsland Mansions, which was a large block of flats let to a large number of tenants. Some of the tenants required the advantage of the telephone in their flats, and in the year 1905 the P.M.G. arranged with the landlords for the introduction of telephone cables into the flats, and the landlords consented to the cables being taken into the storeroom at the bottom of the flats. Thirteen of the tenants enjoyed the advantage of the telephone and 88 did not. Subsequently, the landlords alleged that the cables were a nuisance, owing to workmen coming into the storerooms to look after the cables, and gave the P.M.G. three months' notice to remove the cables, and then the P.M.G. made his application to the Commissioners for an order that the cables must be retained in the premises. In the absence of that order the P.M.G. could not do this.

The MASTER OF THE ROLLS said that in his opinion it was a question of fact for the Commissioners to determine as to whether the respondents had made out that the existence of the cables in the premises caused a nuisance. He could not see that the Commissioners had misdirected themselves.

His Lordship, after some further discussion, addressing Mr. Owen Thompson, K.C., who appeared for the respondents, said the Court did not wish to hear him on the merits, but only on the question whether the Commissioners had power to dismiss the P.M.G.'s application with costs, as in any case the application could not be deemed to be a frivolous and vexatious one.

Mr. OWEN THOMPSON contended that in the circumstances the Commissioners had a discussion as to the costs.

In the result their Lordships, without laying down any general principles, dismissed the P.M.G.'s appeal on the merits, but allowed it so far as it related to the costs, holding that the Commissioners had no power to award costs against the P.M.G.

It was directed that there should be no costs of the appeal.

Parliamentary Intelligence.

Rural Telephones.

Replying to Mr. FOOT, on March 13th, Sir W. JOYNSON-HICKS said: Since May 1st, 1922, about 3 100 rural party line subscribers have been connected with the system and 85 exchanges and about 650 call offices have been opened in rural areas. In addition, a large number of exchanges and call offices are now in course of completion.

The Marconi Co. and Public Messages.

Mr. MIDDLETON, on March 14th, asked the Postmaster-General whether, in view of the fact that under the Telegraph Act the Government has no power to grant to a private company or firm the right or privilege to transmit public telegraph messages, he would consider the withdrawal of temporary licences granted the Marconi Co. to undertake the transmission of telegrams?

Sir W. JOYNSON-HICKS: The Postmaster-General possesses no powers under the Telegraph Acts to grant licences to transmit messages by telegraph, but telegrams to and from places abroad, such as those covered by the temporary licences granted to the Marconi Co., are exempt from the Postmaster-General's ordinary telegraph monopoly. The licences in question have been granted in pursuance of the Wireless Telegraphy Act, 1904, under which no wireless station can be established or worked without the licence of the Postmaster-General.

Mexborough and Swinton Tramways.

Mr. T. WILLIAMS asked the Parliamentary Secretary to the Ministry of Transport, on March 13th, whether he was aware that the Mexborough Urban District Council, Swinton Urban District Council and Rawmarsh Urban District Council were requested by his Department to submit any objections against the continuation of present charges by the Mexborough and Swinton Tramways Co.; that, although each council submitted objections and were expecting some sort of an inquiry to deal with them, his Department granted an Order continuing present charges until March 31st, 1924, without further consulting the said councils; and, in view of the general dissatisfaction in these districts, would he have the question of fares and stages reconsidered?

Col. ASHLEY: In accordance with the provisions of the Tramways (Temporary Increase of Charges) Act, 1920, the application of the Mexborough and Swinton Tramways Co., together with the objections received from the councils named by the hon. member, was referred to the Advisory Committee appointed under the Act. The Committee, after full consideration, recommended that the application for continuance of their existing charges should be granted. The Committee stated that they did not consider it necessary to hold a public inquiry. The Minister accepted the recommendation of the Committee, and an Order was issued accordingly which will have effect until March 31st, 1924, unless previously revoked. I would remind the hon. member that the Act provides for reconsideration of the charging powers if there is any change of circumstances that enables a local authority in such a case to make representations with a view to a revision of the charging powers.

Underground Telegraph and Telephone Wires.

Mr. CASSELS asked the Postmaster-General, on March 16th, if it was the policy of his Department wherever possible to do away with poles for carrying telegraph and telephone wires; and, if so, whether he would reconsider any schemes involving the erection of poles with a view to the wires being placed underground?

Sir W. JOYNSON-HICKS: The substitution of underground for overhead plant wherever the expense is justified has been the policy of the Post Office for many years. Generally speaking, owing to the heavy cost, it is not economical to provide underground plant for a few subscribers, but in any section where there is a reasonable prospect of at least 12 new circuits, that is 24 wires, being required within a few years, underground cables are provided.

Greenock Electricity Bill.

On March 19th, the Substituted Bill of Greenock Corporation, "to confer further powers on the Corporation in relation to their electricity undertaking," was presented, read the first time, and ordered to be read a second time.

British Empire Exhibition.

In reply to Mr. DARBISHIRE, on March 19th, Lieut.-Col. BUCKLEY stated that the Government is liable, up to an amount not exceeding £100 000, for a proportion of any loss which may result from the holding of the British Empire Exhibition. Guarantees from other sources amount to £1 103 000.

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I.E.E. Summer Meeting.

Full Programme for June 5th to 8th.

As already announced, the summer meeting of the INSTITUTION OF ELECTRICAL ENGINEERS is to be held from June 5th to June 8th at Manchester, Liverpool and in North Wales, at the invitation of the Committee of the North-Western Centre, with the co-operation of the committee of the newly formed Mersey and North Wales (Liverpool) Centre. Details of the programme are now available, the following arrangements having been made :—

TUESDAY, JUNE 5TH.—MORNING, 10 A.M.—Alternative visits.

(*a*) The electrically driven rolling mill equipment of R. Johnson and Nephew, Bradford, Manchester, and the engineering works of Mather and Platt, Ltd., Newton Heath.

(*b*) The No. 2 Dunlop Rubber Cotton Mills, Ltd., Rochdale.

Lunch at the Manchester Town Hall as the guests of the Corporation Electricity and Tramways Committees.

AFTERNOON.—Proceed to Clifton Junction, the works there open for inspection being :—

(*c*) Pilkington Tile and Pottery Co.

(*d*) Chloride Electrical Storage Co.

(*e*) The London, Midland and Scottish Railway Co.'s Power Station.

(*f*) The Lancashire Electric Power Co.'s Station, Ringley.

EVENING.—Reception and dance at the Town Hall, as the guests of the Lord Mayor and Corporation of Manchester (evening dress).

WEDNESDAY, JUNE 6TH.—MORNING, 10 A.M.—Proceed at the invitation of the Manchester Ship Canal Co. by special steamer from Pomona Docks, viewing the swing bridges and other engineering features *en route*, to Barton, where the party will disembark and inspect the Manchester Corporation's new generating station.

Lunch at Trafford Park, as the guests of the Metropolitan-Vickers Electrical Co.

AFTERNOON.—Visit the works of the Metropolitan-Vickers Electrical Co. and the Lancashire Dynamo and Motor Co., Trafford Park.

EVENING.—Reception at the Whitworth Hall, as the guests of the University of Manchester (evening dress).

As other alternatives to the foregoing visits, individual members may visit the following places at any time on Tuesday or Wednesday:

(1) The outdoor 33 000 V sub-station (in High Street) of the Manchester Corporation.

(2) The "Manchester Guardian" offices, for the Murray multiplex system of telegraphy, and rotary printing presses.

(3) *On Wednesday morning only* the laboratories of The University, Manchester, will be open for inspection.

THURSDAY, JUNE 7TH.—MORNING, 9 A.M.—Leave Manchester by special train for Liverpool, detraining at Rainhill for the Prescot visit.

Alternative morning visits :—

(*a*) British Insulated and Helsby Cable Works, Prescot.

(*b*) (1) The Liverpool Corporation Tramways, Lambeth Road Works; (2) Automatic Sub-station, Walton; (3) Lister Drive Power Station.

(*c*) The Cunard Co.'s s.s. "Scythia," or some other big liner.

Lunch will be provided in Liverpool. Details will be announced later.

AFTERNOON.—Alternative afternoon visits :—

(*d*) Lever Bros., Port Sunlight (by train from Liverpool).

(*e*) The University Applied Electricity Laboratories, where demonstrations in Radio reception will be given, and the Automatic Telephone Manufacturing Co.

(*f*) (If sufficient applicants). (1) The Liverpool Corporation Tramways, Lambeth Road Works. (2) Automatic Sub-station, Walton. (3) Lister Drive Power Station.

As other alternatives to the foregoing afternoon visits, individual members may also visit :—

(*g*) The Mersey Power Co., Runcorn (the company will arrange for tea and transport at Runcorn).

(*h*) The United Alkali Co.'s Power Station, Widnes.

(*i*) The London, Midland and Scottish Railway, Southport electrified line. In case of alternatives (*g*), (*h*) and (*i*), each member must make his own transport arrangements.

EVENING.—Reception and dance as the guests of the Lord Mayor of Liverpool (evening dress).

FRIDAY, JUNE 8TH.—MORNING, 9 A.M.—Leave Liverpool by special train for Llandudno Junction, where the party will transfer to motor coaches and proceed by alternative routes, visiting Carnarvon and Bangor, and returning to Llandudno.

EVENING.—Reception and dance (evening dress) at the Grand Hotel, Llandudno, as the guests of the London, Midland and Scottish Railway Co. The guests will be received by Mr. A. Watson, general manager of the company.

Visitors who contemplate staying at Llandudno for the week-end following the meeting are particularly requested to give this information, in order to facilitate the reserving of hotel accommodation for Friday night as well as for the week-end. For those who propose to spend the week-end on the Welsh Coast, the free use of the Great Orme Golf Club has been arranged.

It is requested that those intending to take part in the meeting should notify the secretary not later than March 28th. Ladies are specially invited.

The Second London Inquiry.

Motion in the High Court.

On Friday, before Mr. JUSTICE AVORY and Mr. JUSTICE SALTER, Mr. W. E. TYLDESLEY JONES, K.C., proceeded to expound his motion on behalf of the London Electricity Joint Committee Co. (1920), the electricity supply companies represented by the company, and other electricity supply companies operating in the district within the purview of the Electricity Commissioners' London and Home Counties Electricity Scheme. He asked for a *rule nisi* and a writ of prohibition to restrain the Electricity Commissioners from proceeding with the further consideration of the said scheme and a writ of *certoriari* for the return of the scheme to the court to be quashed. His clients' objections were (as stated on p. 285 of our last issue) that the proposals to compel the proposed Joint Electricity Authority to appoint two committees, and to compel the authority to delegate its powers to the committees were *ultra vires*. He mentioned that, until the Commissioners were informed of his clients' intention to apply to the Court, they, having been advised that their proposals were *intra vires*, intended to proceed with the inquiry.

Mr. JUSTICE AVORY: "At what cost?" Mr. TYLDESLEY JONES said he was informed that there were two thousand people present. This evoked some laughter, and Counsel then stated that his remark was erroneous. He meant that the proceedings were estimated to cost £2 000 a day.

Mr. JUSTICE AVORY announced that the rule for prohibition and *certoriari* would be granted, and the judges would see the Lord Chief Justice with regard to appointing as early a day as possible for the hearing. They thought it would be sufficient to serve notice on the Secretary to the Commissioners.

Manchester Steam Users' Association.

Boiler Inspection Work in 1922.

The annual general meeting of the MANCHESTER STEAM USERS' ASSOCIATION was held on Tuesday. Mr. Harold Lee, president, occupied the chair. The report of the Committee of Management showed that the total income of the Association for the year was the highest on record. The net surplus amounted to £3 555, bringing the reserve fund to £43 113. The report states that the policy of faithful boiler inspection continues to be closely adhered to, the number of "Internal," "Flue," and "Entire" examinations for the past year being 11 493. It is pointed out this class of examination is most important and is necessary for the issue of the Association's Certificate of Safety, and the Committee consider it to be a matter of satisfaction that it is so well sustained, and that they are able consequently to repeat that during the whole course of the Association's existence no preventible explosion has occurred of any boiler which had carried the Association's Guarantee and Certificate of Safety.

At the conclusion of the meeting, the members were invited to visit the museum, which contains many items illustrating the causes of boiler accidents and explosion of boilers. It also contains parts of a boiler sixty years old which was recently tested to destruction by the Association. In the laboratory experiments in connection with the safety and working of boilers were carried out, and various other objects of interest to steam users were on view.

The Empire Telegraph and Trade.

Sir Charles Bright on the Need of Better Communication.

In the current issue of the "Fortnightly Review" Sir CHARLES BRIGHT has an interesting article on "The Empire Telegraph and Trade." He points out that no stone should be left unturned which may serve to foster trade within the Empire, and that a greatly developed and cheapened system of inter-Imperial telegraph communication would do much towards that end. A most suitable form of Imperial preference would be an inter-Imperial really low telegraph rate independent of distance. Such a cheap system would mean a closer union between the different branches of the British Empire—something even more valuable than trade.

Sir Charles gave some cogent reasons why the submarine cable companies would be unwilling to undertake the development required, and thinks that for high strategic reasons and healthy competition a State-owned cable system would be an advantage. He considers also that any Imperial wireless chain should be under direct State control, and for strategic and Imperial reasons should be operated by the Government. He suggests the formation of an Imperial Board of Control for this purpose, with representatives thereon of each of the Dominions and Government Departments concerned.

The argument with regard to cable rates is equally applicable to charges and wireless telegraphy and, though there is no objection to private enterprise establishing an international system, there are obvious objections to the Empire being dependent for Imperial inter-communication on anything in the nature of a business monopoly.

In the concluding portion of his article Sir Charles points out that wireless communication may now be regarded as a possible competitor with cables, and the eventual amalgamation of cable and wireless interests leading to monopoly must not be overlooked.

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Imperial Notes.

INDIA.

Delhi and the Mandi Electric Power Scheme.

At the last meeting of the PUNJAB ELECTRICITY BOARD the question was discussed of the inclusion of Delhi in the Mandi electric power scheme, which is being adopted by the Government in preference to the Nangal scheme. Mr. Sale, executive engineer of the New Capital Committee, Delhi, said unless Delhi Province had a large share in the management of the undertaking and had a guarantee that power would be supplied by October, 1928, it would not participate. Delhi had under consideration alterative schemes for obtaining its own supply (*a*) from hydro-electric works on the Jamna and (*b*) from a steam-driven station. The Mandi scheme is estimated to cost Rs. 27 600 000 (£1 800 000) at the initial stage, and Rs. 41 100 000 (£2 740 000) when completed. The manager of the Dhariwal Woollen Mills has been informed that a supply will probably be given to the mills from the Mandi undertaking by the cold weather of 1926–27.

Decrease in Imports of Electrical Goods.

H.M. Senior Trade Commissioner at CALCUTTA states that for the period April–December, 1922, there was a considerable diminution in the total imports of electrical instruments and apparatus—viz., from 335 to 166 lakhs. This was particularly notable in the case of the United Kingdom shipments, which fell from 232 to 116 lakhs. Imports from the United States shrank from 71 to 14 lakhs, those from Italy from 14 to 9 lakhs, and those from Japan from 3 to 2¼ lakhs. Dutch shipments were fairly well maintained at 5 lakhs, while those from "other countries" rose from 10 to 19 lakhs. Imports of electrical machinery for the period amounted in value to 254 lakhs, compared with 275 lakhs for the corresponding period of 1921.

G.I.P. Electrification.

A contract has been placed with the English Electric Co. for the equipment required for the electrification of the first section of the GREAT INDIAN PENINSULA RAILWAY. Messrs. Merz and McLellan are the consulting engineers in charge of the work. This is the first Indian railway to be converted to electric traction.

Obituary.

George Roberts.

The death occurred suddenly on March 14th of Mr. GEORGE ROBERTS, who for 25 years had been a member of the Bakewell staff of the D.P. Battery Co. For a long time he held the position of Works Superintendent.

James Dobson.

We regret to announce the death of Mr. JAMES DOBSON, which occurred under tragic circumstances at Southampton on Monday. Born in 1884, he received his training with the United Electric Car Co., and was later responsible for traction and lighting installations in Africa and Brazil, being, at one time, consulting engineer to the Brazilian Government. He was successively general manager and engineer of the tramways departments at Barrow-in-Furness, Gravesend, and Southampton, holding the last-named appointment at the time of his death. Mr. Dobson was an associate member of the Institution of Electrical Engineers, and a member of the Institute of Transport.

Personal Items.

SIR ROBERT BUCKELL has been elected a director of the Oxford Electric Co.

MR. ARTHUR ELWOOD, electrical engineer, has been elected a member of the Wigton Urban Council.

MR. G. W. SPENCER HAWES, secretary to the Reading Electric Supply Co., has been elected to the committee of the Reading Athenæum Club.

MR. E. HARWOOD, who at the age of 82 has just retired from the staff of the Oxford Electric Co., after thirty years' service, has been presented with an inscribed gold medal by the Oxford branch of the Amalgamated Engineering Union, of which he was a member for over sixty years.

Marylebone Borough Council has increased the salary of the electrical engineer, Mr. C. H. SMYTH, from £1 234 to £1 500 inclusive; that of the assistant engineer, Mr. F. B. LEONARD, from £787 10s. to £900; and that of Mr. F. SELLEY, mains and sales engineer, from £648 to £750.

Reporting upon a collision which occurred at New Cross Station on the SOUTHERN RAILWAY on January 6th, Major G. L. Hall states that the arrangements for working the line in question are open to criticism. He states that "the obvious method of providing the necessary additional security . . . is to track circuit the platform road and to replace the existing block instruments by others better suited for the purpose."

The Electricity Commissioners have approved the construction and pattern of the SANGAMO D5 THREE-WIRE WATTHOUR METER, provided that the meter be constructed as described in the specification and drawings deposited at the National Physical Laboratory, and dated and numbered October 20th, 1922, and No. 88, and be in accordance with pattern meter No. 1 118 376, also deposited at the National Physical Laboratory by the Edison Swan Electrical Co.

Foreign Notes.

EUROPE.

Possibility of Electrical Development in Albania.

In the course of a report on the economic conditions in Albania, H.M. Chargé d'Affaires at Durazzo states that although the Government has no money to spend on development, it is probable that a good deal of local capital would be subscribed in small blocks for the establishment of industrial works, under which head might be put SCHEMES OF ELECTRICAL DEVELOPMENT. The report states: While it would certainly be possible to install hydraulic power stations capable of supplying either the whole country or the individual provinces with electrical energy, the demand for many years will not be sufficient to warrant the erection of plants on such a scale. Hence the development of water power may be classed as local enterprise. As such it would be productive. Only two towns in the country are lit with electricity. Further, electric power might be employed for the small "Decauville" railway system left in the country by the Austrians.

Electrical Unification Scheme in Luxembourg.

Schemes have been drawn up in the GRAND DUCHY OF LUXEMBOURG for the unification of the central electric supplies of the whole of the Duchy, in order that the supply of energy for light and power purposes from one or more central stations may be managed as a single concern. No fewer than four different propositions have been and will shortly be investigated by the Luxembourg Government, and it is thought that there is little doubt that one or other of them will be eventually adopted. Of the four schemes, two emanate from steel manufacturing interests in the Duchy, which would like to see employed for generating power for industrial purposes the large amount of waste gas which is produced in connection with the manufacture of steel. The third suggestion comes from a Belgian company, which offers to construct a steam-power plant using coal; while the fourth project contemplates utilising water power from the highlands of the Ardennes. The last proposition is destined to meet with an encouraging amount of support. Nevertheless, even if carried out, the scheme would not be capable of supplying continuously the full amount of power required; for, in spite of the fact that the highlands of the Ardennes afford storage facilities sufficient for keeping the whole of the plant installed in operation during years of normal rainfall, in a dry season, such as that experienced in 1921, there would not be sufficient water to avoid embarrassment.

LATIN-AMERICA.

Para Electric Railways and Lighting Co.

The receipts of the PARA Electric Railways and Lighting Co., for the year ended November 30th, 1922, were £288 738, and expenses £153 932, while difference of exchange cost £84 090. After providing for debenture interest and other charges, and adding £38 500 to the sinking fund, the net profits were £2 787, which has been added to the renewals fund.

U.S.A.

Exports of Electrical Goods in 1922.

Preliminary figures show the value of the EXPORTS OF ELECTRICAL GOODS FROM THE UNITED STATES in 1922 to have been 63 213 838 dols., as compared with 102 412 502 dols. in 1921, according to the official "Commerce Reports." Changes in the classification of items make it somewhat difficult to draw definite comparisons, and this is further complicated by the reduction of the class "not elsewhere specified," which took place during the year. Some comparisons, however, are possible. In the case of metal-filament lamps, for instance, the export value in 1922 was only about 40 per cent. of that of the preceding year; and for electric fans the total value for 1922 was only 816 116 dols., as compared with 1 270 253 dols. in 1921. The export value of batteries of all kinds in 1922 was 2 556 645 dols., or about two-thirds of the total for 1921. Wireless and telegraph apparatus showed a very heavy increase, however, for 1922, exports being valued at 3 214 098 dols., as against 1 010 891 dols. for 1921. The increase in this class is, of course, due to the tremendous interest in radio that has been shown throughout the world. With regard to the exports for 1922 two interesting points may be commented on. On the one hand, monthly exports were, on the whole, rather uniform, which shows that the diversified markets of international trade taken together do not show the marked fluctuations experienced in individual countries. The second point of interest is that the relation which American electrical exports for 1922 bear to those of the preceding year is almost the same as that shown by British exports of electrical goods for the past year, when compared with their total for 1921. The decrease, therefore, is rather a reduction brought about by a general weakness in foreign demand.

Commonwealth Edison Co.'s Results.

The accounts of the Commonwealth Edison Co. for 1922 show a net surplus of 6 276 375 dols. Dividends absorbed 4 602 416 dols., leaving 1 673 959 dols., and increasing the unappropriated profits to 10 608 465 dols.

The Birmingham Corporation Electric Supply Department has an extensive stand at the twenty-first NATIONAL TRADES EXHIBITION, which was opened at Bingley Hall on Monday.

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Electricity Supply.

Extensions and Developments.

BUXTON Borough Council has received sanction to borrow £2 576, the balance of the sum expended for plant in accordance with the scheme approved by the Commissioners.

GRAYS (Essex) Urban Council has applied to the Ministry of Health for a loan of £2 500, for extending the electricity mains to sites now being laid out for building purposes.

LIMERICK Corporation has decided to spend £15 000 on improving the existing electric lighting plant. A proposal to build a new station at a cost of £60 000 is not considered feasible at present.

HACKNEY Borough Council is to acquire sites for the erection of electricity sub-stations at an estimated cost of £8 000, subject to the consent of the Commissioners being obtained to the necessary loan.

CARLISLE City Council has received sanction to a loan of £2 900 for extending the supply of electricity to Currock. A further loan of £6 000, for meters, transformers, and sub-stations, has been applied for.

At a meeting of the DOVER Corporation Electricity Committee on March 14th it was reported that the Commissioners had refused to sanction the Committee's scheme for two new 1 500 kW turbo-alternators, but had only agreed to one such machine being installed. The Folkestone Electricity Co. had been empowered to instal a similar machine, but in both instances the consent of the Commissioners is subject to the two towns linking up for electricity supply. With regard to the linking up, the Commissioners considered each undertaking should pay the cost of extending to its own borough boundaries, and that they should share the expense of the remaining link (four miles). The Committee approved this and negotiations with Folkestone are to proceed.

Alterations in Charges, Proposed and Actual.

PEMBROKE (Dublin) Urban Council is reducing the lighting charge from 10d. to 8d. per kWh as from April 1st.

The flat rate for lighting at BRIGHTON is to be reduced from 5½d. to 5d. per kWh. The power rate is to be 1½d. per kWh.

GRAVESEND Electricity Committee is recommended by the electrical engineer to consider a further reduction in supply charges.

ISLINGTON (London) Lighting Committee recommends a reduction in the percentage increase in the price of electricity by 50 per cent.

As from the March meter readings, charges at BUXTON will be reduced by ½d. per kWh (flat rate, lighting) and by ½d. per kWh (heating and power).

PLYMOUTH Town Council is reducing charges as from the March readings as follows:—Lighting, 6½d. to 5½d. per kWh; power, uniform charge of 2d. per kWh for the first 250 kWh, and 1½d. per kWh beyond.

FAVERSHAM Town Council has applied to the Ministry of Transport for an order empowering them to charge a maximum of 1s. per kWh for electricity with minimum payment of 15s. for each winter quarter, and 10s. for each summer quarter.

NEWPORT Chamber of Commerce has adopted a resolution expressing dissatisfaction with the recent reduction in electricity charges, and urging that the Corporation should make provision for further reductions to be made in the June quarter.

HESTON and ISLEWORTH Council is reducing charges from April 1st as follows:—Lighting, from 7d. to 6½d. per kWh; power, heating and cooking, from 3d. to 2½d. per kWh for the first 5 000 kWh, with lower charges where the consumption is greater.

WHITEHAVEN Town Council has reduced the charges for electricity as under as from April 1st:—Lighting, from 7d. to 6½d. per kWh; maximum demand, from 3½d. to 3d.; heating and cooking, from 1¾d. to 1½d.; power, from 2¾d. to 2⅝d.; power, flat rate, from 1⅞d. to 1¾d.; factory power—an all round reduction of ⅛d. per kWh, the minimum charge to be reduced from 1¼d. to 1⅛d. per kWh.

Tapping new Areas.

TIVERTON Town Council has decided to call in an expert to prepare an electric lighting scheme.

SEAFORD Urban Council has decided to secure expert advice on the subject of an electric lighting scheme.

ROTHESAY Town Council is to obtain a report from an expert on the offer of the Rothesay Tramways Co. to supply current for lighting the town.

HENLEY-ON-THAMES Town Council has decided to accept the offer of the Thames Valley Electric Supply Co. to distribute electricity within the borough.

MALMESBURY Town Council has decided to support the application of the Western Electric Distributing Corporation for a special order to supply electricity within the borough.

CHEADLE AND GATLEY Urban Council has applied to the Commissioners for an order to enable it to supply electricity to Northern Etchells, which is outside the Council's area.

ULVERSTON Council has been advised by Mr. C. H. Wordingham to take a bulk supply of electricity from Barrow. It has also been proposed that a separate generating plant should be installed.

The West Gloucestershire Electric Light Co. has informed NAILSWORTH Urban Council that it is applying for an order to supply electricity in the urban area, the price mentioned being 10d. per kWh. Another company is seeking similar powers, and the only difference in the application is the price per kWh, which is quoted at 1s. The Council has appointed a deputation to discuss the matter with the Stroud Rural Council.

The MIDLAND ELECTRIC LIGHT AND POWER Co. has applied to the Electricity Commissioners for a special order to authorise the company to supply electricity in Coalville, Ashby-de-la-Zouch, Ashby Waulds and Shepshed urban districts and parts of Ashby-de-la-Zouch and Market Bosworth rural districts; and to transfer all or some of the company's powers and obligations under the order to the Leicestershire and Warwickshire Electric Power Co. or any other company. Objections to the Electricity Commission, Whitehall, London, by April 9th. Ashby-de-la-Zouch Urban Council has approved the scheme.

The Socialist Debate.

Reflections on Mr. Snowden's Condemnation of Capitalism.

The House of Commons seemed to enjoy Tuesday's debate on Mr. SNOWDEN'S motion condemning the capitalistic system. But it is a sad thought that Mr. SNOWDEN did not bring out a single point which could not, without offence, be described as a street-corner point or as a point which has long ago been dismissed by people with experience as having no substance behind it.

He declaimed about child labour, as if child labour had anything to do with capitalism as a theory. It was heart-breaking to the serious student of economic well-being to see this polished agitator, with a hundred socialists at the back of him, having organised the tenants against rent, and organised the builders against building, and thus produced a situation in which houses are no longer a practical proposition, banging the Treasury box and accusing the capitalistic system of responsibility for the fact that the new London census shows 683 000 people living two in a room. The mystery surely is that there are any rooms at all. If it had not been that private enterprise had got a good long start before Mr. Snowden began on his career as an agitator these 683 000 people would to-day be in the condition of the Russians.

Mr. SNOWDEN complained that 2½ per cent. of the people own 88 per cent. of the wealth (the figures are his), and his remedy apparently is that 100 per cent. of the wealth should be at the disposal of a small gang of socialist politicians who would proceed to subject it to experiments, any one of which might prove fatal to the whole. Mr. SNOWDEN was at great pains to show the difference between Bolshevism and Socialism, but the only difference evident to the careful listener was that between the quick dagger and slow poison.

"Socialist," not "Labour."

Sir ALFRED MOND is a courageous and clever, though not a very happy, exponent of the case for common sense, and he scored a big point when he pinned the Labour Party down to the title of Socialist. He reminded the House that most of the Labour candidates, when before the constituencies, complained if they were dubbed Socialists. Mr. SNOWDEN had torn off the mask and once and for all made it quite clear that the term "Labour" was a misnomer and that "Socialist" was the proper designation of the present Opposition.

The seconder of Mr. SNOWDEN'S resolution made great play with the wickedness that he saw in the export of capital. Mr. SNOWDEN had previously explained the sweet reasonableness of his proposals by disowning any desire to confiscate. He advocates a socialism which will compensate the capitalists. Sir ALFRED MOND was quick to drive a wedge between the two ends of the Labour Party. If Mr. SNOWDEN was going to pay the capitalists out and refused to allow them to utilise capital at home, and the Socialist Party was at the same time determined to prevent the export of capital, what was to be done with it?

Notwithstanding the skilful arguments of Sir ALFRED MOND and Sir PHILIP LLOYD-GRAEME, the debate lacked reality to the business man. After all, it was a debate between politicians, who have a certain interest in maintaining the myth that politicians can do things: the truth, of course, being—a truth, by the way, from which we have long departed—that politicians can only create the conditions in which other people can do things. That is the great imposture of politics, carried to criminal lengths by the Socialist Party, leading the common people to think that some force other than their own effort and endeavour can provide them with the comforts of life.

Wimbledon Electrical Exhibition.

An exhibition organised by the Corporation and having as its principal object the encouragement of the use of electricity for all domestic purposes, was opened at the Baths Hall, Latimer Road, Wimbledon, by Sir JOSEPH HOOD, M.P., on Wednesday. The exhibits include lamps and fittings, heating and cooking apparatus, and wireless sets. The Exhibition is on an extensive scale and will remain open until March 29th.

It is stated that the Corporation's Electricity Department has secured nearly a thousand new consumers in the past nine months, and, as the charge for current for cooking and heating is only 1¼d. per kWh (1d. in summer), there appears to be no reason why, with a population of nearly 100 000, an excellent domestic load should not be developed and maintained.

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Tenders Invited and Accepted.

UNITED KINGDOM.

DUNDEE CORPORATION. March 23rd.—(*a*) L.T. paper insulated lead covered and armoured cable. (*b*) l.t. single paper insulated lead covered cable, (*c*) l.t. single rubber insulated and fireproof cable, (*d*) l.t. multi-cored paper insulated lead covered cable. Particulars from the Manager and Engineer, Electricity Department, Dudhope Crescent Road, Dundee.

LYTHAM ST. ANNE'S URBAN DISTRICT COUNCIL. March 26th.—L.T. paper insulated lead covered and steel tape armoured cable. Particulars from the Borough Electrical Engineer.

AYLESBURY GUARDIANS. March 27th.—Electric light wiring and fitting of buildings at the Union House. Specification can be seen on application to the Master.

ISLINGTON (LONDON) BOROUGH COUNCIL. March 27th.—10 H.P. single-phase slip-ring motor, slide rails, no-volt release starter, shafting, brackets, wiring, etc., and electric lighting at Liverpool Road depot. Particulars from Superintendent, Cleansing Department, Liverpool Road, N.1.

SOUTHAMPTON CORPORATION. March 27th.—(1) 1 000 kW rotary converter, (2) extra high pressure cables, (3) extra high pressure switchgear, etc. Specifications from the Borough Electrical Engineer.

BEDWELLTY URBAN DISTRICT COUNCIL. March 28th.—Substation equipments, e.h.t. transmission lines and l.t. distribution systems. Specifications can be seen at the offices of Mr. R. Howard Fletcher, 3, Park Place, Cardiff.

COVENTRY CORPORATION. March 28th.—6 000 kW turbo-alternator condensing plant and auxiliaries. Specifications from the Electrical Engineer.

SALTASH CORPORATION. March 28th.—Wiring and fitting ferry bridge at Saltash. Passage for electric lighting. Specification can be seen upon the ferry bridge.

CARDIFF CORPORATION. March 29th.—(*a*) L. T. paper insulated cables; (*b*) e.h.t. cables; (*c*) extension of e.h.t. switchgear; (*d*) extension of roof and bunkers; (*e*) fuel economisers: (*f*) electric pump (5 750 gal. per min.). Contractors on the King's National Roll can obtain specifications from the Electrical Engineer.

MACCLESFIELD CORPORATION. March 29th.—Four revolving distributors and two sets of sewage screens, with electric motor and worm reducing gear. Particulars from the Sewage Manager, Prestbury, near Macclesfield.

RHONDDA URBAN DISTRICT COUNCIL. March 29th.—(*a*) A.C. house service meters, (*b*) mains and house service material, (*c*) transformers, (*d*) truck type e.h.t. switchgear. Specifications from the Engineer, Electricity Works, Porth, Glam.

BIRMINGHAM TRAMWAYS COMMITTEE. March 31st.—Traction motors, power wiring, etc., for 25 tramcars.

MIDLOTHIAN AND PEEBLES DISTRICT ASYLUM, ROSSLYNLEE. March 31st.—Six months' supply of electric fittings. Forms from the Secretary, 19, Heriot Row, Edinburgh.

BARNET GUARDIANS. April 4th.—Re-wiring of workhouse and repair of electrical installation. Specifications from Kennedy and Donkin, Broadway Court, Westminster, S.W.1.

WEST HAM EDUCATIONAL COMMITTEE. April 5th.—Electric wiring in 12 schools. Specifications (to-day, Friday) from Mr. J. H. Jacques, 61, West Ham Lane, Stratford, E.15.

LONDON COUNTY COUNCIL. April 9th.—Roadwork and plate-laying in connection with construction for overhead electric traction system of tramways in Amhurst Park. Specifications from the Chief Engineer, Old County Hall, Spring Gardens, S.W.1.

CONWAY GUARDIANS. April 20th.—Electric light wiring and fitting at the Union Institution, Bangor Road, Conway, and at the Union Offices. Particulars from the Master of the Institution and the Clerk to the Guardians.

IRELAND.

DUN LOOGHAIRE (formerly Kingstown) URBAN COUNCIL are having plans and specifications prepared for the electric lighting of the town.

BELFAST CORPORATION. April 9th.—Induction motor-driven centrifugal pump. Specification (W.9) from the City Electrical Engineer, East Bridge Street, Belfast.

ROUMANIA.

CONSTANZA PORT AUTHORITIES.*—Six 3-ton electric portal cranes.

URUGUAY.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO. April 20th.*—Electric clocks for use in works, offices and main streets. April 21st.*—10 000 kW turbo-alternator.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO. May 1st.*—L.T. armoured cable, telephone cable and accessories. (This is a second call for tenders for these requirements, none of the previous tenders having been accepted.)

PORTSMOUTH CORPORATION have accepted the tender of the English Electric Co. for switchgear for the generating station, at £952, and four transformers at £200 14s. each.

BELFAST ELECTRICITY COMMITTEE recommend the acceptance of the tender of the Metropolitan-Vickers Electrical Co. for a 12 500 kW generator for the Corporation's new station.

* Particulars from the Department of Overseas Trade.

THE FULLER ENGINEERING CO. inform us that they have recently received contracts for a complete pulverised coal installation for a boiler plant of nearly 5 000 H.P. and for pulverised coal equipment for locomotives.

The tenders of the General Electric Co. for rotary converter, transformer, switchboard, etc., £1 576, and Callender's Cable and Construction Co. for l.t. d.c. feeders, £757, have been accepted by SUTTON COLDFIELD CORPORATION.

CARDIFF CORPORATION are recommended by the Electricity Committee to accept the following tenders:—Davenport Engineering Co., cooling tower for Roath generating station, £3 297; British Thomson-Houston Co., 5 000 kW turbo-alternator, £15 792; W. H. Allen, Son and Co., condensing plant, £4 266.

LONDON COUNTY COUNCIL have accepted the tender of Clough, Smith and Co. (lowest tender received) for overhead electrical equipment of tramways in Amherst Park, etc., at £2 071 0s. 8d. (Four tenders were received; highest £3 888 7s. 3d.).

ILFORD URBAN COUNCIL have accepted the following tenders: Hackbridge Cable Co., e.h.t. cables, £3 662 10s.; Western Electric Co., l.t. cables, £3 203 6s. 8d.; British Insulated and Helsby Cables, Ltd., feeder pillars, £276; Albion Clay Co., conduits, £874 9s. 7d.

The Spearing Boiler Co. has secured an order for an extension of the boiler plant at the NEWPORT (MON.) CORPORATION electricity works. The company has recently secured several contracts for industrial undertakings, including boilers using waste heat gases.

SIDMOUTH URBAN COUNCIL have accepted the following tenders in connection with their electricity supply undertaking: T. Hood and Co., generating plant, £4 287 13s. 6d.; Private Telephone Co., mains, £1 437 5s.; Pratt and Co., buildings, £1 100; total, £6 824 18s. 6d.

Forty Years Ago.

"The Electrician," March 24th, 1883.

THE POST OFFICE.—The Edison Company is about to extend the existing electric light arrangements by an additional 1 500 lamps for use at the Post Office. The current for these lamps will be supplied from the Central Station, at the Holborn Viaduct.

PRIVATE TELEPHONIC COMMUNICATION.—It is stated that a contract has been entered into between the Postmaster-General and Mr. John Burns for special telephonic communication between Glasgow and Mr. Burns's residence, Castle Wemyss, Wemyss Bay, a distance of 31 miles.

PHOTOGRAPHY BY ELECTRIC LIGHT AT NIGHT.—During a fancy ball recently given at the Queen's Hotel, Eastbourne, Messrs. Lavers and Co. most successfully photographed 120 of the guests in their fancy costumes. The lighting of the studio and ballroom was carried out by the Eastbourne Electric Light Company, under the direction of Mr. H. M. Sayers, the company's electrician and manager. The whole installation was provided at a few hours' notice, and was removed before 10 a.m. the following morning. Mr. Sayers, who has been with the Eastbourne Company from its commencement, was warmly complimented on the success of his work.

Institution Notes.

The annual dinner of the ELECTRICAL CONTRACTORS' ASSOCIATION will be held on April 24th at the Café Monico, London, W.

The annual meeting of the NATIONAL ASSOCIATION OF MINING ELECTRICAL ENGINEERS will be held in Glasgow from June 28th to June 30th.

Prizes were awarded last week by the PAISLEY ASSOCIATION OF ELECTRICAL ENGINEERS to apprentice members for papers on electrical subjects. The first prize went to J. Shannon for a paper on "Power Factor," the general tone of all the papers submitted being very good.

The fiftieth annual meeting and conference of the INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS will be held at Leeds this summer. Papers to be read include one on tramway track and highway construction, by Mr. E. W. Cockerlyne.

The dinner of the INSTITUTE OF TRANSPORT will be held at the Savoy Hotel, London, W.C., on May 3rd. The third annual congress will take place at Sheffield on June 14th, 15th and 16th. The address of the Congress Committee is Wicker Station (L.M. & S. Railway), Sheffield.

A conference of the WOMEN'S ENGINEERING SOCIETY will be held at Birmingham University from April 11th to 14th. The programme includes a visit to the Witton Works of the General Electric Co. Papers will be read by Miss M. Partridge on "Engineering Contracts in Country Districts," and by Miss Entwisle on "Some Considerations in Commercial Electrical Design."

Out of the balance of the War Memorial Fund of the INSTITUTION OF ELECTRICAL ENGINEERS it has been decided to establish two scholarships, each of the value of £50 per annum and tenable for three years, to provide for the education of children of members who were killed or permanently disabled in the war. Applications giving full particulars as to general and financial circumstances should be addressed to the Secretary of the Institution, Savoy Place, Victoria Embankment, London, W.C.2.

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Electric Traction.

Tramway Extensions and Developments.

The extension of the EDINBURGH tramway system from Tollcross to the Braid Hills will be opened for traffic on April 1st. A Sub-Committee of the Town Council's Tramway Committee have agreed to recommend that the work of laying down two tramway sidings at Morningside Station and Piershill should be proceeded with, subject to the approval of the Ministry of Transport. The sidings are being laid down for the purpose of keeping the lines clear for cars proceeding to the terminus.

BELFAST Corporation has been advised by the general manager of the tramways undertaking to proceed with the third section of the reconstruction scheme, not only to secure the unemployment grant, but to be able to take advantage of suitable weather. The estimated expenditure is about £235 000, and the work would be in the hands of James Hogg and Son. It was resolved to submit the scheme to the Unemployment Grants Committee to ascertain whether a grant would be available.

LIVERPOOL Tramways Committee is recommending the abolition of the running of first-class cars. It is officially denied that such cars do not pay, but public opinion seems to be against them. Liverpool Corporation is the only public body in the country which has differentiated between classes of passengers on tramcars.

Trailers have been removed from LONDON County Council tramcars on all routes connecting with the embankment. It is stated that they have only been removed as an experiment, but it is not likely that they will re-appear.

Fares, Receipts and Passengers.

From June 1st, 1922, to March 10th, 1923, passengers on GLASGOW Corporation Tramways numbered 321 709 444 and receipts amounted to £1 735 559.

During the period January 1st—March 10th, LONDON trams under "Underground" control, took £371 000 in receipts, a decrease of £25 118 as compared with the corresponding period of last year.

Electric Railway Items.

The London Electric Supply Corporation has secured a contract for fifty years for the supply of the whole of the energy required for the electrification of what was the SOUTH-EASTERN RAILWAY. The contract means an additional output of between 80 000 000 and 100 000 000 kWh per annum.

The six firms which submitted pattern cars for use on the LONDON Underground Railways (see THE ELECTRICIAN, February 9th, p. 146) have been requested to submit fresh designs, but not sample cars. From these designs it is to be presumed that the finally selected pattern of car will be evolved.

The B.E.A.M.A. Annual Report.

Satisfactory Progress in Difficult Circumstances.

The annual report of the BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION for the year 1922, which has come to hand as we go to press, states that the severe trade depression which characterised 1921, and prevailed throughout most of 1922, made little appreciable inroad upon the roll of members, the loss on balance being about 5 per cent. of the total for the preceding year. At the date of the report that loss was almost made good, and should be more than made good at no distant date. The Council were unable to detect any slowing down of effort on the part of the various committees and sections, except in the departments like education, which are always the first to feel the pinch of necessity. The allied departments of research and standardisation are well up to normal, and the work of letting £60 000 worth of space at the British Empire Exhibition in less than six months is a matter for congratulation.

Towards the close of the year there was a slight upward movement in the export trade barometer, but the final figures are a long way short of pre-war standard. Several important concessions were obtained from the railway companies on such matters as the classification of goods and attention is now being directed to the terms and conditions of carriage and other questions, such as the transport of heavy weights, packing of switch-boards, machinery sent by passenger train, and the reduction of rates.

Educational and Publicity Work.

The Education Committee have directed their energies to making closer connection between education and industry at home, and towards amassing statistics to show what the industrial countries of the world are doing in educating future purchasers in foreign lands. The Council applied to the Government to be consulted with regard to any scheme for the education of the Chinese as a result of applying the funds from the Boxer indemnity to that end.

The Industrial Publicity Service, Ltd., in spite of trade depression, has maintained a substantial volume of business and the work of distributing press matter throughout all the overseas countries is now carried on by Industrial Intelligence, Ltd., a large proportion of the news matter sent out being reproduced in the columns of newspapers and trade journals in the British Dominions and foreign countries. This organisation has heretofore been supported by the profits of the Industrial Publicity Service, but it is now felt that companies and individuals should support the organisation directly.

Wireless News.

Licensees and Listening-in.

No definite ruling seems to be available as to whether the installation of a WIRELESS RECEIVING SET IN A PUBLIC-HOUSE involves the taking out of a music licence. The London County Council has informed the Licensed Victuallers' Central Protection Society of London that it is not prepared at the present time to express any opinion whether music given by means of wireless apparatus fixed in the bars of a public house was music within the meaning of the Disorderly Houses Act, 1751. The Society is advising its members to take the precautionary measure of obtaining a music licence.

The GRIMSBY magistrates have declined to grant a music licence for a listening-in set on the ground that no licence was necessary. At NOTTINGHAM the police have opposed the granting of a licence, and the application was deferred.

The South Africa Wireless Co.

A message from CAPE TOWN states that several alterations have been made in the Wireless Bill by the Select Committee, which is considering the matter. The capital of the South Africa Wireless Co. has been fixed at £500 000, which may be increased or reduced with the consent of the Government. The Marconi Co. will take four-fifths of the capital and the South African public the remainder. Owing to the difficulty of obtaining a site, the receiving station may be within range of gun-fire from the coast, but the transmitting station must be out of range. Provision is made for a new agreement ensuring the right of the South African Wireless Co. to use all patent rights in the present and future owned or controlled by the Marconi Co. free of any payment.

Traders and the B.B.C.

A deputation organised by the ELECTRICAL IMPORTERS' AND TRADERS' ASSOCIATION and the BRITISH RADIO MANUFACTURERS' AND TRADERS' ASSOCIATION was received by the Postmaster-General on Monday. The "Westminster Gazette" states that great stress was laid upon "the monopolistic character of the present constitution of the British Broadcasting Co. and the very onerous and restrictive nature of the agreement imposed on many hundreds of electrical firms who are manufacturing listening-in apparatus."

It was also contended that the method of raising the revenue to pay for the concerts by means of royalties charged on parts was cumbersome and objectionable. The deputation therefore urged that the whole basis of the present arrangements should be reconsidered, and that, if necessary, the licence fee should be increased and the public relieved of the capital royalty charges on their apparatus.

Broadcasting Parliamentary Debates.

In view of the recent statement by the Prime Minister that the debates in Parliament would not be broadcast, the following item from South America is of interest:—Engineer Federico N. del Ponte, Chief of the Radio-Cultura Institution, has, the "Review of the River Plate" states, been authorised to BROADCAST THE DEBATES in the ARGENTINE CHAMBER OF DEPUTIES, from a radio-telephonic station at Palermo. Not only will the words of wisdom pronounced by the sapient legislators (to use our contemporary's expression) be heard all over the country by possessors of adequate receiving sets, but other unoffending citizens are to have the speeches thrust upon them, as it is intended "to equip motor lorries with apparatuses which will deliver the speeches to the multitudes in the streets and public squares of the capital and of principal provincial cities." What a horrible idea!

Miscellaneous Wireless Items.

Reports from listeners-in intimate that the new GLASGOW station is functioning with considerable success.

The THEATRICAL MANAGERS' ASSOCIATION has recommended its members not to give any facilities for broadcasting at present.

A message from Washington states that new rules to govern the use of WIRELESS AND AIRCRAFT IN WAR are to be proposed by President Harding soon. The President will ask Great Britain, France, Italy, Japan and the Netherlands to sign an agreement putting these rules into effect.

The Council of the EMPIRE PRESS UNION has passed a resolution congratulating the Government on its declaration of policy on Empire wireless, and expressing the hope that under the new conditions there will be no delay in the execution of the scheme on a scale which will place this country in a position of world-wide communication.

Borough Surveyor Praises Electricity.

Addressing a recent gathering of municipal engineers, Mr. NORMAN SCORGIE, borough surveyor of Hackney, urged the desirability of cultivating the use of electricity in poorer class homes. He considered there was a great output to be secured by wiring such premises and endeavouring to get people to cook by electricity. Referring to the installation of electricity at the Clapton Park maisonettes, he said he had been curious to find out what the tenants, who had had no previous experience of electricity, thought of the experiment.

He found the opinion universally held that electricity was cheaper and better than gas, the tenants being quite satisfied with the way in which their food was cooked.

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Companies' Meetings, Reports, etc.

ABERDEEN SUBURBAN TRAMWAYS Co.—The profit for the six months ended January 31st was £1 371, plus £2 027 brought in, making £3 399.

ROBEY AND Co.—Dividend recommended of 2½ per cent., less tax, on both preference and ordinary shares, carrying forward £26 751, against £34 970 brought in.

SIR W. G. ARMSTRONG, WHITWORTH AND Co.—Dividend on the ordinary shares for the half-year ended December 31st of 6d. per share, making 1s. per share for the year, less tax.

PINCHIN, JOHNSON AND Co.—The report for 1922 shows a net profit of £70 549, making with the balance brought forward, £87 061. Final dividend recommended of 10 per cent., making 15 per cent. for the year, placing £7 000 to general reserve, and carrying forward £16 905.

The following companies will be STRUCK OFF THE REGISTER OF JOINT STOCK COMPANIES, unless cause is shown to the contrary before June 13th: Dutilh, Smith, McMillan and Co., Electric Furnaces and Smelters, Electropathic Institute, Marryat and McNaught.

ELECTRO-BLEACH AND BY-PRODUCTS, LTD.—Net profit for 1922 was £51 281, against £13 115. Final dividends proposed of 5½ per cent. on the preference shares (making 9 per cent., against 7 per cent., for the year), and 18 per cent. (against nil) on the ordinary shares. A sum of £14 116 (against nil) is transferred to reserve (making it £45 000) and £1 245 is carried forward (against £79 brought in).

BROWETT, LINDLEY AND Co.—The net profit for 1922 was £7 100, making with the amount brought in £17 836. Dividend proposed of 8 per cent., less tax, on the ordinary shares, carrying forward £11 836. The preference shareholders have voted in favour of increasing their dividend from 6 to 7½ per cent. and relinquishing their right to share in surplus assets in the event of winding-up.

BRITISH ALUMINIUM Co.—There is a total sum available of £83 804. The sum of £30 000 has been set aside to depreciation reserve, raising the fund to £600 000, and £10 000 has been added to the reserve fund, together with £30 000 reserve against investments not now required, increasing the fund to £220 000. The directors recommend a final dividend at the rate of 5 per cent. per annum on the ordinary share capital, making 5 per cent. for the year, leaving £15 778 to be carried forward.

BRITISH INSULATED AND HELSBY CABLES.—Following the preliminary report in this column last week, it is now stated that the profit for 1922, including dividends, interest and transfer fees, amounted to £346 617, compared with £502 524 for the previous year. After providing for directors' and trustees' fees, interest on first and second debenture stock, the net profit amounts to £304 452, against £460 359 for 1921. After allowing for the preference dividend and the interim ordinary dividend, and including £362 223 brought forward (against £116 864), there is available £599 175, out of which the directors have placed to depreciation of buildings, plant, etc., £40 000, against £30 000 for 1921, transferred to reserve £50 000 (against nil), placed to first mortgage debenture stock redemption fund £5 000, and recommend a further dividend of 6¼ per cent., together with a bonus of 5 per cent., thus maintaining the distribution at 15 per cent. for the year, carrying forward, £391 675. During the year a settlement has been arrived at in the matter of excess profits duty.

Supply and Lighting.

SLOUGH AND DATCHET ELECTRIC SUPPLY Co.—Dividend recommended of 8 per cent., less tax, carrying forward £3 660. The gross profit for 1922, including £2 927 brought in, was £13 920.

WINDSOR ELECTRICAL INSTALLATION Co.—Dividend recommended of 8 per cent., less tax, carrying forward £2 567. The gross profit for 1922, including £1 887 brought in, was £12 688.

LLANELLY AND DISTRICT ELECTRIC LIGHTING AND TRACTION Co.—The net revenue for 1922 was £33 326. By including £473 brought forward and appropriating £1 035 to debenture redemption account, £5 000 to general reserve, and £4 000 to contingency reserve, an available balance of £14 587 is arrived at. The proposed dividend on the ordinary shares for the year is 7 per cent., less tax, and £980 is carried forward. A sum of £18 047 has been transferred from reserve for the purpose of writing down the expense of the issue of capital.

BROMPTON AND KENSINGTON ELECTRICITY SUPPLY Co.—The revenue account for 1922 shows a credit balance of £51 221 (against £41 041), which is added to £3 733 brought forward. After placing £7 031 (against £5 308) to depreciation account, and £10 000 (the same) to reserve, it is proposed to pay a dividend for the half-year to December 31st of 1s. 6d. per share on the ordinary shares, making 12 per cent. for the year (the same), and, in addition, a dividend on the bonus ordinary shares for the year at 1s. 6d. per share. The balance to be carried forward is £7 590.

BOURNEMOUTH AND POOLE ELECTRICITY SUPPLY Co.—The revenue account for 1922 shows a balance of £95 292 (against £48 193). To this is added £4 407 brought forward, and profit on trading account, £1 695, giving an available balance of £101 394. After deducting debenture, note and loan interest (£13 396), leasehold and special redemption funds and interest (£2 515), transferring £10 000 (against nil) to reserve for taxation, £15 000 (against £14 000) to reserve for depreciation, renewals, etc., and £30 000 (against £5 000) to general reserve, there remains a balance of £30 482. The directors propose a final dividend on the ordinary shares of 7½ per cent., less tax, making 10 per cent. for the year (against 6 per cent.), and £9 187 is carried forward.

New Capital Issues.

ELECTRICAL DISTRIBUTION OF YORKSHIRE, LTD.—The capital is to be increased to £250 000 by the creation of 100 000 new shares of £1 each.

MIDLAND COUNTIES ELECTRIC SUPPLY Co.—On Wednesday an issue of 750 000 6 per cent. cumulative preference shares of £1 each was offered to the public.

LLANELLY AND DISTRICT ELECTRIC LIGHTING AND TRACTION Co.—It is proposed to increase the capital from £300 000 to £500 000 by the creation of 100 000 new preference shares and 100 000 new ordinary shares.

New Companies.

MULTI ELECTRODE RADIO VALVE Co., LTD.—Private. Reg. March 12th. Cap., £100 in 10s. shares. To acquire and turn to account any invention relating to wireless telegraphy, etc. Reg. office: Sentinel House, Southampton Row, London, W.C.

WIRELESS ENTERPRISES, LTD.—Private. Reg. March 10th. Cap., £1 000 in £1 shares. Wireless, electrical, mechanical and general engineers and contractors, manufacturers and sellers of wireless instruments, etc. The first directors are: A. A. Fisher and T. S. Lucas (addresses not given).

FITTER AND POULTON, LTD.—Private. Reg. March 12th. Cap., 2 000 in £1 shares. To acquire the business of electrical engineers carried on at Greet, Birmingham, by C. H. Fitter and J. Poulton, as "Fitton and Poulton." C. H. Fitter, Weston House, Weston Lane, Greet, Birmingham, is a director.

FLEET BROS. AND Co., LTD.—Private. Reg. Mar. 7th. Cap. £2 000 in £1 shares. To take over the business of a plumber and electrician carried on by H. J. Fleet at 29, Beaconsfield Road, and 121a, Lord Street, Southport, as "Fleet Bros." Reg. office: 121a, Lord Street, Southport, Lancs.

THAMESMOUTH RADIO MANUFACTURING Co., LTD.—Private. Reg. March 15th. Cap., £500 in £1 shares. Manufacturers of and dealers in wireless apparatus and accessories and other electrical and mechanical appliances, electrical and mechanical engineers, etc. Reg. office: Radio Works, Southsea Avenue, Leigh-on-Sea.

L. JACOBS (LONDON), LTD.—Private. Reg. March 12th. Cap., £2 000 in £1 shares. Importers, exporters and manufacturers of, or dealers in, apparatus used in connection with the generation, distribution, supply, accumulation and employment of electricity, etc. Reg. office: 24, Warwick Street, Regent Street, London, W.

PHONEX MANUFACTURING Co., LTD.—Private. Reg., March 14th. Cap., £100 in 50 preference shares of £1 each and 1 000 ordinary shares of 1s. each. Manufacturers of and dealers in electric, telegraph and telephone apparatus and accessories, musical instruments, gramophones, etc. Reg. office: 188, Blythe Road, West Kensington, London, W.14.

BARROW AND Co., LTD.—Private. Reg. Mar. 6th. Cap. £5 000 in £1 shares. To take over the business of electricians, electrical engineers, armature winders and contractors, and dealers in electrical apparatus carried on by A. Barrow, T. Tomlinson, A. H. Morris and J. Hill at 6, Stanley Street and Horrocks Fold, Bury, as "Barrow and Co." Reg. office: 6, Stanley Street, Bury.

MECHANICAL UTILITIES Co., LTD.—Private. Reg. March 9th. Cap., £1 750 in £1 shares. To acquire the business carried on as "Mechanical Utilities Co.," to adopt an agreement with C. W. Garrett, Mrs. De Roy and H. Selley, and to carry on the business of manufacturers, importers and exporters of and dealers in all kinds of wireless, radio and electric appliances, etc. Reg. office: 20, St. Quintin's Avenue, London, W.10.

Business Items.

T. S. BELL AND Co., 35, Tangier Street, Whitehaven, have opened a department for the supply of electrical goods for collieries, factories and works.

G. Z. AUCKLAND AND SON, manufacturers of radio apparatus, have opened larger factory premises at 125–131, Rosebery Avenue, London, E.C.

THE METALLIC SEAMLESS TUBE Co., Birmingham, have appointed Mr. R. Carter, of Bristol, who has spent many years in the conduit and fittings business, as their representative in the south-west of England.

The hour up to which PRINTED PAPER PACKETS THAT ARE PREPAID ½D. ONLY may be posted, for dispatch on the day of posting, or for local delivery by the first post of the day following, has been extended throughout the country. The latest time of posting at a Head Office, or other principal Post Office, will be not earlier than 4.30 p.m.; in certain districts a somewhat later hour will be fixed. There will be a corresponding extension of the times of collection from street letter boxes. In London the latest time of posting will be 4.30 p.m. at the principal offices, and from 4 p.m. to 4.30 p.m. at the less important offices and letter boxes.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

ADVANCE ELECTRIC LAMP AND ACCESSORIES CO., 11, Northumberland Alley, Fenchurch Street, E.C. £52 2s. January 31st.

CLIFFORD, HOLLINGS AND CO., 1, Market Place, Pontefract, electrical engineers. £20 12s. 5d. January 29th.

KINDLER (a firm), 599, Park Street, Walsall, electrical engineers. £15 8s. 9d. February 7th.

STANDARD ELECTRIC SIGN CO., LTD., 62, Oxford Street, W., contractors. £30 4s. 10d. February 1st.

STONE ELECTRICAL SUPPLY CO., 55, High Street, Stone, electrical engineers. £16 14s. 9d. February 1st.

Bill of Sale.

JAMES, Rupert Edward, 14, Oak Bank, Harpurhey, electrical radio engineer. March 17th. £150.

Receivership.

HELLYAR AND SONS, LTD. J. M. Moore, of 37 and 38, Hatton Garden, E.C., was appointed receiver and manager on March 17th, 1923, under powers contained in first mortgage debenture dated August 23rd, 1912.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

MINEHEAD ELECTRIC SUPPLY CO., LTD.—Registered March 8th, £300 mortgage, to E. E. Johnson, Minehead, C.A., and another; charged on Marshleigh, Minehead. *£12 000. June 6th, 1922.

WADEBRIDGE AND DISTRICT ELECTRIC SUPPLY CO., LTD.—Registered February 12th, £1 500 debentures (filed under section 93 (3) of the Companies (Consolidation) Act 1908) present issue £500; general charge. *£350. April 25th, 1922

Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

ECON MANUFACTURING CO., LTD., 63A, Paris Gardens, Stamford Street, London, wireless instrument manufacturers. At the statutory meeting last week of the creditors, the liquidator, Mr. H. Garton Ash, C.A., of 6, Broad Street Place, London, E.C., presented a statement of affairs showing liabilities £1 442 all due to unsecured creditors, and net assets estimated to realise £148, a deficiency of £1 294. A measure of success had been obtained for the Econ insulator. The company made substantial purchases from the Government Disposals Board, and executed orders for first class firms in the electrical trade. There had been delay in executing the orders owing to insufficient capital. The insulators were made in accordance with a patent which was held in the name of Mr. D. Mackenzie. Nettlefold and Sons, Ltd., obtained judgment against the company for £142, and as there were not sufficient goods for them to levy upon, they commenced proceedings for compulsory liquidation. In the meantime the company went into voluntary liquidation. The petition for compulsory liquidation was before the Court the previous Tuesday and was adjourned to enable the wishes of the creditors generally to be ascertained. During the course of the discussion which ensued the liquidator said that the petitioning creditors were agreeable to the voluntary liquidation being continued subject to a supervision order being obtained, and he thought that would be a good course to pursue. There were matters requiring investigation and his hands would be strengthened if there was a supervision order and a committee of the creditors. The stock consisted largely of ebonite parts which would realise badly at a forced sale, but they could be made up and sold. There were large orders in hand from some of the best firms in the trade. There were parts in hand for something like 60 000 insulators and the capacity of the works was 5 000 a week. The creditors passed a resolution expressing the opinion that the voluntary liquidation of the company should be continued with Mr. Ash as liquidator, subject to a supervision order being obtained, while a committee of three of the principal creditors was also nominated. The following are creditors:—Burton Delingpole and Co., £42; Fuller United Electric Works, £52; Hirst, A. W., and Son, £84; Hart Accumulator Co., £33; London Electric Wire Co., £27; Lund Bros., £41; Nettlefold and Sons, Ltd., £131; Telephone Manufacturing Co., Ltd., £103; Burton, Delingpole, £70.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-up.

THE MODERN ELECTRICAL SUPPLY CO., LTD.—Meetings, of creditors March 28th, 11.30 a.m., and contributories 12 noon, 33, Carey Street, Lincoln's Inn, London, W.C.2.

Companies Winding-Up Voluntarily.

ACME ELECTRIC TRACTION CO., LTD. E. H. Hawkins, 4, Charterhouse Square, London, E.C.1, appointed liquidator.

BRITANNIC ELECTRICAL CO., LTD. Meeting of creditors at the offices of Flint and Thompson, 71, Temple Row, Birmingham, on Monday, March 26th, at 12 noon.

Bankruptcy Information.

TURNER, John Samuel (trading as THE STANLEY MOTOR CO.), 542, Stanley Road, Bootle, Lancaster, electrical and motor engineer. Date of receiving order, March 17th. Debtor's petition.

WEEKS, William Edward, 59, Victoria Street, and 12, Filton Avenue, Horfield, Bristol, wholesale electric dealer. Receiving order, March 13th. Debtor's petition. First meeting, March 28th, 11.30 a.m., Official Receiver's Office, 26, Baldwin Street, Bristol. Public examination, April 27th, 12 noon, Guildhall, Bristol.

Notice of Intended Dividend.

HUMPHRY, George William, 24, Broad Quay, Bristol, under the style of HUMPHRY ELECTRIC CO., electrical engineer. Last day for receiving proofs, March 31st. Trustee, F. W. Darley, Official Receiver, 26, Baldwin Street, Bristol.

Bankruptcy Proceedings.

SATTERTHWAITE, Albert, trading as GREGSON AND CO., 22, Dutton Street, Liverpool, electrical engineer. The public examination of this debtor was held last week at Liverpool, the statement of affairs showing liabilities of £1,142, against assets of £343. Debtor, who attributed his failure to bad trade during the last two years and heavy working expenses, commenced business in November, 1918, and had had two different partners, but lately had traded alone.

Prices of Metals, Chemicals, etc.

TUESDAY, March 20.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£78 0 0	£2 10 0	—
Electro Wirebars	,,	£83 10 0	£2 15 0	—
H.C. Wire, basis	per lb.	11 9/16d.	5/16d.	—
Sheet	,,	11 3/8d.	5/16d.	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 3 5/16d.	5/16d.	—
Brass 60/40—				
Rod, basis	,,	7½d.	—	—
Sheet, basis	,,	10½d.	—	—
Wire, basis	,,	11d.	—	—
Pig Iron—				
Cleveland Warrants No. 3	per ton	£6 7 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 0 0	—	—
Lead Pig—				
English	,,	£30 0 0	—	5s. 0d.
Foreign or Colonial	,,	£28 15 0	—	7s. 6d.
Tin—				
Ingot	,,	£226 0 0	£1 5 0	—
Wire, basis	per lb.	2s. 11½d.	⅛d.	—
Aluminium Ingots	per ton	£110 0 0	£5 0 0	—
Spelter	,,	£37 5 0	17s. 6d.	—
Mercury	per bottle	£12 5 0	15s. 0d.	—

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2⅞d.
,, (Roll-Brimstone)—,, £7 15s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.— ,, £26 per ton, £7 10s.
Boric Acid (Crystals). ,, £55 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 4½d.; plantation 1st latex, 1s. 4½d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

189 847 K. NISHIMOTO. Incandescent lamp. (29/8/21.)
189 855 PROPRIETARY SMALLWARES, LTD., and A. B. GOLDSMITH. Holders for electric lamps. (3/9/21.)
189 857 W. J. PRITCHETT. Switch for controlling circuits. (3/9/21.)
189 861 METROPOLITAN-VICKERS ELECTRICAL Co. and G. H. FLETCHER. Armatures of electric machines. (5/9/21.) (Cognate Application, 33 657/21.)
189 862 ELECTRO-DYNAMIC CONSTRUCTION Co. and N. PENSABENE. Electric machines. (6/9/21.)
189 873 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Continuous production of tungsten compounds from tungsten ore. (8/9/21.)
189 878 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Arc lamps and other electrical discharge devices. (9/9/21.)
169 163 SCHOTT AND GEN. Electrodes for electrolytic measuring-instruments. (17/9/20.)
189 889 PORSCKE, R. Depolarisers for galvanic elements. (12/9/21.)
189 900 BRITISH LIGHTING AND IGNITION Co. and E. B. TUPPEN. Contact-breakers. (16/9/21.)
189 903 BRITISH THOMSON-HOUSTON Co. and A. P. YOUNG. Magneto-electric machines. (20/9/21.)
189 905 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Electric control of rotation of bobbins during winding. (21/9/21.)
189 918 M-L MAGNETO SYNDICATE and E. A. WATSON. Ignition magnetos. (30/9/21.)
180 931 A. M. TAYLOR. Improving current carrying capacity of three-phase cable systems. (12/10/21.)
189 955 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Electric condensers. (31/10/21.)
189 961 METROPOLITAN-VICKERS ELECTRICAL Co., J. S. PECK and G. E. GITTINS. Protection of electric circuits. (5/11/21.)
189 963 W. FAIRWEATHER (SINGER MFG. Co.). Centrifugally-actuated electric switches for electric motors. (8/11/21.)
189 982 J. MASSOLLE, H. VOGT and DR. J. ENGL. Electrostatic telephones. (23/11/21.)
189 984 SIEMENS BROS. AND Co. and H. E. HUMPHRIES. Selecting-devices for automatic and semi-automatic telephone systems. (24/11/21.)
189 989 V. HOPE. Iron-clad switches. (28/11/21.)
189 993 SILICA SYNDICATE, F. A. KING and F. REYNOLDS. Mercury and other vapour electric lamps. (29/11/21.)
190 003 E. ROHNER and E. SIMIC. Incandescent lamps. (8/12/21.)
190 017 AUTOMATIC TELEPHONE MFG. Co. (AUTOMATIC ELECTRIC Co.). Impulse transmitters of dial type for telephone systems. (22/12/21.)
190 053 A. E. GARRETT, C. E. FUNNELL and W. L. HOFFMAN. Storage battery grid. (7/2/22.)
190 057 M. SOLOMON, C. C. GARRARD and W. WILSON. Motor controlling switchgear. (11/2/22.) (Addition to 165 626.)
177 530 J. MASSOLLE, DR. J. ENGL and H. VOGT. Glow discharge tubes. (24/3/21.)
180 985 F. KRUPP A.-G. Overload protective systems for motors. (28/5/21.)
190 096 W. H. ILLINGWORTH. Electrical cut-out. (26/9/21.) (Divided Application on 189 284.)
190 184 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Electron discharge devices. (15/6/21.)
190 209 A. M. TAYLOR. Electrical transmission systems. (7/9/21.)
168 911 SCHWEIZERISCHE MAGNETA A.-G. Electric clock and time signal installations. (11/9/20.)

APPLICATIONS FOR PATENTS.

March 5th.

6 279 J. B. LAIDLAW. Wireless receiving systems.
6 284 E. D. YOUNG. Heating conductors for thermic telephones.
6 285 W. FISKER. Remagnetising magneto magnets.
6 296 D. A. NICOLL. Primary battery.
6 297 A. T. SCOTT and A. M. MACTAGGART. Electric apparatus for sound reproduction, etc.
6 305 W. M. BETTS and S. E. GRUBB. Detectors for wireless telephony.
6 317 R. RODRIAN. Smelting and electrolysing processes. (3/3/22, U.S.)
6 336 WESTERN ELECTRIC Co. Electric cables.
6 337 R. L. and T. E. BEAUMONT. Tuning stand for wireless receiving apparatus.
6 344 J. F. CULLIN. Means for driving generator armatures.
6 346 E. C. R. MARKS (DELTA STAR ELECTRIC Co.). High-tension cut-out systems, etc.
6 349 N. JAPALSKY and M. KOTENSKO. Electro-magnetic generator.
6 350 N. JAPALSKY and M. KOTENSKO. High-speed c.c. generator
6 355 G. WEISSMANN. Incandescent lamps. (4/3/22, France.)
6 359 STERLING TELEPHONE Co. and T. D. WARD-MILLER. Electric connectors.
6 371 W. S. FLIGHT and E. B. WEDMORE. Insulating materials.

March 6th.

6 374 T. COCKERILL. Tuning of magnetos.
6 378 BROOK, HIRST AND Co. and J. A. HIRST. Motor starters.
6 379 C. A. BATTISCOMBE and E. W. NESHAM. Apparatus for obtaining supply of electricity.
6 400 J. W. DUNGEY. Telephone receivers.
6 403 F. W. COOMBER. Wireless receiving apparatus.
6 406 DEUTSCHE SOLWAY-WERKE, A. G. and P. LUTH. Arrangements for operating electrically-driven machinery.
6 421 A. J. WHEELER. Automatic metering of telephone calls, and electric relays.
6 424 L. F. BRAUN and E. L. CONRADI. Electric contact-making devices.
6 428 J. E. S. TRELAWNY. Swivel joints or couplings for flexible.
6 433 A. K. S. M. DE CARVALHO. Call signal receiving apparatus for telegraph stations, etc. (4/12/22, Portugal.)
6 438 G. UNTERBERG. Magneto electric ignition and lighting apparatus.
6 453 T. L. R. COOPER. Combined electric motors and pumps.
6 456 C. A. F. FENNELL and C. E. FOSTER. Switches.
6 459 E. W. GAUTHIER. Make and break apparatus for magnetos. (17/3/22, Belgium.)
6 471 METROPOLITAN VICKERS ELECTRIC Co., W. J. BROWN, J. W. BUCKLEY and E. J. E. HUBBARD. Microphonic transmitters, telephone receivers, etc.
6 472 N. E. DAVIS. Caps for telephone mouthpieces, etc.
6 475 D. S. ELLIS. Apparatus for counting telephone calls. (7/3/22, Australia.)
6 480 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co). Switches.
6 490 F. LECONTE, G. DUBOULET, R. V. HEBERT and W. TREHERNE. Electro-compressors.
6 495 R. A. SMITH. Wireless telephone receiver.

March 7th.

6 567 F. H. ELSON and J. A. NEWBY. Wireless telephone apparatus.
6 584 J. A. WARD. Variometers for radio telegraphy, etc.
6 593 CO-OPERATIVE CINEMATOGRAPH Co. Variable resistances.
6 601 R. OPPENHEIM. Electric cells.
6 613, 6 614, 6 615, 6 616, and 6 617, B. E. D. KILBURN (NEDERLANDSCHE THERMO-TELEPHOON MAATSCHAPPIJ). Long-distance telephony.
6 618 and 6 619 B. E. D. KILBURN (NEDERLANDSCHE THERMO-TELEPHOON MAATSCHAPPIJ). Cables for long-distance telephony.
6 620 NEDERLANDSCHE THERMO-TELEPHOON MAATSCHAPPIJ. Long-distance telephony. (7/3/22, Germany.)
6 626 WESTERN ELECTRIC Co. Loud-speaking telephone receiver.
6 638 AUTOMATIC TELEPHONE MANUFACTURING Co. and W. O. PASSMORE. Metering arrangements for telephone systems.

March 8th.

6 642 G. A. MILLER. Sectional electrolytic deposition of metals.
6 658 A. W. DRANSFIELD. Thermionic valves.
6 666 L. C. BYGRAVE. Wireless apparatus.
6 672 W. A. CROSSBEE. Electric horns.
6 682 V. BARRETT. Reflectors for electric lights, etc.
6 697 A. C. BROWNFIELD. Electric indicating apparatus.
6 698 ELECTRIC HEATING AND HARDWARE, LTD., and F. J. WINEBERG. Electric hand irons, etc.
6 712 WESTERN ELECTRIC Co. (DEAKIN AND POLINKOWSKY). Automatic telephone systems.
6 717 V. T. SMITH. Crystal receiver sets.
6 721 METROPOLITAN-VICKERS ELECTRIC Co. and T. C. CHRISTIANSON. Switchgear.
6 727 S. S. AUSTIN and J. F. C. LADD. Variable inductances, resistances, etc.
6 729 E. A. R. MORTON. Wireless receiving apparatus.
6 746 W. H. WOODS. Head telephones.
6 751 VOXMASCHINEN, A. G. and W. VOGELSANG. Telegraph apparatus.
6 566 C. A. SIMPSON. Prevention of overheating electric irons, etc. (1/4/22, New Zealand.)
6 757 AUTOMATIC TELEPHONE MFG. Co. Electromagnetic impulse responding apparatus for telephone systems.
6 760 P. ELPHICK. Wireless telephony.
6 761 LANDIS AND GYR A.G. Time switch. (17/8/22, Switzerland.)
6 771 H. E. S. HOLT. Fault detector for electric circuits.
6 773 COMPAGNIE GENERALE ELECTRIQUE. Synchronised asynchronous machines. (22/4/22, France.)
6 775 F. H. ANSTEE. Spiral filaments for lamps and thermionic valves.

March 9th.

6 784 H. G. CAMERON. Apparatus for reception of wireless telegraphy.
6 848 W. J. L. SANDY. Miners' electric safety lamps, etc.
6 860 DISTRICT CHEMICAL Co. and W. R. J. BRITTEN. Electrodes for arc welding, etc.
6 866 SIR P. DAWSON and F. W. FAWDRY. Insulators for electric railways having overhead wires.
6 868 W. F. GROVE. Electric swivel for telephone cords, etc.
6 875 E. S. RUSSELL. Electric connectors.
6 884 E. I. EVERETT, K. EDGCUMBE and F. E. J. OCKENDEN. Electric measuring instruments.
6 892 BENHAM AND SONS and N. C. BARRETT. Electric heating elements.
6 905 R. M. BALSTON and T. H. J. WATTS. Spark detector.

March 10th.

6 914 B. E. A. VIGERS. Device for preventing radio reception on power and light wiring systems.
6 915 T. E. BEAUMONT. Crystal detector.
6 921 F. FAIRER and A. SHAW. Device for audibly indicating whether electric light is out.
6 930 K. C. D. HICKMAN. Electric apparatus for measuring concentration of electrolytes in water.
6 931 J. I. M. HOGG. Switch.
6 934 M. R. and D. M. SCANLON. Wireless apparatus.
6 951 H. STEVENS. Electric condensers.
6 964 A. WILKINSON. Shade holders for electric lamps, etc.
6 970 J. C. SWAN. Electric igniter for flashlight powder.
6 979 F. W. SCHILDT. Insulators.
6 990 A. F. HERBERT. Wireless loud speakers.
6 991 STERLING TELEPHONE Co. and T. D. WARD-MILLER. Apparatus for wireless telegraphy and telephony.
6 992 STERLING TELEPHONE Co. and T. D. WARD-MILLER. Crystal detectors.

Arrangements for the Week.

FRIDAY, MARCH 23rd. (To-day.)

PHYSICAL SOCIETY OF LONDON.

5 *p.m.* At the Imperial College of Science, South Kensington, London. The following papers will be read :—

1. "A New Moving-Coil Galvanometer of Rapid Indication," by Dr. W. J. H. Moll.
2. "A Thermopile for Measuring Radiation," by Dr. W. J. H. Moll.
3. "Aberration and the Doppler Effect on the Theory of Relativity," by Capt. C. W. Hume.

The following Experimental Demonstrations will be shown :—

"The Production of E.M.F.'s by Heating Junctions of Single Metals."
"Double Refraction Due to the Motion of a Vanadium Pentoxide Sol, with Some Applications."

JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette on "History and Development of the Underground Railway," to be read by Mr. R. J. Siddall.

INSTITUTION OF CIVIL ENGINEERS, LEEDS.

7.30 *p.m.* At the Philosophical Hall, Leeds. Lecture on "Industrial Standardisation," by Mr. C. Le Maistre.

INSTITUTION OF ELECTRICAL ENGINEERS (SOUTH MIDLAND CENTRE). (STUDENTS' SECTION.)

Lecture on "Temperature Measurements with the Einthoven Galvanometer," by Mr. F. Adcock and Mr. E. H. Wells.

EDINBURGH ELECTRICAL SOCIETY.

8 *p.m.* At Philosophical Institute, 4, Queen Street, Edinburgh. Questions and Answers Night.

ROYAL INSTITUTION OF GREAT BRITAIN.

9 *p.m.* At the Institution, Albemarle Street, London, W.1. Lecture on "Life History of an Alpha Particle from Radium," by Sir Ernest Rutherford.

SATURDAY, MARCH 24th.

WEST YORKSHIRE METALLURGICAL SOCIETY.

At Halifax. Discussion on "Utilisation of Scrap Metals in Industry."

ROYAL INSTITUTION OF GREAT BRITAIN.

3 *p.m.* At Albemarle Street, London, W.1. Lecture on "Atomic Projectiles and their Properties (Lecture VI)," by Sir Ernest Rutherford.

MONDAY, MARCH 26th.

INSTITUTION OF ELECTRICAL ENGINEERS. (NORTH-EASTERN CENTRE.)

7.15 *p.m.* At Armstrong College, Newcastle-on-Tyne. Paper on "Works Production," by Mr. G. H. Nelson.

TUESDAY, MARCH 27th.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.

7.30 *p.m.* At the Institution, 39, Elmbank Crescent, Glasgow. Informal Meeting. Discussion of papers read at the Sixth General Meeting.

ILLUMINATING ENGINEERING SOCIETY.

8 *p.m.* At the House of the Royal Society of Arts, John Street, Adelphi, London. Paper on "Window Design and the Measurement and Predetermination of Daylight Illumination," by Messrs. P. J. Waldram and J. M. Waldram.

WEDNESDAY, MARCH 28th.

INDUSTRIAL LEAGUE AND COUNCIL.

7.30 *p.m.* At Caxton Hall, Caxton Street, London, S.W.1. Lecture entitled "The Function of Capital," by Mr. E. J. Garmeson.

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THE ELECTRICIAN

ESTABLISHED 1861.

THE OLDEST WEEKLY ILLUSTRATED JOURNAL OF

Electrical Engineering, Industry, Science and Finance.

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CONTENTS.

Notes of the Week	323	Henry Ford's Life and Ideas	347
Trade Promotion	325	The Institute of Patentees	347
A Recent Tendency in Housing. By W. C. C. Hawtayne. Illustrated	326	B.E.A.M.A. Annual Meeting	347
		Employers and the E.P.E.A.	347
The Electric Vehicle as an Aid to Trade Promotion. By Raymond J. Mitchell, M.I.E.E., A.M.I.Mech.E. Illustrated	328	Wages Reductions in West Midland District	347
		Legal Intelligence	348
		Obituary	348
The Position of the Electrical Contractor. By H. Marryat, M.I.E.E., M.I.Mech.E.	331	Personal Items	348
		The Mullard Valve Appeal	349
Alloys' Resistance to Corrosion	331	Rights of a Supply Company	349
Electricity and the Domestic Hot Water Problem. By C. Orme Bastian	332	Imperial Notes	350
		Foreign Notes	350
Broadcasting as an Aid to Trade Promotion. By Sir Wm. Noble	333	Parliamentary Intelligence	350
		Electricity Supply	351
Co-operation Between the Architect and the Electrical Engineer	334	Forty Years Ago	351
		Tenders Invited and Accepted	352
Advertising in the Technical Press—The Appropriation. By Hugh M. Goody	336	Business Items	352
		Wireless News	353
The Electric Heating of Large Buildings, Offices, and the Home. Illustrated	337	Manchester Wireless Exhibition	353
		Electric Traction	353
Fans as Merchandise to Sell and Profit By. By "A Spectator"	338	Institution Notes	353
Electric Lighting and Education. By Georges Benoit-Levy	340	Companies' Meetings, Reports, etc.	354
Institution of Electrical Engineers	341	New Companies	354
Spring Cleaning and Electricity. Illustrated	342	Commercial Intelligence	355
Merchandise to Sell and Profit By	344	Patent Record	356
A Modern Electrical Showroom	346	Arrangements for the Week	356

Notes of the Week.

The National Board Re-Established.

We are glad to be able to announce that the National Joint Board of the employers and employed in the electricity supply industry has been re-established, and will meet again at an early date to discuss the Halifax case and salaries generally; and to deal once more with the agreements which the E.P.E.A. have entered into with the manual workers' unions. This re-establishment has had as its immediate result the prevention of a strike by members of the E.P.E.A., but we hope its more permanent outcome will be a realisation of the fact that "drastic action" by either party is not the way to deal with matters in dispute. In the present crisis the E.P.E.A. and the employees generally have behaved exceedingly well. The agreements, which were the primary cause of the trouble, were entered into in good faith on their part and have resulted in smoother working between the staff and the workmen of the electricity supply undertakings. The sniping on the wages question, which the dissolution of the Joint Board made possible, has been resisted firmly but diplomatically. As a result the Association has come out of the fray with increased prestige, and, we are not surprised to hear, with increased membership. On the other hand the prestige of the employers has suffered, and we hope they have learnt a lesson which they will apply in future.

International Telephony.

We learn from an official announcement that the technical committee which has been sitting in Paris to study the problem of international telephony in Europe has concluded its preliminary work in an atmosphere of perfect cordiality. Unanimity, we understand, was obtained on all the technical points raised, especially on the need for uniformity in equipment and operating practice. Unfortunately this is the least part of the work, as the political problems will cause far greater difficulties than those in the technical field. The appointment of a permanent committee, which has been decided upon, with a secretariat in Paris, is therefore a wise step. This secretariat will form a centre for the international exchange of all kinds of technical information on long distance telephony, information which will be the necessary superstructure to the main characteristics of the construction, upkeep and development of international telephone circuits, which have been agreed upon by the committee. The committee have drawn up a programme of communication to be provided during 1923 and 1924 and is to prepare a scheme for the construction needed during the next ten years. A great advance towards a great ideal has therefore been made.

Points and Costs.

Though the ethics of turning other people's necessity to glorious gain may be doubtful, there is no harm in pointing out that the present shortage of houses can be taken advantage of by electrical engineers. Architects, builders and prospective house-owners should be persuaded of the advantages of using electricity as much as possible for domestic purposes and of the necessity of so planning the wiring beforehand that the employment shall be most economical. It will be argued that this is costly. But the cost of the electrical installation is, in any event, but a small percentage of the cost of the whole house, and even if it were not the benefits that it provides are well worth the extra expense. When the house is being built it is possible to make provision for the proper employment of electricity at a price very little greater than that of the exiguous installations so popular at present. This is particularly desirable in blocks of flats, a type of dwelling which is becoming increasingly popular

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in our large towns, and we are therefore glad to see that in several cases in London the opportunity of introducing the electric idea into such places has been seized with both hands.

Some All-Electric Flats.

In this connection we particularly commend to our readers the article by Mr. W. C. C. Hawtayne which we publish on another page of this issue. He describes the electrical equipment of some large blocks of flats in the Marylebone area, and shows in no uncertain way how modern ideas, properly carried out, can help modern people. There are one or two points about this installation to which attention may be drawn. Both private and communal kitchens are provided ; and both are wholly electric. The rising mains consist of copper strip, which can be added to as occasion demands. Every room in the flats has at least one power and lighting plug in addition to the usual points. Every care is taken to avoid condensation in the conduits. Lifts and telephones are generously provided. The tariff consists of a kilowatt charge based on the lighting demand, and this charge is included in the rent, with an addition of 1d. per kWh consumed. In another block of flats electricity is gradually replacing gas in the communal kitchen with satisfactory results. We agree with Mr. Hawtayne that the essence of these flats is electricity. We congratulate those concerned on their enterprise, and hope the excellent example will be widely followed.

Electrical Engineers and Architects—Some Confusion.

The discussion at the joint meeting of the Institution of Electrical Engineers and the Royal Institute of British Architects which took place on Thursdays, March 15th and 22nd, was in some ways a curious affair. Both architects and electrical engineers have their own peculiar problems, but they have certain difficulties which can best be solved in conjunction. These difficulties will not, however, be solved by treating electrical engineers as a not very superior kind of workman (as one architect seemed inclined to do), nor by suggesting that the Institution should publish "A Short Guide to Electricity for the Use of Architects," nor by insisting on the need for a uniform voltage, the scrapping of single phase 100 cycle systems, and the hiring of apparatus. Indeed, the architects generally displayed a woeful ignorance of the aims and objects of electrical engineers, and we can only hope the electrical engineers' remarks on architectural problems were not so wide of the mark. But if the discussion did nothing else, it did indicate the crying need for the Joint Committee suggested by Mr. Beauchamp, not to talk about details but to study important generalities. We hope that committee will be set up without delay.

Need for Early Consultation.

We do not propose to comment on the discussion as a whole, for the remarks of many of the speakers showed their inability to perceive the wood for the trees. But the need for the electrical engineers being called in at the earliest possible moment (a point made by Capt. R. J. Wallis Jones and other speakers) is of a paramount importance, both from the technical and the economic points of view. If this early co-operation is achieved great good can follow ; but each party, architects and engineers, must stick to their own work. For the architect to try and be an electrical engineer would be as hopeless in its results as the reverse ; and this ought to be realised. On the other hand, we have no doubt that the electrical engineer is not faultless, though little was heard of this side of the question, except as regards illumination. The illuminating engineer, as Mr. Eck and Mr. Cash both indicated, does not realise the importance of shadows. The result is a certain flatness, and in churches and other similar buildings a spoliation of effect. It was left, however, for Mr. Cash to make the most devastating criticism of the practical incursions of the engineer into the field of illumination. The Committee of the Engineers' Club are recommended to study his remarks in conjunction with the article by M. Benoit-Levy, which appears in this issue, and to draw the plain moral.

The B.E.A.M.A. and Advertising.

The speech of the chairman, Mr. B. Longbottom, at the annual general meeting, and the annual report, with which we dealt in last week's issue, both indicate that, in spite of industrial conditions, the British Electrical and Allied Manufacturers' Association has had a successful year. In commenting on the report of this body for 1921, we said that its highest duty should be to encourage research. This duty we are glad to see is fully recognised, though in practice there is at present a certain short-sighted lack of enthusiasm on the part of some of the members. Without research the electrical industry must fail. If it is to prosper it could not rest upon a surer foundation. It appears that the Association is a little hurt because it is said it does not advertise enough, and Mr. Longbottom countered this by remarking that sound and productive work is the best advertisement. But the B.E.A.M.A. does not act alone. It is only one among many similar electrical associations. Those bodies' operations are sometimes in concert and sometimes in opposition with those of the B.E.A.M.A. In both cases a little light on what is happening is desirable to save time and to avoid dissension. But this is not advertising ; it is only good policy.

Electricity in the City.

Some belated reports of the London electricity supply companies show that the prosperity upon which we commented a week or two ago is a common lot. The City of London Electric Lighting Co. report an increase in income from £676 455 to £740 158, and a decrease in expenditure from £445 142 to £421 187, largely due to a fall in the prices of coal and oil. Of the surplus £100 000 is being put to reserve and £15 000 goes towards the cost of altering consumers' equipment consequent on the change over of the system to standard requirements. A dividend of 15 per cent. is being paid. We are glad to see that the chairman specially called attention to the reductions in prices which had been effected during the past year. In spite of the limited area served by the company electrical development has not reached saturation point, and these reductions, by encouraging the use of electricity for all purposes, will help towards that end. The kilowatt hours sold increased from 35 930 446 to 42 605 947. These figures are likely to increase, not only for the reasons mentioned, but because Bankside will in future be used for giving bulk supplies.

Some Other Results.

The Chelsea Electricity Supply Co.'s report shows that the gross receipts increased by £9 300, while the costs fell by £8 000, owing to reduced running expenses and high prices. The latter, we are glad to see, are about to be reduced, in spite of the fact that while the price of electricity is 25 per cent. more than in 1914, that of gas is 50 per cent. more. But we want to cut out gas. The results obtained by the County of London Electric Supply Co. are also good from the shareholders' point of view. The revenue was £858 317, an increase of 15 per cent., and the working expenses £374 013, a reduction of over 12 per cent. The kilowatt hours sold were 54 241 758, an increase of 7 021 679 kWh, and 6 292 kW was connected during the year. The chairman spoke optimistically of the future and referred to the coming of the "Golden Age of Electricity" This is not likely to dawn in some of the districts served by the company unless they reduce their prices.

Electricity and Spring Cleaning.

At this time of year some means of alleviating the trials and troubles of spring cleaning are earnestly desired by every housewife and every house-man. No better apparatus for this could be found than that which is electrically operated. On other pages of this issue we give some descriptive details of a few of the electrically driven vacuum cleaners which are now on the market, and commend them to the attention of those who want to give a

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useful permanent present or to get rid of some temporary inconvenience. The prices of these equipments are coming down, and they should soon be within the reach of all, to the advantage of all. Though they would be used every day they would only be used for a short time, and their employment, even at lighting rates, would not be expensive, and is worth consideration. The vacuum cleaner is an attractive piece of equipment to housewives, and properly pushed should form the thin end of the wedge for the introduction of electric power into the home. It is therefore a field worth cultivating.

Trade Promotion.

To-day we publish the third Annual Spring Trade Promotion Number of THE ELECTRICIAN. We have sometimes been told that to publish Trade Promotion numbers is wrong, and alternatively that to publish Spring Trade Promotion numbers is useless. We do not know what the arguments in favour of the first proposition are; they can be neither very weighty nor well found. In favour of the second proposition it is argued that at the end of March the electrical trade, the trade in small apparatus that is, is showing an inevitable seasonal decrease, that in the summer no one takes any interest in the equipment upon which that part of the industry exists, and that the wise are already beginning to think about their winter campaign. If these arguments ever were tenable in the days when the electrical industry meant lighting alone, they are certainly quite untenable now, when domestic equipment, to say nothing of power, is engaging so much of our enterprise and attention.

Cooking—A Summer Load.

The truth of this statement may well be emphasised by a few examples. Cooking, in which so much has been done and from whose development so much may well be expected, is certainly not seasonal. In its present stage of progress it may with truth be said to be more of a summer than a winter load. Coal fires within the next few weeks will be disappearing from the homes, and the need for some cooking apparatus which does not heat the kitchen will be more rather than less felt. That we do not deal specifically with cooking progress in this issue does not mean that we do not realise that every effort must be made to increase its use in the home and elsewhere, but is simply due to the fact that the electric cooking idea has achieved a certain small momentum upon which it may be allowed to run for the time being.

The Hot Water Problem.

The same cannot be said for the hot water problem. Here we have an electrical application in which little visible progress has been made during the past few years, though, as Mr. C. ORME BASTIAN points out, the movement underground has been considerable and may soon break cover in ways which can be considered satisfactory. Mr. BASTIAN'S policy for attaining this end is worthy of note. It is iconoclastic. Electric water heating must not be built up on the existing installations, but must be designed afresh, a combination of thermal storage and extra heating being provided to meet the ordinary domestic requirements. The figures that he gives show that this can be done economically where the price is right, and we hope that his arguments will induce many more station engineers to provide tariffs which make the use of this plant attractive. We look upon this matter of water heating as one of the most urgent and important problems which the electrical industry has to solve at the present time. It forms the very basis of the domestic load and properly dealt with will overcome many of the station engineer's present and prospective difficulties. Its load factor is high and, as is being done at Hackney, it can be arranged to be entirely "off-peak." For that reason we deal with it in this issue. For that reason our second competition has the discovery of the best system of electric water heating as its object.

The Electric Vehicle—Why is it Neglected?

Another "off-peak" load which unaccountably has received little encouragement from the station engineer, is the electrical vehicle. Mr. R. J. MITCHELL deals with this matter. He points out that one electric van of one ton capacity will use from 100 kWh upwards per week, while a five-ton vehicle will consume three or four times as much. In other words, the smallest electric vehicle will consume as much as half a dozen houses and will take 90 per cent. of its demand during the stilly watches of the night. Without exaggeration it may be described as an ideal load. Why, then, has it not been more developed? We are honestly puzzled to provide an answer which does not cast a slur on the electrical industry. We recommend all supply engineers to study Mr. MITCHELL'S suggestions for their own good and to take his advice.

Are Fans Solely Seasonal?

An electrical application which seems at first sight to be entirely seasonal is fans. Our correspondent "Spectator," however, exposes the fallacy of that idea. He gives a number of examples where electric fans can with advantage be used during the winter months, and some useful hints as to the purchase and sale of this equipment. His most important point, however, is for fans to be satisfactorily dealt with the campaign must be planned, and planned ahead. This is the more necessary if the fan is a seasonal piece of apparatus. Too often our summer comes—and goes—like a flash. The fan stock must be ready for immediate purchase and delivery. The same equally applies to other apparatus, whether seasonal or not.

Broadcasting an Opportunity.

At the present time a section of the electrical industry is enjoying a popular boom. We may, perhaps, hardly say that we refer to broadcasting. Whether we, with the optimists, consider that broadcasting is going to last, or with the pessimists think that it will be inevitably short-lived, there can be no doubt that all branches of the electrical industry should take advantage of the demand for wireless equipment that is still growing and take every reasonable means to develop it. We commend to our readers what Sir WILLIAM NOBLE has to say on this point. Broadcasting has created practically a new industry which, owing to the manufacturers seizing their opportunity, has meant additional work for electrical men. In Sir WILLIAM'S opinion, however, the contractor has not been equally spry, with the result that money which ought to be flowing into electrical pockets is going elsewhere. To alter this enterprise and push are essential. Even if the boom in broadcasting is only temporary the results will be worth while. If it is not temporary, and the future is rosy, a permanent business will have been established on a paying basis.

The Contractor the Vital Link.

We have left Mr MARRYAT'S article to the last, not because we think it is the least important, but because we feel that in trade promotion the contractor holds the key to the situation. The electrical industry makes contact with the public at two points: the supply department and the contractor. They both have their problems, but the contractor has this advantage. He is admitted into the house as a man who comes to put something (not necessarily something electrical) right. While he is doing that he can do a great deal for the electrical idea. If for no other reason we think the electrical contractor is essential to the industry, and the more prosperous the contractor is, both individually and collectively, the better for the industry as a whole. We are glad to hear from Mr. MARRYAT that after a period of semi-strangulation the artificial respiration which he and his Association have been applying is beginning to take effect. The contractors have troubles and disagreements with other branches of the industry, but if they take all measures to build up trade it will not be long before they are prosperous. That will be a good thing for them and for the industry.

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A Recent Tendency in Housing.

Some Up-to-Date Flats and Their Electricial Equipment.

By W. C. C. HAWTAYNE.

The difficulties that have arisen in recent years with regard to housing and the apparent disinclination of young women to enter domestic service have given a great impetus to the work of conversion of large town houses into flats, and in spite of the heavy cost of building, or perhaps because of it, blocks of flats for the accommodation of many families have been erected in almost every part of London. This has opened, or should open, up a great field to the electricity supply authority as well as to manufacturers and contractors.

I myself happen to live in a large block of flats built in pre-war days. This is supposed to be in every way up-to-date, but unfortunately the whole place is equipped for gas heating and cooking, and a change-over from gas to electricity is not possible without the complete re-wiring of the premises and the strengthening of the rising mains—an expense which the tenant cannot be expected to bear, and which the landlord will not meet.

Some Modern Flats.

It has fallen to my lot to carry out the electrical equipment of some very large blocks of flats in North-West London for the Central London Building Co., whose chairman, Mr. Alderman Davis, has taken a strongly progressive line to the advantage of supply authority, manufacturer, contractor and consumer alike. Some of these blocks are in the district of the St. Marylebone Borough Council, who have not been slow to recognise the value of Mr. Davis' work and have given every encouragement to his ideas.

In the case of another large block, now under construction and partly occupied in Maida Vale and known as Clive Court, the supply is in the hands of a company who have not seen their way to deal with the matter on similar progressive lines and the outlook at present is very different. The latest block of flats—now being extended—supplied from the Marylebone mains is known as St. John's Wood Court, St. John's Wood Road, N.W.

Each flat has its own private kitchen and there is a communal kitchen for serving those who desire to limit their own kitchen work or to avoid it altogether. There is a service lift from each flat to the communal kitchen and a complete telephone installation permitting a tenant to call for what he wants at any hour.

Supply Arrangement.

The supply mains are run by the Borough Council through a sub-way in the building and at points beneath each tier of flats are connected to d.p. switch fuses supplied and fixed by the Council. From the d.p. switches short pieces of cable connect to rising mains which consist of bare copper bound on heavy pattern porcelain insulators fixed by Lewis bolts and rising to the top floor in casings of hard wood lined with "Poilite." The rising mains run in all but a few instances through the kitchens of tenant's flats and are there connected by gunmetal clips with cable sockets to the service cables feeding the flats. The rising mains vary in size from 0·25 sq. in. to 0·5 sq. in. sectional area and the capacity can be readily increased at any time by the addition of more copper. As a general rule the service connection from the risers is of 19/0·052 in. or 19/0·064 in. V.I.R. cable passing to a 100 A size d.p. switch fuse of the Midland Electric Manufacturing Co.'s make and thence to a distribution board. The cost worked out at £3 12s. 0d. per point including heavy wiring and the cost of the rising mains. The cost of the flats now being equipped is estimated at £2 3s. 8d. per point.

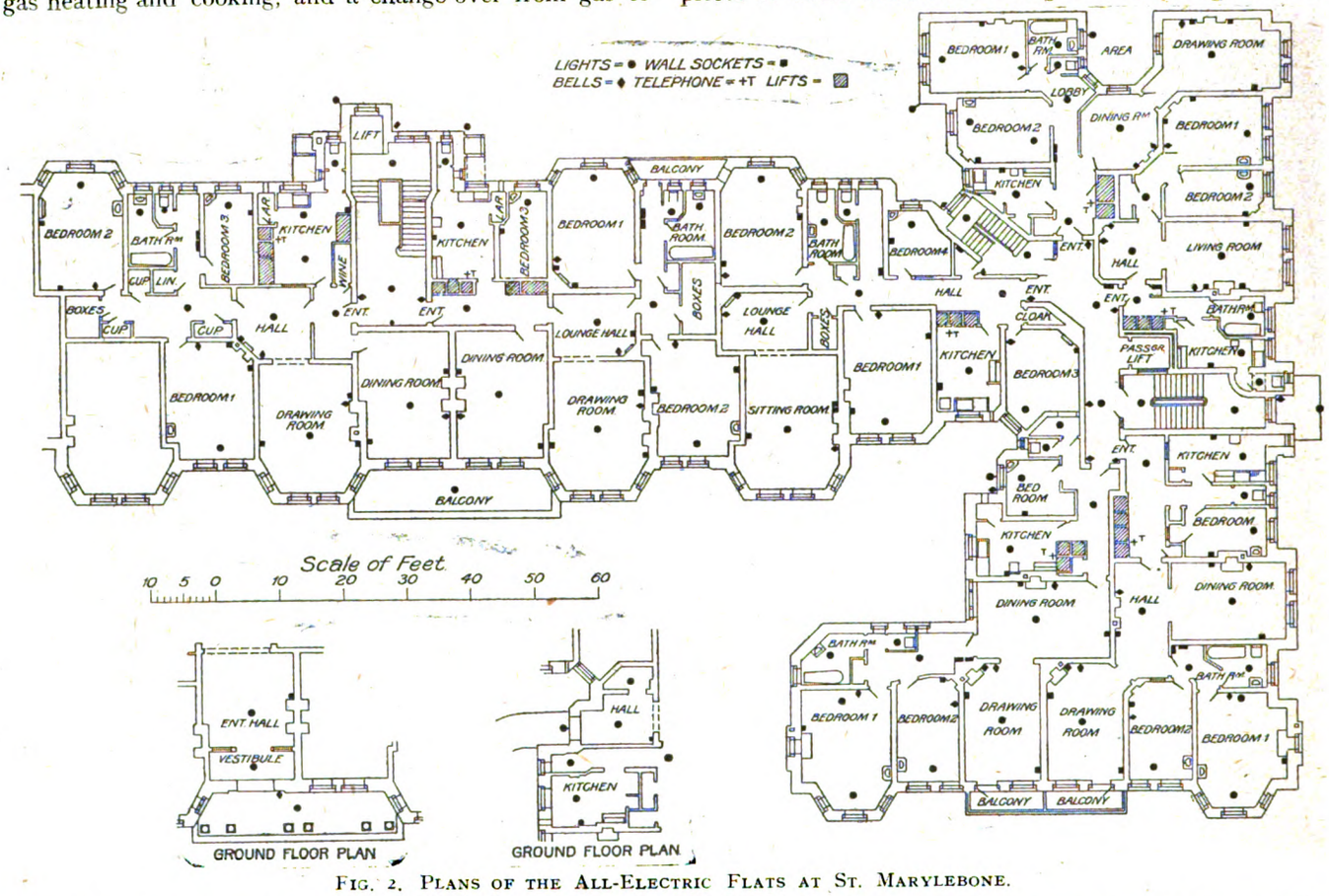

FIG. 2. PLANS OF THE ALL-ELECTRIC FLATS AT ST. MARYLEBONE.

Kitchen Equipment.

Each kitchen is provided with a 30 to 40 A cooking point at 240 V, and every room in the flat is provided with one 15 A three pin wall socket and rotary switch alongside the fireplace as well as the usual lighting points on the ceiling or wall.

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The distribution boards carry one 40 A cooking circuit, the necessary complement of 15 A heating circuits—not more than two heating points being on one circuit—and lighting circuits. The boards are iron cased, with Home Office pattern fuses.

The conduit draw-in system of wiring is employed throughout, the conduits being galvanised and cables and wires being of Association class and make.

Conduit Runs.

Conduits pass from the distribution board via the ceiling space of the flat, or the floor of the flat above, being

FIG. 2.—A VIEW IN ONE OF THE ELECTRICAL FLATS IN ST. MARYLEBONE.

first bent to shape and dropped into position. The ceiling points consists of a backplate carrying one or more tubes nutted on to the plate, and covered with a deeply recessed hard wood block. To avoid trouble from condensation the conduits running to wall sockets run downwards from the ceiling. Galvanised terminal boxes are used at all switch and socket points, inspection and draw boxes are not used; there is thus a free and independent draw through conduit system for each flat, which is connected to an earth wire stapled to the wall in the riser chase.

On the top or service floor some pairs of rising mains are looped together, and from the loop connections are taken through switches and fuses to distribution boards for the communal kitchen and general service.

Ample Lifts Equipment.

There are two 12 cwt. electric passenger lifts and twenty-seven 56 lb. kitchen service lifts now running with one more passenger lift and eight more service lifts about to be installed. One of the passenger lifts is by Waygood-Otis, and is of the push button type, and the other, which is operated by a car switch during the busy hours of the day and by a push button at other times, is by The Express Lift Co., who have also supplied the whole of the service lifts.

The passenger lift motors are below the shafts, and the services for them are in lead-covered and armoured cable run in the subway from a busbar board fixed in the central motor room.

The service lifts are operated by selector push buttons from the kitchen floor if more than one flat is served by one lift. Electrical and mechanical locks are provided at each hatchway, so that the hatch cannot be opened unless the lift is opposite to it and at rest, and the lift cannot be operated unless the hatches are closed. The closing of a hatch returns the lift automatically to the kitchen floor. The service lift motors are mounted above the shafts and are wired to two main distribution boards, each connected through a meter, switch, and fuse to the looped rising mains.

Telephone Switchboards.

There are two telephone switchboards, one on the kitchen floor and the other for night use in the caretaker's flat, interconnected by a multiple change over switch. The boards are of the central battery lamp signalling type, and together with the special change over switch and telephone instruments are of the Sterling Telephone and Electric Co.'s make.

Corridors and stairs are lighted in tiers from a landlord's service board, equipped with time switches; two way switches are also provided to control the circuits in case of emergency.

The whole of the internal wiring for lighting, power, telephones and bells was carried out by W. J. Furse and Co., of Nottingham and London.

In addition to the electrical installation there is a complete hot water heating and domestic hot water supply system, by G. N. Haden and Sons, of Trowbridge and London, which is of interest electrically by reason of the fact that accelerators driven by motors are employed in connection with the heating system.

Tariffs.

The supply is charged at per kW of estimated lighting demand (exclusive of heating and power), plus 1d. per kWh. The kW charge is included in the rent. The tenant pays only one penny per metered kilowatt-hour, whether for lighting, power, cooking, or heating, and is therefore free to use any wired point for any purpose.

It may be said of the St. John's Wood Court installation, that its essence is electricity, and it is doubtful if it has a rival in any part of London, so far as the thorough provision of up-to-date labour-saving facilities is concerned.

An Example to be Followed.

The advantages to the tenant and to the supply authority are so obvious that it is to be hoped supply authorities generally will speedily realise the value of assisting progressive landlords, not only by moral but by financial encouragement.

It is too early to give reliable figures of the consumption per person, or per flat, in this particular block, but I hope to give the information later. From conversations I have

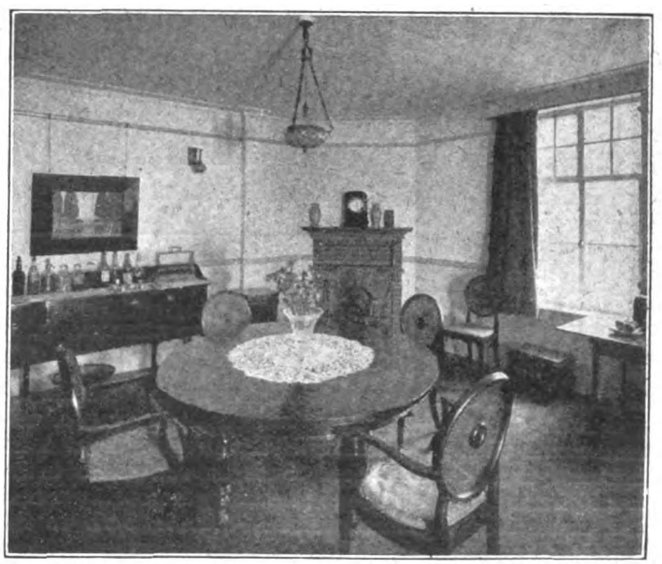

FIG. 3.—ANOTHER VIEW IN A DINING ROOM.

had with tenants, caterers, and the supply authority, I gather that all are well satisfied with the working results.

Two other blocks of flats were equipped by me last year for the same landlords, and the following figures regarding them should be of interest. The blocks, of which photos are shown, are known as Addison House, Grove End Road, and Circus Road Mansions, and are the two first of a group planned for this estate. They were laid out for lighting by

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electricity and heating by gas, and gas fire points were installed in all rooms.

Cooking and heating by electricity was an afterthought, but at Circus Road Mansions heating points were placed alongside the fireplace, in addition to the gas points and the position at present shows :—

Number of flats (excluding caretaker)	43
(*a*) Number using electricity exclusively for cooking and heating as well as lighting	16
(*b*) Number using electricity for heating and lighting but not for cooking	22
(*c*) Number using gas (except for lighting)	5
Average size of cookers	4 to 6 kW
Average size of heaters	2 kW
(*a*) Consumption for quarter ending December 31st by six largest flats using electricity for cooking, heating, and lighting, 1 020 kWh at 1d.	£4 5 0
(*b*) Ditto, ditto, heating and lighting only, 600 kWh at 1d.	£2 10 0

Gas to Go.

A kitchen and restaurant at Addison House caters for both blocks. When first started it was equipped for gas cooking and with gas hot cupboard, the apparatus being installed on a hire-purchase system, which still runs. There were no electrical utensils of any sort.

The gas installation in the kitchen comprises :—

Two hotplates.
Two boiling rings } Used for vegetables.
One copper .. }
One large cooker of which only the boiling rings are now used.
One stewing oven, very rarely used.

One gas cooker has already been removed, and the rest of the gas apparatus will probably follow suit when the hire-purchase agreement comes to an end. The gas consumption (kitchen only) for the December quarter amounted to 591 therms at 10d. per therm, or £24 12s. 6d.

All roasting, frying, and general cooking is done by electricity, and there are now installed and in use :—

One double roasting oven	8 kW
One grill	6 kW
Two fish friers, each 3 kW	6 kW
Two five-gallon stockpots, each 3 kW	6 kW
One coffee urn	1 kW
One milk urn	1 kW
One hot cupboard	5 kW
Total	33 kW

In the restaurant, fed through the same meter, and depending entirely on electricity for heating there are seven small radiators, each of 1 kW. These are used between the hours of 12 and 2 p.m., and 6 and 9 p.m., and equal 7 kW.

The restaurant provides on the average 80 meals a day, and the total consumption for the December quarter was 5 899 kWh, at 1d. per kWh, or £24 11s. 7d. Electricity is stated by the manager to deal with 75 to 80 per cent. of the cooking, or about 70 per cent. of the cooking and hotplate work combined. Stronger evidence of the efficiency and economy of electric cooking can hardly be expected.

A Cook's Opinion.

Is it any wonder that a cook in one of these flats said to me recently that she had always been in places where they had gas or coal to cook by, but that now she had had experience of what electricity could do she would never again take service where she had to revert to the older methods ?

Progress in Marylebone.

Mr. Selley, the genial mains engineer of the St. Marylebone Council, who is keenly alive to the development of electric cooking and heating, and indefatigable in pushing the advantages, has given me the figures for a number of installations connected to his mains, of which I have selected the following as typical of the particular class of building served.

Restaurant (Medium Sized).

Nine months' cooking consumption	12 059 kWh
Dinners, served, average from	80 to 100 daily
Teas served, approximately	30 daily

Technical Institute (Restaurant attached thereto).

Twelve months' cooking consumption	135 000 kWh
Lunches, daily average	600
Teas and supper, daily average..	1 200

Drapery Establishment (Public Restaurant attached).

Twelve month's cooking consumption	119 000 kWh
Lunches, daily average	1 200
Teas, daily average	1 200

Block of Small Flats occupied by Professional Class on the opposite side of the Road to Clive Court above referred to.

Total number of flats	84
Total number using electricity for all purposes ..	64
Twelve months' consumption of electricity ..	196 408 kWh

The installation at St. John's Wood Court is laid out for about 30 kW of lighting and for over 600 kW for power and heating. The installation at Clive Court is laid out for about 60 kW of lighting and for 1 600 kW of power and heating.

My experience convinces me that when tenants are given equal facilities for the employment of gas or electricity for cooking and heating, electricity will easily take precedence, and I also feel convinced that if supply authorities will see their way to quoting a reasonable figure for securing the heating and cooking load of flats and other large establishments, and assist the owners in making the necessary provision in the way of safe and sufficient wiring a tremendous impetus can be given to this branch of electricity supply.

The Electric Vehicle as an Aid to Trade Promotion.

By RAYMOND J. MITCHELL, M.I.E.E., M I.A.E., A.M.I.Mech.E., etc.

Nature of the Problem.

Trade promotion may be regarded as the exercise of dynamic psychology directed towards supplying a will momentum where the will is either sleeping or at least inhibited from useful action. Such an activity is in its inward nature very subtle, yet essentially thoroughly honest and conducive to *general* welfare—that is, both to the producer (including the seller) and the consumer. There must, of course, exist potential *buyers* for trade promotion to be possible, which is merely another way of saying that goods cannot be *sold* at any real price unless such circulations and exchanges of value are in progress as will ensure a distribution of purchasing power more or less commensurate with the production of goods. Quite obviously there could be no worse obstacle to trade promotion than unemployment on a large scale. The problem is therefore twofold (at least). One must deal with the sleeping will and with whatever reduces the menace of unemployment. Electrical men can do their bit to counter both these evils. Some suggestions are offered whereby the electric accumulator vehicle may be employed as a means tending towards these ends. If our efforts be likened to those of the cord-nibbling mouse in the fable, do not let us despair. That mouse *did* release the lion, and became immortal for his pains.

Co-operative Endeavour Essential.

At this stage the writer is almost ashamed (and very surprised) that many engineers who should be thoroughly acquainted with the case for the electric vehicle yet remain passively inert, blinking at the progress which has taken place, and not in the least conscious of their duty to help matters forward by all and every means in their power. Of course, one knows that the central station engineer is often cursed with interference and obstructive tactics adopted by committees possessed of a mentality akin

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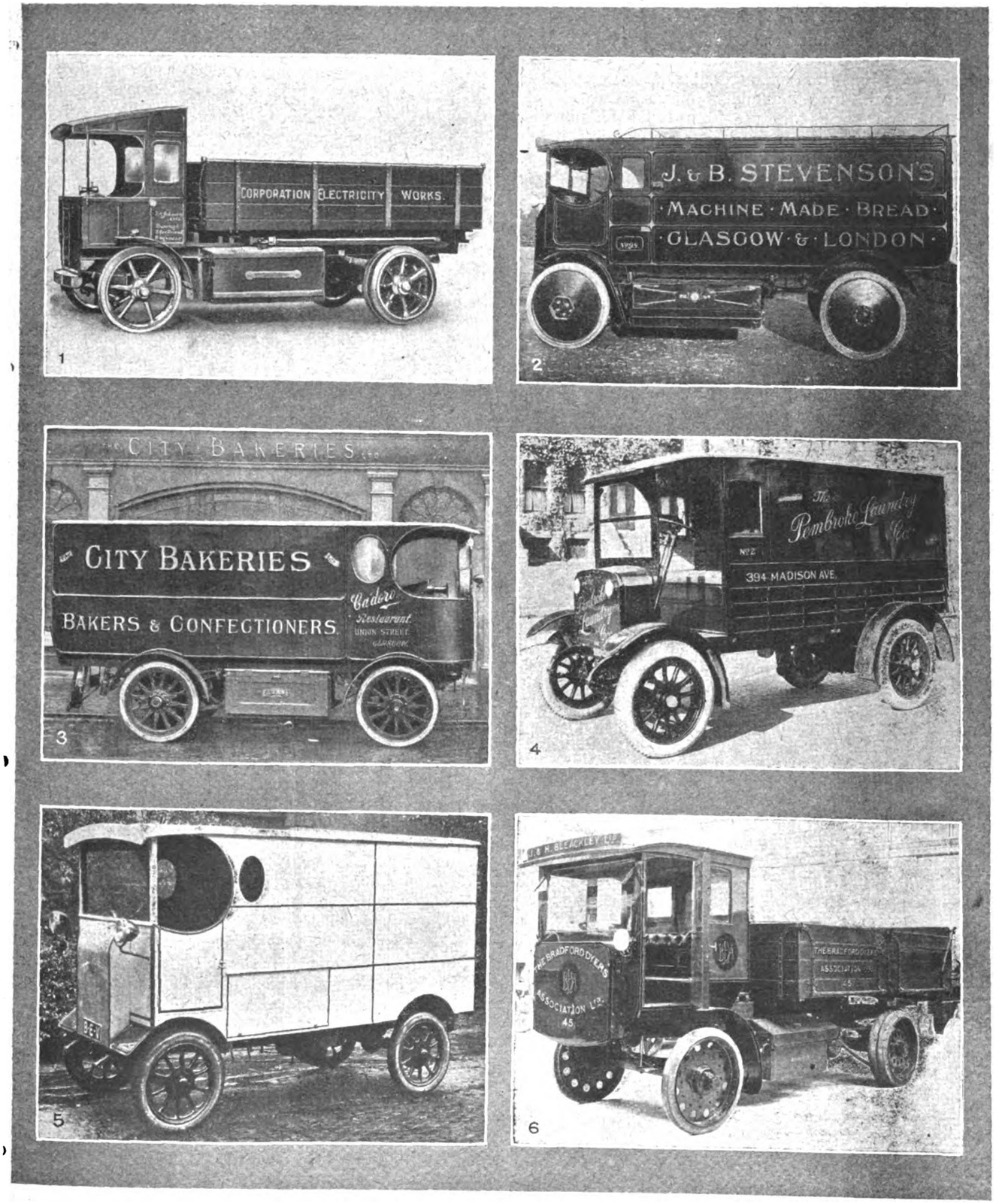

FIG. 1.—"NEWTON DERBY ELECTRIC," FITTED WITH EITHER SIDE STEEL LINED TIPPING BODY—3½ TO 4 TONS.

FIG. 2.—30 CWT. "GARRETT" ELECTRIC, FITTED WITH VAN BODY, SUITABLE FOR TOWN DELIVERY WORK.

FIG. 3.—ELECTROMOBILE VAN, IN USE FOR THE DELIVERY OF HIGH CLASS CONFECTIONERY.

FIG. 4.—SHOWING RECENT AMERICAN DEVELOPMENT. AN EDISON ACCUMULATOR LANSDEN RAPID DELIVERY VAN.

FIG. 5.—LIGHT DELIVERY VAN, MADE BY BRITISH ELECTRIC VEHICLES, LTD., SOUTHPORT. SPEED FROM 15 TO 25 M.P.H., ACCORDING TO LOAD.

FIG. 6.—3½ TON RANSOMES' "ORWELL" ELECTRIC TIPPING WAGON, FITTED WITH TOTALLY ENCLOSED CAB AND WITH BODY HAVING HINGED DETACHABLE SIDES.

to that of a rabbit, such "control" reducing him to a state of mind bordering on melancholia, but if he (the engineer) asserted himself more such ignorant opposition would crumble in time, and with it the reproach concerning lack of enterprise. If it be granted that "electrification is civilisation," and in many ways the truth of the dictum is sufficiently obvious, then it follows naturally that every move in the electrical game which increases the demand for electrical energy must react strongly to the general good.

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A Number of Corollaries.

Now this entails a number of corollaries of an important character. Firstly, since an "electric" is an off-peak current consumer of an important character, it should be encouraged might and main by all available means. One electric van of 1-ton capacity will use from 100 kWh upwards per week, whilst a 5-tonner may easily consume three or four times as much. In other words, the smallest electric is equal to half a dozen houses at least as a revenue producer, and takes 90 per cent. of its demand in the no-load watches of the night, when otherwise the station efficiency would fall to a minimum, and this without a stiver of extra capital outlay to the station. Yet the station engineer does not get excited at such a wonderful load awaiting him for little more than the asking.

What the Engineer Should Do.

As a first move it is urged that every station engineer should buy at least half a dozen of the coloured charging station signs lately issued by the Electric Vehicle Section of the Society of Motor Manufacturers and Traders, 83, Pall Mall, London, S.W.1. Next, the engineer should instruct one of his senior staff to get to know all about electric vehicles, or at least the leading facts concerning their operation, economy, charging, and general maintenance. If it became recognised that the central station staff were keen on battery traction, many users of road transport would ask for their advice, resulting in a steady stream of inquiries to the manufacturers and a gradually increasing business which would be of enormous benefit to all concerned. Such business would benefit the purely electrical industry as regards a preponderating proportion of the components of the vehicles manufactured, in addition to their current-using value afterwards. The purely motor-car side of industry would also share in the benign reactions set free.

Incidentally, it is incumbent on engineers to preach the gospel of British in these days of difficulty. By no stretch of logic or sophistry can the continued importation of foreign electric vehicles be justified unless they be of special types having a use-value so high as to offset the loss to the country entailed by such importation. We cannot have our cake and the halfpenny, which means here that we ought as a solemn duty to make within our own borders everything that can be so made, *even if it appear a little more costly to take such a course.* Unemployed men cost us far more than the dole, even reckoned in £ s. d., and all real leaders of industry now appreciate this. Having considered in outline the entries and expediencies of the case from the maker's and power station engineer's point of view, let us turn to the user and see how he can benefit by using electrics in his efforts towards trade promotion.

Previous Obstacles Conquered.

Next to a certain apathy in purely electrical circles, the greatest drawback to the more extended employment of accumulator electric vehicles has been the rather high price at which such machines have been offered up to the present time, resulting in their being outside the consideration of many firms who otherwise would have been well able to use the type, and greatly assisted thereby. Prices have now come down to more commercial levels, and a sufficient number of vehicles are available at prices which are within the means of a sufficient number of buyers to augment by many hundreds per cent. the total number of electrics in commission throughout the country.

The illustrations accompanying these notes will afford a sufficient index of the enterprise of British engineers in the electric vehicle field and also contradict the erroneous belief that only drapery and light goods delivery services can be dealt with by battery cars. It is becoming well realised by the commercial man that internal town transportation is a field of goods movement all to itself, demanding a special type of machine which shall combine mobility, fuel economy, safety, reasonable speed, and great simplicity of operation, not to mention reduced fire risk and complete absence of smoke and fumes. Only the electric vehicle combines all these desirable attributes in one machine, and this fact explains why engineers have in the face of much discouragement plodded away at this development for so many years. A great measure of merit should also be accorded to the small though financially powerful group of businesses which have assisted the electric vehicle to reach its present status.

Electrics and the Commercial User.

The ordinary business man is apt to be a little nonplussed at the idea of anything electrical, and particularly when that something is a car. Such a man probably uses for himself a petrol automobile, and may be very well informed as to its design, construction, and operation. But electrics are apt to be regarded as rather a mystery and not too reliable, possessing enormously heavy batteries, which need recharging and so on. Explain to this man that matters have entirely changed since the early days, that accumulators are guaranteed as to performance for a definite period of years, that mileage capacity has been abundantly proved to be equal to all requirements, that general reliability is the merest fraction under 100 per cent., whilst total cost of operation (including capitalisation and standing charges) is lower than can be attained by any other means for the service rendered and he will be a more ready listener to the salesman who wants him to try an electric for *his* job.

The Golden Rule.

The golden rule in such exploitations is never to allow any electric to be put into service where the demands are outside the capacity of the machine, either in terms of speed or mileage. Manufacturers should also take steps to "get together" for general advertising purposes, including the broadcasting of booklets dealing with the electric vehicle case generally and for specialised industries such as confectionery, milk, bread, and other foodstuffs. Such booklets could be distributed through Chambers of Commerce, station engineers, and directly by the manufacturers themselves. A careful study of really artistic bodywork will also repay those who so apply themselves, for no other type of vehicle can be made to look more dignified when in service. In addition, the electric scores heavily by possessing the virtues of silence and excellent lighting facilities, thus enabling illuminated signs to be easily applied, so that the vehicle becomes a traffic unit of greatly enhanced interest at night. In fact, as an advertising car pure and simple, the electric cannot be surpassed, and this field has not yet been touched.

Electrics and Domestic Electricity.

Electrics can also be of paramount service in extending the domestic electricity idea, and there can be no excuse for any town of, say, more than 20 000 inhabitants, not having its travelling electric show car, in the body of which are installed such appliances as vacuum cleaners, grillers, toasters, hot plates, and the like in order that the argument may be brought to the very door of the wished-for consumer. Such a practical demonstration would often be irresistible, and the man in charge could cover an enormous area in only two days' work every week. It would touch the householder's imagination. Various slogans could also be used to some effect, such as "It's Electric; It's Modern, You See." To sum up, we still need education, co-operation, persuasion, action. But what an immense field awaits our renewed attack!

New telephone exchanges have been opened at WARRINGTON and ST. ANNE'S-ON-SEA. The latter consists of multiple switchboards and all auxiliary apparatus for the service at the outset of 900 subscribers (ultimate capacity, 2 000) and for the accommodation of the necessary junctions to Blackpool, Lytham, Preston and Manchester. A new underground cable system has been prepared from which 1 450 lines are led into the Exchange, well over 100 per cent. increase on the existing service.

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The Position of the Electrical Contractor.

By H. MARRYAT, M.I.E.E., M.I.Mech.E.

The position of the electrical contractor is improving every day and in every way, but progress is still comparatively slow, and left alone to fight his own battles, or his Association to fight them for him, it will be a long while before he is able to support the other branches of the industry in the way he wishes.

When the Electrical Contractors' Association came into being some twenty odd years ago the contractor was on the direct road to extinction—pushed out of business by municipal and manufacturers' activities. For the first ten years of its existence it could do little more than stay the decline, since then it has been building. In the past the contractor has had good cause to complain very bitterly of his lot, for, whilst his business was the most easy to enter, it was the most difficult in which to make progress, and it afforded no opportunity for accumulating the capital necessary to undertake a progressive policy.

Things Changing for the Better.

Things are now changing, and, if the capital which can be accumulated in this section of the industry is still extremely small, the effect is cumulative and will finally secure for the contractor the position he desires. It is the manufacturer who is now complaining that the contractor is unable properly to push his wares. The bulk of the produce of the manufacturer is still distributed direct or through the wholesaler to the user, and only a portion—an increasing portion to be sure—passes through the hands of the contractor or retailer. Manufacturers are beginning to find that this is an extremely expensive method of distribution; many travellers and agents of rival firms cover the same ground in their efforts to secure comparatively small orders direct from the user. A really substantial well capitalised retail section of the industry is what is needed to short circuit this expense: A body of men throughout the country whose business is in direct touch with all users—who have the means to display and demonstrate the goods; and who—with or without the support of the local supply authorities—are in a position to conduct aggressive local campaigns to popularise the latest designs and methods!

What the Contractors Are Doing.

It has been my great pleasure during the past few months to visit electrical contractors in many parts of the country. I have seen their showrooms—their business equipment—and their methods of publicity. I have heard their hopes and aspirations, and listened to their difficulties, and as a result of this I am more than ever convinced that these are the men who are best situated and equipped to deal direct with the user, and that their employment upon a large scale for this purpose would result in a great economy in the cost of distribution and a general reduction in retail prices.

What the Manufacturer Thinks.

The manufacturer is inclined to think that the contractor is a half-hearted individual entirely lacking in enterprise, initiative and push; who is inclined to recommend his client to cheap and ineffective methods, and slow to take up anything that is new and up-to-date. A man not to be trusted with the exploitation of new ideas to the public! I find, exactly the opposite to be the case. No doubt the manufacturer is justified in his conclusion, but he has not correctly diagnosed the cause. The contractor—generally speaking—is a very hard-working individual with a sound commercial instinct. As compared, for instance, with the average supply engineer, he is miles ahead in his knowledge of ways and means of developing the use of electricity. He is also quite clear in his mind upon the fact that to introduce a new article or a new idea a great deal of money must be spent upon display, demonstration, and advertisement, and he is naturally slow to enter upon any such campaign if the return of his expenses is not reasonably secure. So long, therefore, as the manufacturer makes it possible for the great bulk of users to purchase at trade prices, leaving the contractor only a fractional, if any, margin of profit, enterprise on the retail side of the trade cannot be expected.

How the Manufacturer Can Help.

There are manufacturers who fully appreciate the principles involved and who support the contractor in the best possible fashion; many others see the position clearly but do not feel able to move individually. They are no doubt right. The retail trade cannot be put upon a proper footing by the efforts of individual manufacturers, unless these should be the two or three leading houses whose example would be quickly followed by others. The real solution of the difficulty is, for manufacturers to get together and to agree to the reservation of a sufficient margin to cover the expenses and profit of the retailer, and, excluding certain heavy plant, to deal with the user only through him.

Let there be no misunderstanding. I do not suggest that trade discounts to the contractor should be larger than at present—in many cases they might well be smaller—but that they should be made secure.

It would not be politic to put such a scheme in hand at one time to cover all classes of electrical goods, that would be too big a mouthful for the electrical retailer to swallow at one gulp. It would be better to commence with a few convenient lines suitable to the present organisation of the retail trade, and to follow a consistent policy of extension as results justify that course. A first step in the direction indicated has already been taken by the lamp manufacturers, with results which are eminently satisfactory, but much more could be done in this direction, inasmuch as a great proportion of the general public is still able to purchase its lamps in one way or another at trade prices, so leaving to the retailer a margin which is insufficient to enable him to build up capital.

A Regrettable Action.

It is, perhaps, regrettable that the B.E.A.M.A. should have instructed its members not to sign any of the very reasonable "fair trading" clauses advanced by the Contractors' Association, especially as so many members of the B.E.A.M.A. express their entire approval of these clauses. No doubt the action was taken with a view to the making of some agreement with the contractors on trading policy, and if this be so, now would be an excellent time to get such an agreement under way, and so advance the labours of the E.C.A. by many years. That such an agreement does not exist is in no measure the fault of the contractors, who have for many years fully appreciated the importance such an understanding would bear to the prosperity of the industry in its wider sense.

In the meantime, the policy of the Electrical Contractors Association, and generally of its individual members, is to take all measures possible to build up the capital available in the trade, to open showrooms, to demonstrate and to advertise; to support the E.D.A. and to co-operate with electricity supply in any scheme for the furtherance of electrical development.

Alloys Resistance to Corrosion.

A symposium and general discussion on the subject of the RESISTANCE of ALLOYS to corrosion will be held at the Department of Applied Science, Sheffield University, on April 13th. The meeting is being organised jointly by the Faraday Society, the Sheffield Section of the Institute of Metals and the Manchester Metallurgical Society. The scope of the discussion will include the new non-corrodible non-ferrous alloys such as stainless nickel silver and the nickel chromium alloys as well as stainless iron and steel.

A general introduction to the discussion will be given by Prof. C. H. Desch, and numerous contributions of interest are expected. Further particulars may be obtained from Mr. G. R. Bolsover, Brown-Firth Research Laboratory, Princess Street, Sheffield, or from the Faraday Society, 10, Essex Street, Strand, London, W.C.2.

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Electricity and the Domestic Hot Water Problem.

By C. ORME BASTIAN., M.I.E.E.

Since writing on this subject two years ago, a sort of underground progress has been made, which is considerable, though not yet productive of any results which are very apparent on the surface. There is an upper crust of prejudice to break through, which even casual observers can see is yielding here and there. As in all such cases (where legitimate progress is hindered by prejudice) there will presently be an upheaval and revulsion of ideas in favour of the truth.

The general attitude to-day as regards water heating by electricity is comparable in many ways with the attitude encountered some thirty years ago by the small band of advocates of separate electrically driven tools, as against collective driving by means of shafting and belts from one prime mover.

It took years and years to convince even our own fraternity that so much power was wasted in driving the shafting that it would pay to scrap the big prime mover, scrap the shafting and belts, and replace these with electric motors at each tool or machine. To-day the economy and advantage of the method are accepted as self-evident facts, but the fact is only beginning to be recognised that the domestic hot water problem is capable of being solved on exactly parallel lines.

A Scrapping Policy Essential.

Scrap the kitchen fire, gas circulator and coke boiler, scrap the hot water pipes throughout the house, and replace these with electric water heaters at each point where hot water is required, or at any rate every floor.

Each water heater for kitchen quarters, bathrooms or the nursery floor should be of the thermal storage type and of sufficient heating capacity to cope with normal daily needs. They must each be fitted with an extra heating element to provide for reasonable emergency requirements, and the fact must be realised that some limitation as to quantity of hot water is unavoidable, just as with any other water heating system employed.

The Bath Problem.

There is no reason why the necessary limitation in the capacity of thermal storage heaters should fall short of real requirements, and it must be remembered that even with a full size gas geyser it is not possible to get more than two comfortable baths in one hour. With the 600 W electric bath water heater, for which the writer's firm is responsible, two luxurious baths can be taken in much less than one hour, because the bath can be filled from the storage tank in much less time than with the gas geyser. Two baths in the morning, and two baths at night is what the writer would fix as the extreme *maximum* demand for any single bathroom in a well arranged house. The *normal* daily demand may be taken as two baths. This would entail a normal daily consumption of 7·2 kWh for two baths, and 14·4 kWh on those days during which the two extra baths are required. An average of 3½d. per bath at 1d. per kWh, is a cost that is easily within the means of the fairly well-to-do, and those who are not so well provided for, take small sponge baths or do not take daily baths, and whenever necessary pay 6d. or 1s. at the public baths.

This question of baths is dwelt on because it is the bludgeon that is always swung by those who would have us believe that the great bulk of the community spend a great deal of their time in steaming hot baths. Such arguments can be made to sound quite final and convincing until critically examined, and revealed as profoundly untrue.

Gas Economy and Mixed Bathing.

The same people accept such statements as appear from time to time in the Gas Press to the effect that four or five baths can be had for a penny, without taking the trouble to ascertain that this economical result is only arrived at by means of mixed bathing. The truth is that a bath from a one year old gas circulator costs just about the same as an electrically heated bath, at 10d. per therm and 1d. per kWh respectively. Fur reduces the efficiency of a gas circulator or geyser, whereas in a properly designed thermal storage water heater, it only acts as additional heat insulation and somewhat increases the efficiency.

The forthcoming large scale experiment at Poplar, which is due to the enterprising initiative of Mr. Horace Bowden, will determine once and for all the relative cost of bath water heating by gas and electricity respectively, and the data that will become available as the result of this important experiment, cannot fail to prove of enormous utility in formulating statements and arguments that will be convincing, not only to engineers who are at present disbelievers, but also to the lay minded public.

Imitation Flattery but not Efficiency.

For years and years manufacturers and inventors have slavishly striven to imitate the apparatus that was specially designed for heating water by gas. All these attempts have definitely and finally failed. They always must fail because the electrical equivalent of a gas geyser has to be from 12 to 15 kW capacity, and there is no market for such an apparatus even though it could be guaranteed to work for ten years without trouble. The serious increase in the cost of the service line, meter, main switch and fuse and heavy leads to bathroom, are alone factors which will always make the general adoption of such a geyser a sheer impossibility. It can be freely admitted that such an apparatus would be Utopian from the viewpoint of the person in the bath, but the designer must also consider what are the prospects of a large sale, and how will the use of the apparatus affect the supply authorities' load curve. Both considerations must lead to an emphatic veto.

Ideas Changing for the Better.

Ideas are at length changing, and so far the manufacturers of water heaters have led the new thermal storage fashion without very much assistance or encouragement from the supply side of the industry. The cheap "off peak rate" which was first suggested here two years ago, is now about to receive a fair trial, and doubtless other authorities will soon follow the lead given by Mr. Bowden at Poplar. Water heating by thermal storage will then be possible on a large scale, and, properly developed, a system of large thermal storage tanks supplying hot water to blocks of dwellings or flats will remove the disability from which the electric industry suffers, owing to the fact that electricity can be stored only on a relatively small scale. These storage tanks of heat energy will improve the load factor just as much as a large electric accumulator could improve the load factor, with this added advantage, that the accumulation of energy will be at the consumers' end of the mains, and in the long run this means less buried copper.

It is very arguable as to whether electric fires and ovens improve the load factor or the reverse. The diversity factor is very different in different districts, and a cheap rate for electric fires may not always be a paying proposition to the supply authority. Hot water is wanted like bread, day in and day out all the year round. When all domestic hot water is provided electrically a cheap enough flat rate will be possible for all purposes, and the necessity for complicated tariffs, that few of the public ever understand, will have vanished.

Hot Water and the "All-Electric" House.

We commend Mr. Bastian's article to all those who propose entering for our second competition. Full conditions about this competition will appear in our next issue, and it will be seen that we are asking our readers to solve a very interesting and important problem. This will require ingenuity and technical knowledge, but we have no doubt a satisfactory solution will be arrived at.

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Broadcasting as an Aid to Trade Promotion.

By Sir WM. NOBLE.

There could be no more opportune moment than the present for the launching of wireless broadcasting. The electrical and allied trades have undergone a period of severe depression, and eyes have been turned in vain to find some source which would add stimulus to the industry. The wanted aid has been, we believe, provided by the introduction of broadcasting. It was evident in the early autumn of last year that an unprecedented boom in wireless was inevitable. That manufacturers of electrical apparatus were quickly alive to this is proved by the fact that less than a year ago makers of wireless receiving sets were few in number—probably not exceeding twenty. These firms supplied the requirements of a comparatively small band of wireless enthusiasts. Now already over 300 firms have applied for membership of the British Broadcasting Co., which is open only to *bona fide* British manufacturers of wireless apparatus. A year ago the number of wireless licences for reception was some two to three thousand; to-day the number exceeds 80 000 and is increasing by several thousands every week. Even if the present rate of increase does not continue, it is not unlikely that in the near future the number of "listeners-in" to the broadcasting programmes will have reached 200 000. This all means a huge business for the manufacturers.

A New Industry Created.

Broadcasting has created what is practically a new industry and it takes but little thought to see that such an event acts and reacts upon many other industries, for almost all are inter-dependent.

The daily production of thousands of receiving sets involves the use of large quantities of raw materials covering a very wide range. Timber, sheet metal, wire drawing, and the metal trades generally have suddenly been called upon to increase their output. In addition to this, there are such articles as accumulators, dry batteries, valves and the like, all finished products to the trades engaged in their manufacture, but only components in the instruments used for wireless reception. Such trades have received demands which their existing organisations were quite incapable of filling. These have in turn necessitated extension to existing factories so that urgent requirements may be met. Such extensions, and in some cases new factories, mean much additional machinery and tools. Besides the furnishing of new equipment at the outset, there will be a large and continuous demand for components for replacements and additions; for the erection of aerials and for the re-charging of accumulators.

Additional Work for Electrical Men.

The foregoing should suffice to prove that this new industry provides much additional work for the electrical and allied trades, and it is doing much to reduce unemployment in the trades concerned.

In this connection a practical illustration will be of interest as confirming these statements. At the works of one of the manufacturers, the additional number of staff and workpeople engaged as the result of the development of wireless exceeds 900. This includes engineers, draughtsmen, toolmakers, supervisors and test officers, besides other non-manipulative staff. There has been a very large percentage increase in orders for various classes of timber, magnet steel, iron and steel, copper wire and sheet, brass rod and tubes, German silver, aluminium, silk, cottons, manilla paper, solder, and many other items, whilst there has been a great increase in the output of ebonite sheet and rod. So great has been the general demand for these materials that few, if any, of the contractors are in a position to make prompt deliveries. The manufacturers of dry cells and accumulators are in a like position, and are unable to keep pace with the demands. The orders for aerial equipment—poles, wire, insulators, etc.—are also heavy.

With over 300 firms engaged in this industry, the additional staff and workpeople engaged must run into big figures. The firms employed on woodwork alone must have largely increased their workers, as every set requires one or more high grade wood cases.

What are the Retailers Doing?

The manufacturers have seized their opportunity; what about the retailers and contracting branches of the electrical industry? To them a veritable Alladin's cave has been opened.

In many cases, however, instead of finding the overstocked slump-ridden contractor bounding forward with outstretched arms to take advantage of the profit and prestige to be gained by the greatest trade boom in one well-defined class of article ever experienced, we find him looking askance whilst the go-ahead universal store, draper, chemist, music shop and the like, enjoy the prosperity which, but for his own want of initiative and enterprise, would be his.

The Position Analysed.

Let us endeavour to analyse this surprising state of affairs. Why should the electrical contractor allow himself to be displaced or over-reached by others not hitherto in the business? In a considerable number of cases where contractors have offices, stock rooms and warehouses, but no main street windows, there is probably a feeling that this latest development is not for them. They overlook the drawing power, however, of this new and seemingly miraculous innovation. An advertisement or a notice in office window or the door that a wireless demonstration will be given, will suffice to fill his showroom nightly, or occasionally as desired, with an eager and interested public—all potential customers, not only for wireless material, but also for many other supplies which he sells as well. Nothing succeeds like success. These crowded showrooms would result in a return in sales which would bring back the prosperity of 1920 and the wheels of business would once more get into prosperous motion. Valuable time has been lost, but it is not yet too late for the ground to be recovered. But enterprise and push are essential.

The Road to Increased Turnover.

There is another sure road to increased turnover. So great, so keen, and so almost universal, is the interest in wireless at the present moment that in the supply and erection of aerials alone there is a big business for the wide-awake contractor. There is also a profitable source of income from the sale of component parts, valves, batteries, and the re-charging of accumulators.

It is impossible to forecast the probable extension of wireless broadcasting, but if the Broadcasting Co. develops its present line of action by giving the public grand opera, popular, scientific and other interesting lectures, speeches by eminent men, and high grade vocal and instrumental music, receiving sets will find their way not only into the homes of residents in cities, but of those in villages and in remote hamlets, as well as places of public entertainment, hotels, clubs and hospitals. There is therefore a big field not only for the manufacturers, but for the contractors and retailers of electrical apparatus. The manufacturers have risen to the occasion; let the contractors and retailers do the same.

The BRITISH EMPIRE EXHIBITION authorities advise intending exhibitors to make their applications for space in the Industrial Hall before April 30th. The necessity for allotting space so many months ahead of the opening date arises from the fact that as there are so many sections it is impossible to lay out the exhibition space until the requirements of each section are known.

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Co-operation Between the Architect and the Electrical Engineer.*

At the joint meeting of the Institution of Electrical Engineers and the Royal Institute of British Architects, on March 15th, two papers on "Co-operation between the Architect and the Electrical Engineer" were read by Mr. Francis Hooper, F.R.I.B.A., and Mr. J. W. Beauchamp respectively.

Electricity's Manifold Applications.

Mr. HOOPER, in his introductory remarks, drew attention to the manifold applications of electricity to-day—for lighting, in ventilation by exhaust or supply fans, in acoustics by means of wireless and telephone communication, as an aid to advertising, and in many other fields. He confined himself to (1) lighting (diffused and concentrated), (2) heating and cooking, and (3) ventilation and sound. Both forms of lighting had many applications. The manner in which electric lamps could now be fixed in special positions, the ease with which they could be controlled, and the fact that electric light was unimpaired by wind, rain, or absence of oxygen were notable features. There was, however, one point that still needed careful attention—the danger of glare, which affected comfort and economy, and was apt to be prejudicial to the popularity of electric lighting. This problem was not met with in the illuminants of the past. Delightful was the small lamp or candle in the club, reading room, choir, drawing room, etc., each fitted carefully suited to its purpose. To-day, too often, excessive candlepower dazzled and irritated the eye and brain alike, and some advertising agents had made vulgar some of our important streets and open places. Upon this point the public needed education.

Street Lighting and the Architect.

In street lighting the use of elevated central lamps had permitted the removal of standards which, in crowded thoroughfares, reduced the capacity of footways. In shop-lighting the concealment of lamps behind screens had added much to the attractiveness of illuminated windows. Much improvement in façade lighting was possible. Diffused and concealed lighting from a distance might be distinctive and dignified, whereas the outlining of windows and cornices by lamps wholly destroyed the architect's work. In internal lighting concentration was often of importance, but delightful effects might be produced by the aid of hidden sources. The lighting of pictures and sculpture was too often overlooked and forgotten, and the same applied to costly memorials erected since the war, which, after dark, were lost sight of and their purpose nullified. Public and private gardens might also be turned to good account by artificial lighting.

Heating and Cooking.

Heating includes electric radiators, fires, and cooking appliances, which were now beyond the experimental stage, and presented opportunities to the architect where electrical energy could be obtained economically. The architect and the engineer should, however, realise that such appliances do not provide automatically for the essential changes of air in the apartment in which they are used, as is the case with the coal fire with its chimney, and careful provision must be made for efficient substitutes.

Ventilation and Sound.

Exhaust and intake fans for promoting ventilation were of the greatest importance to the architect, enabling him to provide the movement and renovation of air and means of remote control, thus making it possible to meet and overcome variations of temperature or fluctuations in the number of occupants of an enclosed space. This had already served to permit the use of many buildings for purposes quite impossible in their absence.

Mines, Telephony, etc.

Such matters as the lighting and ventilation of mines and the development of telephony and wireless communication were outside our range on this occasion, but the connection between ventilation and the study of sound may be less remote than was commonly supposed; for acoustic defects were reported to have been overcome by improved ventilation of buildings.

The health and well-being of the community were much affected by our respective occupations and interests.

Mr. Beauchamp on the Relation between the Professions.

Mr. J. W. BEAUCHAMP'S paper referred mainly to the relations between the two professions, and to recent developments of interest to architects. Both professions, he said, must have in view the needs of the ultimate user of the structure dealt with. The application of electricity involved the services of the supplier of electrical energy, the maker of electrical apparatus, and the contractor. Important assistance was also rendered by the architect, the consulting engineer, and other designers or advisers. In many respects the modern architect was up-to-date in electrical matters, but in the case of an industry which progressed at such a rapid rate as electrical engineering, the leaders of other industries and professions, such as the architect, the ventilating engineer, and all whose business involved handling of material or transport should invite assistance and advice from experts. It was equally necessary for electrical engineers to have some knowledge of the processes to which electricity was applied. In the past the use of electricity was regarded as a mystery, but electrical engineers now knew precisely what they could do with their appliances under various conditions. It had sometimes been found that architects were inclined to veto methods which they regarded as experimental, but which had really been accredited by experience.

Educational Propaganda.

The electrical profession desired that everyone outside it should get some practical working knowledge of electricity, its applications, and the economics underlying its use. Much propaganda work in this direction was being done, and in 1924 the representative display of electrical apparatus at Wembley should prove beneficial. Electricity was sometimes reproached on the ground of waste of fuel. But the relatively low efficiency of generation was offset by the extremely high return which the consumers obtained from appliances. There were other factors which contributed substantially to the economic value of electrical methods, notably the elimination of labour and dirt which they made possible.

Consideration of the relative cost of electricity and other gas and fuel was too large a subject for treatment. It was commonly contended that gas at 10d. a therm was equivalent to electricity at 0·5d. per kWh. Nevertheless, many preferred electricity to gas at rates up to 8d. to 10d. per kWh for lighting, 3d. to 4d. for small heating and power appliances, and 1d. and 1½d. for general cookery and fires. Hence the heat content was in itself no sufficient measure of services rendered. In this connection Mr. Beauchamp presented the following table:—

	Coal Per cent.	Gas Per cent.	Electricity Per cent.
Potential heat value ..	100	100	100
Effective heat value (fires) ..	10 to 25	40 to 60	100
Effective cookery value—			
Ovens	5 ,, 10	20 ,, 40	65 ,, 70
Boiling plates	?	30 ,, 40	50 ,, 60
Kettles	?	—	80 ,, 90

Electricity Worth More.

Users would pay more for electrical energy than for any of the competing services. But how much depended on many variables, such as the wealth of the consumer, his views on comfort and cleanliness, etc. In some processes of industry the cost of power was so large a percentage of the total cost of production that closely competitive rates must be secured. In others it was so small that the cost per kWh was of minor importance. Similar differences occurred in regard to domestic applications of electricity. Broadly, the best prospects lay with the middle classes, where a careful combination of electric heating with other systems was often advantageous. Generally speaking, electric lighting gave satisfaction at figures up to 10d. or 1s. per kWh, as compared with gas at 4s. to 5s. per 1 000 cub. ft. In a middle-class home, inhabited by five or six persons, the pre-war value of the house being £35 to £70 per annum, lighting consumption might reach 200 to 300 kWh in the year. This at 7d. per kWh worked out at roughly £7 per annum. Regular cookery on an electric range

* Abstract of papers read before the joint meeting of the Institution of Electrical Engineers and the Royal Institute of British Architects, on March 15th.

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involved a consumption of about 1 kWh per head per day, say, 1 750 kWh per year at 1½d. per kWh, or about £9 per annum.

Tariff Questions.

In the next section of his paper Mr. Beauchamp referred to the factors determining the charge per kWh. The variable rates in different districts must seem confusing and inexplicable to the architect. The same applied to methods of charging, which had been very fully examined and discussed by electrical engineers during recent years.

Lighting Progress.

Mr. BEAUCHAMP then turned to the question of lighting. Out of the work of the electric lamp maker had arisen the modern science of illuminating engineering. Architects had assisted in the work of the Illuminating Engineering Society, and were acquainted with the researches made by that body into the lighting of schools, public buildings, cinemas, etc., all of great value, leading to economy, protection of eyesight, and a better public understanding of good lighting. There was room for the closest collaboration between the architect, the electrical contractor, and the illuminating expert. The help of the architect was the more welcome, as in this work we had so often to make some compromise between scientific perfection and the taste and desire of the client, who must, as a buyer, be guided rather than forced towards better methods.

Misunderstandings.

Occasionally instances of misconception and misunderstanding of scientific data were formed. The recent references to the effect of the electric lamp on eyesight were a case in point. The industry produced lamps of all kinds, suited to different purposes, but it could not always control those who used them or put them up. Correct height, spacing, and shading of lamps removed all trouble, and resulted in effective illumination which preserved the eyesight under the severe strain put upon it by close work and long hours of artificial lighting, characteristic of modern life. It might be stated quite definitely that there was nothing to fear from ultra-violet, X, or other non-luminous rays in the case of incandescent lamps.

Getting Rid of Monotony.

The relatively low cost of modern electric lighting made it possible to introduce decorative features of value. Indirect lighting was apt to suffer from a certain monotony. Decorative wall brackets and ornamental fittings with small lamps could be employed to correct this tendency. Proper contrast between lighting of desks and surroundings aided mental concentration. The growing use of flood-lighting should also be of interest to the architect. In the lighting of churches his co-operation was badly needed. The standard of lighting in many places of worship was too low for reading. Lately there had been a tendency to introduce a little dramatic element by the use of concealed lights to reveal the features of the building and focus the attention of the congregation. In this connection some suggestions on the lighting of churches by Mr. H. J. Cash were quoted. Absence of glare was an important feature.

The Most Perfect Method of Warming.

The growing use of heating was still little realised in many quarters. Electricity offered the most perfect method of warming the air, heating solids and liquids, and cooking food. New methods might enable heat to be stored in the form of heated water, the energy being used at periods of the day when it was cheapest. Here, again, the flexibility of electricity and the ease with which it could be brought to bear at any desired point were important features. The general user had still no clear notions of quantity of heat, but only of difference in temperature. Electric heating had the merit that it enabled people to exercise economy without the exercise of thought that was so irksome when it governed the daily routine. There had been much discussion on the merits of electricity, fuel, and gas for heating. It was often contended that electricity was out of it "because of the large amount of heat lost at the power station. But, as had been pointed out, this was offset by economies in the application of electricity, notably the ease with which it could be turned on or shut off at will. Much attention had been given to the use of waste heat at generating stations, for example, for the supply of hot water in congested. It was possible that ultimately we may devise better methods of using the cheap and inferior carrier of heat energy for heavy heating work, and the more expensive but far more controllable carrier, electricity, for "finishing off" processes.

Little Competition for Power.

In the supply of power the electrical engineer meets with but little competition, at least, until large powers and long hours were concerned. The architect was most interested in the use of power on a small scale for lifts, central vacuum cleaning plants, ventilation, etc., but the small motor had also many uses, which were continually extending. When electricity supply conditions permitted the regular electrical cooking of food this became one of the most convenient methods. In converting old and large houses into flats its advantages became evident. The choice of the method of cooking in canteens, hotels, and restaurants was likewise of great interest to the architect. As in the home electric heating gave greater freedom in design and often saves space and labour. Some large hotels which had installed their own electric generating plant depended on a combination of electricity and fuel for all requirements. The tendency was for such organisations to become more and more self-supporting in such matters, having their own laundry, sewing rooms, and repair shops, etc., like little towns under one roof. The difficulty of storage of electricity could be partially overcome by storing energy in the form of heat, especially in connection with the heating of water. Already much progress had been made in such methods in countries where coal was scarce and water power abundant, and even in this country the heating up of storage tanks during the day, with the ensuing facilities for obtaining hot water for bathrooms, lavatories, etc., are of interest.

Country House Applications.

In country houses electricity has hitherto been used mainly for lighting, but even here new uses were developing, and in installing plant a fair margin for future increase in energy used should be allowed. In cases where there was a home farm, a few spare horse power might prove valuable for many purposes. Architects were hardly sufficiently familiar with the advantages of electric lifts, which were apt to be placed in some out of the way ill-lighted part, while a capacious main staircase was provided. Where buildings were erected for utilitarian purposes rather than for ornament the lift should receive more attention.

The question of providing adequate mains and outlets for electricity when a building was designed was a most important one. Ducts or openings through all walls leading from room to passage or room to stairs might with advantage be provided. In certain flats now to be built it was proposed to sink massive copper bars in chases throughout the building, so that each flat could tap off and obtain an adequate supply of electricity for lighting, heating, and cooking. Many small appliances were sold for working from a lamp holder, but the method was not ideal. The real solution was to provide ample plug-outlets in each room. Naturally, in all applications of electricity a high standard of workmanship was important, and the Electrical Contractors' Association was now devoting special attention to the training of workers, apprenticeship, and registration.

In conclusion, Mr. Beauchamp suggested the formation of a permanent *liaison* between architects and electrical engineers through the medium of a joint committee, drawn from the councils of the various associations concerned. Out of such a committee might arise some method of instructing architectural students in electrical matters.

Books Received.

"Colour and Methods of Colour Reproduction." By L. C. Martin and W. Gamble. (London: Blackie and Son). Pp. ix+187. 12s. 6d. net.

"The Generation and Utilisation of Cold. A General Discussion held by the Faraday Society." (London: The Faraday Society). 10s. 6d. net.

"Socialism: Its Fallacies and Dangers." Edited by Frank Millar. Fifth Edition. (London: Watts and Co., Johnson's Court, Fleet Street). Pp. 80. 1s. net.

"The Practical Electrician's Pocket Book, 1923." (London: S. Rentell and Co.). Pp. xci.+571. 3s. net.

"Atoms." By Jean Perrin. Second English Edition. (London: Constable and Co.). Pp. xiv+231. 8s. 6d. net.

"The Prevention of Vibration and Noise." By Alec. B. Eason, M.A. (London: Henry Frowde and Hodder and Stoughton). Pp. xii+163. 15s. net.

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Advertising in the Technical Press—The Appropriation.

By HUGH M. GOODY.

Although the days when advertising was considered a gamble are fast drawing to a close, that impression still lingers in engineering circles, and lingers the longer because the more advertising is treated as a gamble the more does it become one. It is probably not far from the truth to say that the average engineer approaches, for example, the settlement of his advertising appropriation in the true gambling spirit. Much in the same way that the amount of his bet is decided not merely by the "chances" but by custom, his sense of dignity, his momentary humour, and a hundred similar considerations, so these factors enter largely into the decision as to advertising expenditure. Messrs. Smith, his competitors, are spending so much; the dignity of his firm demands that he shall spend a little more. Or perhaps he regards advertising as a necessary evil on which it has always been the firm's custom to spend a certain minimum. Or he feels it his duty to support the trade papers (as if the trade papers wanted his support except as a business proposition). Thus, a dozen arbitrary factors decide the first step in advertising and probably mar the campaign at the start.

Intelligent Consideration Necessary.

Now I do not pretend that the advertising appropriation can be determined in a mathematically exact fashion, but it is undoubtedly true that an intelligent consideration of any individual case will show that the figure lies between fairly definite limits.

Like any other expense the advertising appropriation is considered most easily as a percentage of sales. The actual percentage, being based upon the relation of the manufacturing cost to the margin of profit, will vary widely with the class of business. For example, in the case of a luxury article where sales are likely to be based less on reason than emotion, the margin of profit is likely to be high and the advertising appropriation will be correspondingly high. In other cases both the margin of profit and the advertising appropriation are likely to be lower. Probably 5 per cent. may be regarded as the maximum percentage of sales which the average engineering commodity will stand as an expenditure upon publicity and kindred activities. On the other hand, from 1·5 to 2 per cent. may be considered as the smallest percentage which is normally justified.

In choosing a figure between these limits, several factors have to be borne in mind. For example, the ratio of manufacturing to selling cost will vary widely as between one engineering commodity and another. Consideration of this point will help to indicate the position between maximum and minimum which might be considered suitable for any particular business. On the high side, financial considerations may dictate a maximum lower than that suggested above; whatever you may consider justifiable in theory, in practice you may find it desirable to fix a lower limit.

Press Advertising and Catalogues.

Similarly on the low side, certain factors peculiar to your business will possibly suggest a minimum higher than that given. The percentage decided upon will require to be divided between "press advertising" on the one hand and catalogues, circularising, etc., on the other. Now in both these directions a low limit will become opponent. For example, certain catalogues and price lists will probably be regarded as essential whatever may be decided regarding folders, circular letters, etc. The minimum expenditure upon press advertising will require a little calculation. Make a careful list of trades which you consider it essential to cover—electrical, general engineering, mining, shipbuilding, etc. Mark opposite the trades the most influential journal in each. Decide the minimum space (i.e., whole, half, or quarter page) which you think you can usefully employ, having regard to the class of business you are doing, the necessity or otherwise for illustrations, etc. Calculate the cost of taking this minimum space fortnightly in the case of weekly journals or monthly in the case of monthly journals. The total of these amounts will give you a figure below which it would probably be impossible to run any effective advertising campaign. If this figure be added to the cost of the absolutely essential catalogues, etc., the result will possibly indicate a minimum appropriation higher than the percentage suggested.

Plan for Extension.

Having thus narrowed the limits, it remains to chose a figure within them. This is a matter which cannot be generalised upon. It is, however, true of most engineering enterprises that it is better to plan an advertising campaign which can be extended later rather than one which circumstances might possibly cause to be curtailed. Press advertising, in particular, is very much a matter of overcoming inertia on the part of the buying public. If a medium be employed for a short period and then dropped because the advertising appropriation has been cut down, then much of the expenditure is wasted. It is therefore better to err on the low side, as long as the appropriation is large enough to cover the ground properly. There are exceptions to this rule, but it applies to the majority of engineering undertakings.

Assuming now that a figure has been fixed on the basis of the foregoing remarks, it is necessary to consider how it should vary from year to year. The most obvious course is to translate the appropriation into a percentage of turnover and to keep the percentage constant, so that the appropriation increases in direct proportion to the sales. There are very excellent reasons for following this plan. In times of good trade the amount of advertising necessary to produce a given volume of sales will be low. To this extent your advertising is more effective at a less cost than at other times. Since your return will then be proportionately greater, your investment in advertising may wisely be extended.

Advertising and Turnover.

There is, however, another view of the matter, which applies with some force in certain instances. Let us take the case of a manufacturer with a plant, the capacity of which can neither be increased nor (economically) decreased with any speed. In such a case production is obviously the most efficient (and the margin of profit greatest) when the plant is producing exactly at its maximum level. That being the case it is arguable that the advertising appropriation should be designed to ensure a steady turnover and should be greatest when the sales are lowest. Obviously in times of trade depression the sales would be effected at a greater cost, but then they would be more valuable at such times, in keeping the efficiency of production at a proper level. The logical outcome of this argument is that the appropriation should vary in inverse proportion to the turnover. No business, however, can stand completely still, so that the inverse ratio should be modified to give a gradual increase in turnover. Provided such an increase is not spasmodic it can usually be catered for economically.

Advertising in Slumps and Booms.

Now, in no business will either of these views be completely true to the exclusion of the other. In any particular enterprise both are likely to be tenable to a greater or less degree, one or other dominating according to the characteristics of the particular business. The first view represents the more general opinion, and it is probably safer to lean in that direction than the other. It should, however, at least be modified in consonance with the alternative theory, somewhat in the following fashion. In "piping" times, while increasing your appropriation do not increase to the full extent of the agreed percentage but carry the balance to an advertising reserve. Then, when trade is poor it will be possible to spend rather more than the proportion decided upon in an attempt to mitigate the effects of the depression. Incidentally, such a plan will help to avoid in bad times any too great reduction in advertising, which would be undesirable for the reasons mentioned earlier.

Suggestions Summarised.

At the risk of belabouring the point I will summarise what are perhaps the rather obvious suggestions contained in this article. Consider your appropriation in relation to (1) your margin of profit; (2) your financial capacity, and (3) the minimum effective expenditure. Between the limits which these factors dictate let your decision err on the low side. Increase or decrease your expenditure roughly in proportion to your sales, but level off the peaks somewhat so as to avoid either spasmodic increases or decreases of turnover. Finally, whatever figure you decide upon let it run for at least twelve months.

Last week the CONJOINT BOARD OF SCIENTIFIC SOCIETIES was formally dissolved. In view of this step, the work done by the various Committees was terminated some time ago, and the World List of Scientific Periodicals was vested in Dr. Chalmers Mitchell, Sir Robert Mond and Sir Arthur Schuster, as trustees.

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The Electric Heating of Large Buildings.

A Flexible, Cheap Hot Water System.

At the present time the term electric heating, both to the engineer and the layman, predicates the use of what are generally known as radiators. This class of apparatus has been brought to a high state of technical and artistic efficiency, and there is no doubt that it will find an ever increasing application. But much harm has been done to the electrical heating cause in the past by the promulgation of claims for certain electrical equipment which for physical reasons they could not fulfil. Electrical heating has especially suffered from its friends, with the result that, owing to lack of experience, equipment of too small a capacity to produce and maintain a given heating effect has been specified. It may be taken as an axiom that the heater should always be well on top of its job; this is easy of fulfilment seeing that ample regulation can be provided.

Limitations of Straight Electric Heating.

Even so, the straight electrical heater has its economic limitations when it comes to warming halls and large rooms, and it has therefore been necessary to devise special equipment for this purpose. Before, however, describing what has been done in this direction, we may draw attention to certain theoretical aspects of the problem.

The Heating Problem Analysed.

We have already remarked that the early failures of electric heating were due to insufficient grasp of the problem to be solved. It became common practice to allow 1 W per cub. ft. of space, forgetting that the loss of heat or heat requirements of a room or building are not directly proportional to its volumetric capacity. The heat requirements of a room or building may be considered under two headings. The first is the amount of heat that will be necessary to raise or build up the temperature, and the second is the amount required to maintain a satisfactory temperature.

The amount of heat required to raise the temperature of a building is in most cases far in excess of that required to maintain a given temperature. Nevertheless, it is the almost invariable practice to install an apparatus designed only to meet the second condition. This is found to work out satisfactorily in practice, because during the period of absorption

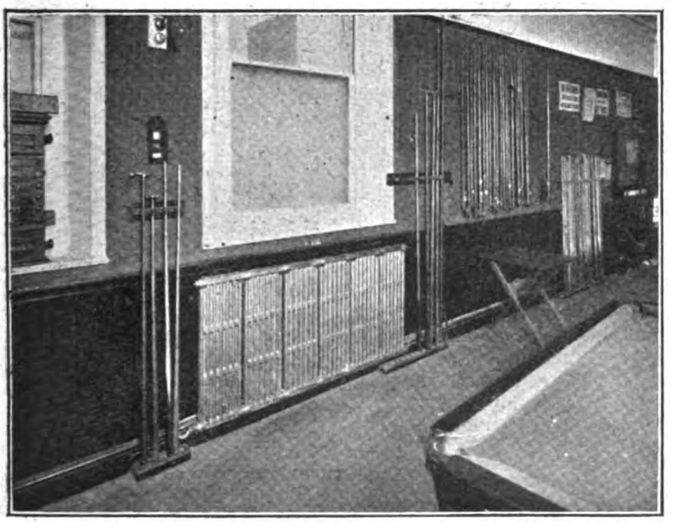

FIG. 1.—SIX-SECTION 32 IN. "GENII NEPTUNE" RADIATOR. TOTAL LOADING 3 000 W.

the weather is seldom continuously at the external "test" temperature, and, consequently, the apparatus slowly builds up the internal temperature.

On the other hand, there are types of buildings or rooms which are only used intermittently. In such cases the heating arrangements should be more powerful than that required for continuous heating by an amount proportionate to the heat-absorbing quality of the structure and to the time of discontinuance of heating, or, alternatively, to the permissible time of pre-heating before occupancy. Where the heat input is interrupted daily, which is the condition electrical heating engineers have mostly to meet, a 20 per cent. addition to the normal requirements as calculated for continuous heating is recommended. For offices not heated during the week ends, an addition of 25 per cent. should be made, and in the case of rooms only occupied for an hour or two daily or two or three times a week, the addition should be 33 per cent. to 50 per cent., according to the purpose of the room.

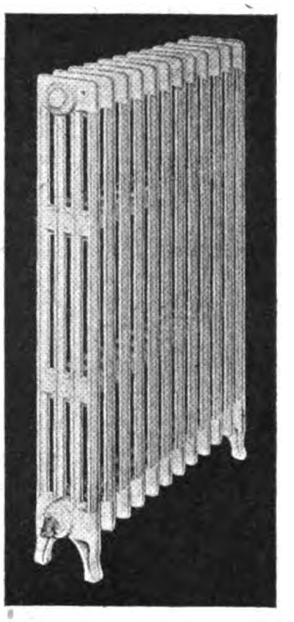

FIG. 2.—"GENII" FLOOR TYPE HEATER.

Heating Requirements.

In order to determine the heat requirements of a room or building, the only method having any pretence to accuracy is to calculate the amount of heat lost from the several parts under standard conditions of temperature, exposure and the like, for which standard coefficients are available. Then, allowances having been made for variations from the standard, the heat input must be equal to the sum of all losses, otherwise the requisite temperature will not be maintained.

The external air temperature range during the heating season in this country is about 30 deg., the average temperature for the season being approximately 40 deg. F. The average velocity of the wind is between 12 and 15 miles per hour, say, approximately, 20 ft. per sec. Under such conditions experience has taught us that living-rooms require such artificial warmth within them as will maintain 60 deg. F. inside during prolonged periods of 30 deg. F. weather outside in order to satisfy the physical and psychological needs of the occupants. When calculating the heat loss through walls, ceilings or floors, as the case may be, which separate the heated rooms from other rooms or attics not heated, it is usual to assume a temperature of 45 deg. F. for the unheated parts of the building, the mean temperature between warmed rooms and the external air temperature is assumed in such cases.

Factors for Consideration.

Other factors that have to be taken into consideration are the coefficient of heat transmission through the building materials, a very complete series of figures for which have been published by the Research Committee of the Institution of Heating and Ventilating Engineers, the question of room aspect, the amount of heat carried away by the air, the effect of air interchange between the rooms, the leakage and diffusion losses, the position and area of the windows and doors, and the effect of the outside walls. A good deal of interesting information on these subjects has been collected; but it must be emphasised that the variance in heating requirements that may occur in practice between rooms of the same size is very great and each case must be decided on its merits.

Figures for Heating Requirements.

In general, however, the following figures connecting the heating requirements and the electrical load necessary to fulfil them may be given. In theatres, which are very economical places to heat owing to the absence of outside windows, 10 or 15 deg. rise over the outside temperature is sufficient. Electrically this means 300 W per 1 000 cub. ft. In domestic work a useful semi-"rule-of-thumb" method is to allow 0·9 W per cub. ft. for a 30 deg. rise of temperature per hour, or 0·6 W per cub. ft. for a 20 deg. rise. These figures predicate the use of central warming apparatus only, as will be described later. If ordinary fires, either coal or electric, are used in addition, the figures given above may be reduced 50 per cent. It may be mentioned that this data is based on the heating engineer's rule of 18 sq. ft. of heating surface per 1 000 cub. ft. of space.

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The Importance of Position.

It may be added that the success or failure of any particular installation largely depends on the positions where the apparatus is installed. In rooms a position under the windows is the best place, as shown in one of the accompanying illustrations (Fig. 1), but in large halls and churches places in the roof or half-way up the supporting columns may be used with advantage to counteract down-draughts and to obtain that even heating effect which is so desirable, and this effect is assisted by dividing the heating surface into small units. In this way too, a great reduction in the electrical load required can also be effected, as witness a case at Edinburgh, wherein a normal heating load a 500 kW was reduced to 64 kW and space was saved by placing the heaters on the supporting columns.

Electric Water Heating Apparatus.

Turning to the apparatus available as electric hot-water radiators, we may mention the "Genii" equipment of GEORGE NOBBS, LTD., examples of which are given in our illustrations. This apparatus employs an immersion heater in conjunction with hot water, the latter being an ideal heating medium, as it allows the heat to be distributed over a large area at a temperature varying from 120 to 180 deg. F., according to the position of the heat-regulating switch. Another important point is that as heat emission is proportional to the temperature difference, a low radiator is to be preferred to one of "tall narrow" design, seeing that in the latter case the upper part is enveloped in air already heated by the lower part. This is attained by making "Genii" radiators comparatively low in height, while by an appropriate design of heater quick heating up and cooling down is achieved. For comfort and hygiene it is important that the heating surface does not exceed 185 deg. F.

The "Genii" Radiator.

In design the "Genii" radiators are graceful in outline, of compact proportions and present many advantages over the ordinary heavy and cumbersome cast iron radiators. The reduced size of the columns and their symmetrical spacing permit 50 per cent. more heating surface in a given space as compared with any other radiator. The internal area of the columns is about one-fourth that of other radiators; this ensures a rapid heat circulation. These are factors of much importance in the saving of electricity, heating results, saving in transport costs, breakages, labour, handling on site and erection.

The radiators can be supplied in various heights or length to suit special requirements; the wall type project only $3\frac{3}{4}$ in.

These wall-type radiators are constructed on the unit principle in two standard units or sections, loaded for 250 W and 500 W respectively. These sections when assembled together side by side form larger complete radiators to the loadings specified; but where the space available does not permit "side by side" units, then sections may be bolted back to back to form a tandem radiator. Where space permits and a powerful radiator is required, it is preferable to use single-depth radiators as these give better heat distribution, while the initial cost is less than for tandem radiators. For warming a large room it is preferable to use two or more small radiators instead of one large radiator, thus securing a better heat control and more equable heat distribution. The "Genii Neptune" radiator is, it is claimed, particularly suitable for meeting conditions that apply aboard ship for the warming of cabins, state rooms, saloons, etc., and for every purpose where space is limited.

For those who prefer radiators to stand on the floor "Genii Floor Type" radiators (see Fig. 2) are made in three heights in sizes from 500 W to 3 000 W loadings. All are suitable for three-heat regulation, and, it is claimed, combine beauty and gracefulness of design with great compactness and high efficiency for air warming.

Brief reference may be made to the "Genii" immersion heater which is used in these radiators. Its essential feature is that the exterior metal casing is, except for the insulation, in actual contact throughout its length with the interior heating element. The cover is pressed down from round into a keyhole section, which ensures a "breathing" effect when the wire of the element expands. The insulation is of solid mica, and a bronze sheath takes up any inequalities in the mica so that perfect contact is obtained with the cover throughout its length. Thus ensuring long life extending over several seasons' work.

The Advantages of Central Heating.

Finally, it may be said that this system of electric heating has the great advantages of responsiveness and easy regulation. In an ordinary central heating system control is difficult and can only be effected from one point. In this system each radiator is complete in itself, and can be turned on, off or down, as required. In heating churches by ordinary hot-water equipment it is necessary to fire up some forty-eight hours before. With electric heating this preliminary period is reduced to four or five hours. In ease, flexibility and economy it has therefore everything to recommend it.

Fans as Merchandise to Sell and Profit By.

By "A SPECTATOR."

"In any movement in the electrical industry in the interest of more business the value of an appliance business merits careful study. Fundamentally, appliances are a source of merchandising profit for the manufacturer, the factor, contractor and retailer; for the central station they are income producers and offer merchandise profit in their sales. The third party to any successful business venture, the public, receives full benefit, getting value in the device itself and even greater value in the service rendered by it."

I am indebted to an American contemporary for the above inspiring introduction to a discussion on a problem which is also our problem—the need for a larger turnover in electrical appliances. In these few notes I shall purposely limit myself to the marketing of fans, this being appropriate to the Spring Trade number of THE ELECTRICIAN.

Need of Spring Cleaning.

No one will gainsay me the simple statement of fact that we in the electrical industry in this country have need to furbish up our ideas regarding the merchandising of fans. This is not a criticism; it is, as I have said, a simple statement of fact. There are many reasons for this condition and the responsibility can be fairly well divided among us all. Commencing with the source of the supply, it can be said with every truth that the manufacturers and larger distributors are much behindhand in their development programme, and it is this reason that justifies to some extent the half-hearted way in which contractors and retailers lay out their merchandising plans. The fault of the manufacturers and larger distributors is that they commence their sales campaign far too late in the season. They ridicule the plea of the retailer that the vagaries of our climate make fans a very speculative business, but they are obsessed with the same fear. As is the way of our weather, it will probably be freezing in the early part of May and a heat wave will be sprung upon us in the latter part of the month. Until this moment arrives, hardly any attempt is made to secure orders in advance. Then the heat wave having arrived, contractors and retailers are bombarded for orders. Quite naturally and properly, the contractor cannot handle the proposition on such a basis. He cannot make a heavy financial commitment because it is hot on a particular day, and obviously it is then too late for him to make any effective use of the publicity matter which a manufacturer may offer him.

Evading the Point.

It will be argued that it is for the contractor and retailer to seek out the best buying market for fans early in the year and thus get to know each manufacturer's plans. This, however, is evading the point. The truth is that if any contractor or retailer asked a manufacturer for fans in the early part of February or March, he would be told to "wait and see." This statement of the manufacturer's shortcomings does not relieve the contractor of his part in the merchandising of fans. The fundamental cause for the fact that our turnover in fans is so small is the fear we all have of the English weather. It is not suggested that we can ignore it when laying out our selling plans, but we can pay more attention to the fact that fans also have an *all-the-year-round* use. When we cease to handle fans as a speculative business, and lay our plans on the undeniable basis that fans are a staple line of merchandise, we shall increase our turnover manifold.

Fans an All-the-Year-Round Device.

We need a campaign to educate the public on the lines that fans are an all-the-year-round device. Manufacturers need to be bolder in their investment in fan production and also in their

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publicity matter. In turn, the contractor and retailer should study and use every detail of the publicity campaign to reap the full measure of profit. Plans must be laid early both by the manufacturer and the retailer and vigorous use made of the pungent publicity matter of the E.D.A.

The Study of Technical Data.

Much time should be given to the study of the technical data of fans so that the right type and size of fan can be recommended and supplied. A lot of harm is done when a small size fan is sold with an assurance that it will perform the task that a much larger fan can only just achieve. A 9 in. fan has a limit in performance. It is rendering a poor service to the public (and to the electrical industry) to sell a 12 in. table fan to exhaust the fumes in a large kitchen where a 16 in. exhaust fan is required. The mistake is made owing to the anxiety to "sell him something," but the profit will never appear in the balance sheet because it will be absorbed in rendering service long after, to pacify the customer. The range of types and sizes in fans is very comprehensive and there is one for almost every need.

I have referred to the fact that fans should be sold as an all-the-year-round appliance. That is so, particularly with exhaust fans, but even with this type of fan the man in the street has a vague idea at the back of his mind that its usefulness is limited to the hot summer days and he calculates the total cost in proportion to those days. The more widely bought swivel and trunnion fan need not be idle during the winter. In houses where a central steam heating system with radiators is in use they are very useful. It is not sufficiently well known that a 12 in. table fan in front of a radiator will "tickle it up." The breeze from the fan placed in front of the radiator is the moving force which scatters the surrounding blanket of hot air. Further it can be used in a way which will particularly appeal to the housewife—in the indoor drying of clothes.

Need of Better Buying Plans.

While I emphasise the need for better selling plans, it is equally important that contractors and retailers should learn how to *buy* fans. I know that in making such a bold pronouncement I take the chance of touching the susceptibilities of many, but none the less I should do wrong if I failed to bring out this very important question, How do we buy? What do we buy? Is it not a fact that each of us make the mistake of buying discounts? But scant attention is paid to the technical details of the fans offered, and in the case of the more domestic type of table fan the finish must be carefully studied. The best principle to lay down for buying fans is to deal with one or two only of the makers who can present the best proposition on quality consistent with price. When I speak of price, I mean the *list* price. This is the figure that matters when buying, because the best makers always arrange list prices which appear prominently in all their publicity matter. Consistent with a reasonable profit, do not pay much attention to discounts! The buying public is only interested in a fan because of its service, quality and price; it will not buy any particular fan because we obtain 33⅓ per cent. discount off the list price instead of another fan on which we can obtain only 25 per cent. It is perfectly legitimate to make the fan turnover show as much profit as possible, and it is for this reason (and there are other reasons) why one or two makes of fans should be concentrated on.

As a matter of fact, if the buyer is satisfied with the service, price, and finish of any particular make, and decides to market the fan throughout the season, the manufacturer will at once grant a preferential rebate if he can have an assurance that the number of fans to be taken will be worth while. Some manufacturers will require a definite order for "delivery to be taken as and when required, but not later than——"; others will be satisfied (particularly if the trading relations are of long standing and very cordial) with an assurance. If, however, the attempt is made to market say six or more of the many fans on the market, excellent though they may be on every score, the selling campaign will miss fire and the retailer will not be able to claim for rebate on quantities sold, because obviously, when the total number sold is divided among six or more makers, the quantities for each are too small to warrant any rebate that is worth while.

A Brief Flutter.

We need not take too seriously the 25s. and 37s. 6d. 9 in. fans of American and German make which have their flutter for a brief fortnight during the summer. We have to remember that the large departmental stores can afford to take the risk of these fans slumping by applying profits of other merchandise to writing them down, a method of business perfectly correct, but which the average electrical retailer cannot follow. Secondly, but far more important, is the fact these stores do not take any risk of service. If the fan fails, which it will do after a brief moth-like summer existence, it is pleaded that it is only a "cheap" appliance and as such only value for money spent on it.

Electrical contractors and retailers are, however, not in a position to take up such an attitude. It must ever be kept in mind that they are the "service agents" of the electrical industry to the public, and it will serve the cause of the "Electrical Idea" ill if for the hazard of a season's profit they sell a device which is not an electrical device but merely a toy. Perhaps I may put it more definitely. If any one of us trade as electrical contractors or retailers, then we will have no doubts that our self-imposed positions as "service agents" means that we must leave these fans alone. If, however, we argue that we must take the hazard of a season's profit on these toys, then we must accept it that we are not in business as "electrical retailers and contractors" but as "fancy goods, toy and novelty retailers." The penalty of doing this is that we cease to have the support of the best manufacturers and the electrical industry as a whole.

Seasonal Tendencies in Electrical Merchandising.

Is it Wise?

"BY A SPECTATOR."

It is becoming the ever-growing practice to talk of and develop the "electrical idea" in terms of the seasons. We know, of course, that the idea is followed very closely in U.S.A., where retailers are exhorted to "cash in" on spring, summer, autumn or winter business, as the case may be. It is questionable, however, whether the idea (for the tendency is still but an idea) is a wise one for us in this country to adopt, because the trading conditions and seasons here are so different. It is questionable whether we have reached that period of sturdy old age in electrical merchandising to enable to take the risk which this seasonal tendency involves. For most surely does it involve some risk. If we adopt wholeheartedly "seasonal lines" then most assuredly we shall, consciously or unconsciously, educate the public to buy on the same basis. This will involve purchases of "seasonable goods," and such purchasing means (as is well known in other trades) much writing down if the season turns out bad; that is to say, if we have a very mild winter or a very cold spring or a wet summer.

Most assuredly the development of the electrical contractor and retailer is not sufficiently advanced and on concrete to bear heavy writing down of stock, particularly now, when the economic conditions in this country are so bad for traders that many of the old-established retailers and contractors are not yet on their feet.

Drawbacks of Seasonal Sales.

A further question on this subject would I ask. Has it not been the tendency to regard certain items of electrical merchandise as seasonal for some years past, and therefore the sales have suffered? I would cite the case of fans. This is a line which we will persist in regarding as a seasonal line. It is true that it is to some extent, but a much more sound business could be built up to the benefit of all concerned if fans were handled as an all-the-year-round device.

I feel that the turnover in many lines is so small that we have got to keep on hammering the public all the year round. We cannot afford to give them time for breath, whereas with this seasonal business tendency the sales effort will always lag off as the end of the season approaches. Hence, out of the total of 365 days in the year there will be many days when we shall sit back and philosophise: "Ah well! 'tis approaching the end of the season." Can we afford to do this?

I am feeling my way on this question of seasonal business, and therefore I will continue to ask questions. Will it not make business much more difficult for the manufacturers? The last thing in the world an electrical contractor or retailer will forsake is his conservatism, and while he may express himself as being thoroughly enthusiastic for the "seasonal business" idea he will wait, and keep on waiting to see how the cat jumps before he orders his stock. When the season proves that it is going to behave itself, he will order, and the manufacturer will have to deliver the goods off the shelf. The greatest economic curse which the electrical merchandising field suffers from is the fact that they have to keep too many goods on the shelf!

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Electric Lighting and Education.

Well-lighted Carriages provide Thousands of Hours of Reading for the Traveller in Greater London.

By GEORGES BENOIT-LEVY.*

If Mr. Pickwick were living nowadays and happened to be travelling in London by night, instead of being packed in an hurtling and dark coach, he would be comfortably seated—or standing!—in a well-lighted carriage, reading old scripts or writing notes to his world-renowned club. To enjoy such conveniences he should not have come to life again more than a score of years before Dickens' centenary, as men and women of our generation still remember the old London bus, with the oil-lamp projecting its very sparse halo of light on to its half-asleep passengers. Indeed, the benefit of decent lighting could not possibly have been given to the travellers without the help of the good fairy—Electricity.

But there are many kinds of lighting. The fact that electricity is employed does not guarantee the efficacy of the process. At first there was as much ignorance in that particular field as in the wiring and switching of houses.

The Work of Propaganda.

To-day the electrical engineer is well aware of the requirements of the electrical home. Powerful bodies like the British Electrical Development Association have inaugurated such an intense propaganda that the British householder is splendidly educated in the best way to heat, feed, light and live electrically.

But it is only quite recently that transport companies have really taken the trouble not only to give their passengers electric light, but to give them the best, most even, most pleasing illumination possible. Lighting for service is one of the many problems which confront the directors of transport companies in search of the best carriage available.

Some Factors in Vehicle Lighting.

Great progress has been obtained in the way of quiet running, ventilation, easy access, etc. The good distribution of light in a large vehicle, be it tram, bus or train, is not an ordinary proposition—direct rays must be avoided, light must be diffused without the formation of shadows, publicity contracts must be fulfilled with regard to the illumination of advertisement boards, reflectors ought to be of convenient design and be set up at an accurate angle, a choice has to be made among varieties of fittings, concealed lighting, frosted bulbs fixed to the roof, brackets on both sides of the car, safety and economy in wiring cannot be neglected and comfort in reading must not be arranged for the benefit of the *beati possidenti* who has a seat at the inconvenience of the unfortunate straphangers who stand in the glare.

As a layman who is not troubled by technical difficulties, I would say to my brother electrical engineer: "Mix up all these ingredients and give us a good light: give us a good light that the people may read, read and read every minute of time employed in transport; and, providing that the reading is of good quality, you will have converted 'Electricity' to the service of the nation for the education of the people."

The "Commuter" and Reading.

The benefits of self-contained garden cities cannot be questioned; and yet it would be interesting to know whether the peaceful gardener of the "new towns" or the daily "commuter" devotes the more time to reading. The number of regular travellers to and from London is over 2 300 millions per year; 750 millions use the motorbus, 615 millions the tramways, 610 millions the underground railways and 325 millions the suburban lines within a radius of 20 miles.

Supposing two hours' journey to be the average for each person per diem, that would mean 4 500 million hours which could be devoted to reading. Is it not wildly wasteful to forego such a source of wealth if we consider that education together with health are the two greatest assets of a country? And if we take into account the mileage travelled underground, the number of foggy days or of dark hours, even on surface lines, it may be conservatively stated that during at least 1 000 million passenger-hours efficient lighting is necessary if reading is to be conducted at all.

The British and Reading.

Another fact which must not be overlooked is the peculiar position of Great Britain in the matter of reading. In no other country can be found so many and so complete agencies for public education. The enterprise of the British publisher helped to forge the first link in the educational chain. The cheapness, good taste and fair presentation of English books are an object of universal wonder. The delightful Dent's Everyman Library or Nelson's popular editions, for instance, wholesomely feed the average brain. Moreover, in the remotest parts of the kingdom, on land or on sea, libraries receive special care. Need we recall how libraries are meeting a genuine demand of ship's crews, and how they were organised by the Seafarers' Education Service? To do so would be only to mention one of the many activities of the World Association for Adult Education, which is itself an outcome of the Workers' Educational Alliance originated by Albert Mansbridge. And from the villager's club to Oxford's Ruskin College, through the Carnegie and municipal libraries, the adult schools, the settlements associations, the tutorial classes, the United Kingdom is like a big honeycomb where everyone may obtain a taste for literature.

Ample Means for Education.

In this way every citizen who is ambitious to educate himself has ample means at his disposal. It is to be hoped that everyone will avail himself of these facilities in an age when everybody must not only be the master of his own mind but a governor of his neighbour's.

These thoughts are forcibly confirmed by the following words borrowed from a bulletin of the Adult School Union:—

> Literature is the most important factor of human progress, the best thoughts of the best men, the ripest product of the mind. The man who does not appreciate books does not value his birthright. We can begin almost anywhere. The man who is interested in the Bible can begin there and study the most wonderful literature in existence; the man who is not interested in his Bible can begin with his newspaper. From these beginnings men may be led anywhere. Almost all the greatest classics can be bought for a shilling or two a volume and so every man may possess the treasures of literature.

We may also quote a self-educated man, Mr. Clynes, the former Minister of Food, who, in the course of a splendid speech, exclaimed: "He is a better citizen, the man who likes to read."

Such being the importance of reading, and so many hours being available for it to those who patronise the "common carriers," blessed be the fairy electricity for its past services in this respect, and still more blessed for the future possibilities in the development of public lighting.

At present travellers in Greater Paris enjoy electric lighting in all the tramcars, buses, underground railways and in some of the taxicabs, and on the suburban lines of the Orleans railway and the Invalides portion of the State Railways, which are electrically operated. Other railways will soon be electrified; and this means that every day more and more passengers in the Parisian area will be given greater reading facilities. But, as in London, the lighting methods are still open to improvement. For, as Mr. J. W. Beauchamp forcibly expresses it: "Artificial lighting is to-day a science with a literature of its own, because in the course of developing the electric lamp and in the search for its continuously increasing efficiency, is the secret and foundation of the whole of the work of the illuminating engineer."

Electricity and the Development of Knowledge.

Summing up the possibilities of electricity in connection with the development of knowledge and of reading, I quote four lines which would apply both to our good fairy and to its educative power, from the "Edison Monthly," where, in the "Love Lyric of an Engineer," Frederick Maxon sings:

> Transmitted from this heart of mine
> Flows current so amazing
> It might the universe make shine
> With incandescent blazing!

*Georges Benoit-Levy, author of "The Garden City," "The Happy House," and of many other books, is a propagandist of world repute in the application of science to the improvement of everyday life. His home is at Mentone on the French Riviera.

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The Institution of Electrical Engineers.

The papers by Mr. F. Hooper and Mr. J. W. Beauchamp which were read at the joint meeting of the Institution of Electrical Engineers and the Royal Institute of British Architects, on March 15th, are given in abstract on p. 334 of this issue. We give below an account of the remarks of various speakers at the meetings on March 15th and 22nd.

The Greatest Need.

Major F. H. MASTERS, in opening the discussion, congratulated the Council on having arranged this joint meeting with the R.I.B.A. If we were going to reach that state of electrical development which everyone hoped for, it was not going to be a matter for the electrical engineer or the architect alone, but one for the electrical engineer and the architect in combination. We had heard *ad nauseam*, that the greatest need of the country was houses, but electrical engineers felt that the greatest need was houses in which electricity could be used to the greatest possible extent. He lived in a place where middle class houses had been built with one or two lighting points in each room, and, as a concession to modern thought and practice, one wall plug per house had also been fitted. That was not enough. In each living room and each bedroom there should be at least two plugs—one, which might be called a power-plug, with a capacity of 15 A, and the other with a capacity of 5 A for smaller apparatus; and in any district where a two-rate tariff was available these could easily be made, for wiring purposes, one point. With such an arrangement in each of the rooms there was great flexibility, and electricity could be largely used with only a small amount of equipment. This should be an easily attainable ideal. Unfortunately, at the moment, it was only an ideal.

Co-operation Essential.

Mr. A. H. DYKES said that the result of co-operation between the electrical engineer and the architect was that the building was much more satisfactory when completed than otherwise would have been the case. But this collaboration should begin at the earliest possible stage, and not after all the plans had been prepared.

Owners' Parsimony.

Mr. A. O. COLLARD, member of the Council of the R.I.B.A., said that if these two papers were published in the "Journal" of the R.I.B.A., there would not be many architects who, after reading them could doubt the special advantage of engaging the services of the electrical engineer. On the point of one plug per house, mentioned by Major Masters, the difficulty was the parsimony of the owners.

A Wiring Economy.

Mr. F. TREMAIN mentioned having seen hollow concrete blocks for building houses, and said he had consulted some of the people who made these to ascertain whether transverse ducts could also be cast in the blocks for carrying wiring. He had been told there was no difficulty, and, following up this, said it seemed to him that there might be a duct provided so that the dust from the use of vacuum cleaners could be carried straight outside the building, perhaps from a number of them into a common dustbin. By the use of ducts in these hollow blocks, bare wires could be used and the cost of wiring reduced. He also suggested a plan of building four houses in a block with a central shaft in which would be carried all the wiring, sewerage pipes and other services. Such houses would be electrically heated, and in the dining-room there could be an inter-oven arrangement using an electric fire with the upper part available for plates.

At this point Mr. C. C. PATERSON, who had taken the chair owing to the President having to leave for the B.E.A.M.A. dinner, said that he had the names of nine more speakers. On a show of hands, the discussion was, therefore, adjourned for a week.

An Electrical Vade Mecum for Architects.

At the meeting on Thursday, March 29th, the attendance was very small, especially considering the importance of the subject.

Mr. A. E. MUNBY, who opened the discussion did not think it would ever be possible for architects to grasp all the technicalities of electricity and for that reason nothing but benefit could follow from close working with the electrical engineer. There was a great deal of small work which did not justify the calling in of the consulting electrical engineer and the architect had to rely upon the contractors. It would therefore be of the greatest assistance if some general specification could be drawn up for the use of architects indicating the advantages and disadvantages of different classes of wiring and the kind of things the architect should specify in order that tenders might be fairly obtained. Turning to electrical matters he suggested that differing voltages and 100 cycle single phase systems were things that might be improved, and that hiring should be established and free services provided.

Mr. JUSTUS ECK remarked that the electrical engineer must appreciate that his work was subsidiary to that of the architect. It was an important part, however, and the electrical engineer should be called in at an early stage and not when the building was half completed. In particular should the architect consult the illuminating engineer.

Necessity for Looking Ahead.

Capt. R. J. WALLIS-JONES pointed out that it required a good deal of technical knowledge to apply the Institution wiring rules, and from his experience he felt justified in saying that architects had not that knowledge. One of the most important things was for the architect to appreciate the necessity of looking ahead in electrical requirements.

The Ventilation Problem.

Mr. A. F. HARMER suggested that before we could regard any other form of heating as being a good substitute for the coal fire, the question of ventilation would have to be considered. He agreed that wiring rules were necessary, but it was also necessary that they should be applied with a broad mind in relation to the nature of the installation.

Mr. F. CHARLES RAPHAEL assured architects generally that there was a body of electrical engineers who could help them very materially if they would only take advantage of their knowledge. The electrical part of the work was as much a matter of design as the architectural, but he was afraid architects would not have time to learn that aspect. He knew of cases in which the consulting engineer's fees had been saved in the less amount of cutting away necessary through dealing with the electrical work at an early stage.

Architects and Illuminating Engineers.

Mr. H. J. CASH suggested that the proposed Joint Committee might also do useful work in instructing illuminating engineers on some architectural points. The illuminating engineer often set out to provide illumination. He put so many candle-feet or lumens, and, if he got the required illumination, he considered he had done well, whereas the architect would say that he had reversed every shadow and made things horrible because all the light was coming from the wrong direction. As a contractor, he supported the view that consulting engineers should be employed.

Author's Reply.

Mr. HOOPER, replying to the discussion, said he had purposely dealt with the subject generally, leaving it for the individual items to be discussed in detail later. He referred again in general terms to the advantages of electricity for the various purposes already mentioned and expressed his optimism in the results likely to follow from this discussion.

Mr. BEAUCHAMP, in his reply, said that for the reasons that had been mentioned by various speakers, he wished to see a graded scale of wiring rules so that the quality of the installation should have some relation to the conditions. As to testing, he preferred visual testing to relying upon tests of ohmic resistance. It was the fault of the electrical engineer that the electrical part of a big scheme, as mentioned by Mr. Raphael, was only 4 or 5 per cent. whereas the plumber got 8 or 9 per cent. The great trouble was that architects referred to electric heating and cooking as expensive without troubling to inquire into the comparative costs. He agreed that it was the duty of the electrical engineer to advise his client that there was something in the proposition, or to advise him, on the other hand, to leave it alone, but the flourishing state of electricity and cooking was due more to salesmanship than to cheap electricity.

In proposing a vote of thanks to the authors, Mr. F. GILL, President, said the subject seemed to grow in importance as the discussion proceeded despite the small attendance. The points raised would all be brought before the Council of the Institution as, he assumed, they would be brought before the Council of the R.I.B.A., and it might be that some further action would be taken.

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Spring Cleaning and Electricity.

A Foreword.

Domestic electrical development is so intimately bound up with heating and cooking that this may seem quite the wrong time of year to talk about trade promotion. People are thinking about river picnics and cricket and bathing, and do not want to be reminded, though they will have to endure them a little longer, of fires and dark evenings.

Nevertheless, there is one domestic operation which, though it fortunately only comes once a year, is at present topical, and all its woes and worries are typical of what electricity can do to lighten house work. That operation is, of course, spring cleaning. In alleviating its miseries, both to the wife and to the husband, the electrically driven vacuum cleaner can be of the greatest help. We describe exactly how below. The advantages of using electricity for dry cleaning may also indicate to the housewife that electricity can also help her with the washing, a duty that has to be performed more often than spring cleaning, and is just as unpleasant. We also say something about that. Our paragraphs are, of course, written for the salesman to pass on to those more intimately concerned.

The "Sturtevant" Turbine Cleaner.

In reviewing and looking over the prospects for a big boost on cleaners this spring, the retailer will make a mistake if he limits his vision to the field which will only absorb the more domestic type of machine, listed at various prices between 8 and 15 guineas. There is in many localities the householder who must have, or who can afford, a larger machine. We have previously had the

FIG. 1.—A TURBINE CLEANER FOR LARGE HOUSES.

pleasure of commenting in these columns on the turbine cleaners manufactured by the STURTEVANT ENGINEERING Co., who have developed the science of "vacuum cleaning" on sound and undeniable principles, and the householders we have referred to will be attracted by these excellent machines. The No. 5 Sturtevant portable turbine cleaner (Fig. 1) is especally suitable for large houses. The machine is portable, and will do the work "on the spot," but it can be adapted to a stationary installation. Those interested are recommended to arrange for an early demonstration of this equipment's possibilities.

FIG. 2.—ONE OF A USEFUL SERIES OF VACUUM CLEANERS.

The "Cadillac" Vacuum Cleaner.

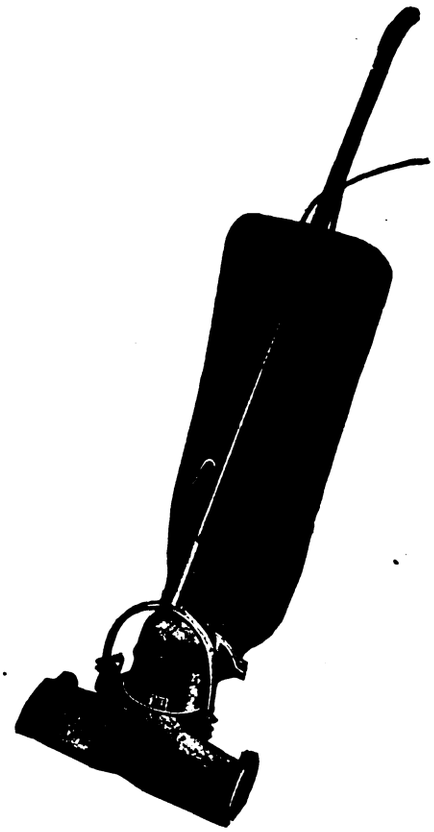
The "Cadillac" cleaner is a machine distributed in this country by the METROPOLITAN-VICKERS ELECTRICAL Co. It falls under the heading of higher priced machines, being listed at £15, without accessories, but it will fill the demand for a cleaner of heavy build and generous capacity. A further note of interest is that the Cadillac is made in two models. We illustrate (Fig. 2) No. 90, and the other model is known as No. 36. Each model has many talking points (as will be proved by a study of the "Met-Vicker" price lists), and each is listed at £15 (without accessories).

The "Premier" Vacuum Cleaner.

The "Premier" vacuum cleaner (marketed by the HOTPOINT ELECTRIC APPLIANCE Co.) is a sound device at an attractive price. It is attractive in appearance, which counts for a lot when selling domestic devices. The cleaner is listed at 12 guineas, and the attachments at 3 guineas.

The "Sunshine" Vacuum Cleaner.

Spring is associated with sun, and the "Sunshine" cleaner is associated with the SUN ELECTRICAL Co. This happy association is a significant augury for the prospects of the retailers who decide



THE "SUNSHINE" CLEANER.

on the "Sunshine" cleaner for the coming spring boom. This machine is a well made one, and can be handled with assurance that the profits will not be lost in heavy service charges after the cleaner has been in use only a short while.

The "Nilfisk" and the "Little Nilfisk" Vacuum.

"Nilfisk" is the name of the vacuum cleaner for which GILLESPIE AND BEALES are the sole agents. They claim it is "the world's best vacuum cleaner." This is another machine of the heavy duty type. The motive power is supplied by a vertical spindle

A TYPICAL "NILFISK" CLEANER.

commutator motor, having a two-stage turbine fan of special design mounted direct on the spindle. The machine is supplied in four sizes at list prices from £19 10s. for the smallest size A to £70 for the largest size D. There is also a baby brother in the "Nilfisk" family who bears the proud name of "Little Nilfisk." This is a compact and useful machine, which the retailer can recommend to do a lot of hard work, and, what is more important, to stand up to hard work for a long time.

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The B.V.C. Vacuum.

This machine is manufactured by the BRITISH VACUUM CLEANER Co., and is claimed to be the most efficient of its type. The cleaner is listed at £18 15s., with set of attachments. It will perhaps be questioned as to whether there is a market for the retailer in these comparatively high priced machines, but it must be emphasised that they are very robust in quality, generously rated, and there are undoubtedly many large households who would make such a heavy demand on a cleaner as to render a smaller machine almost useless.

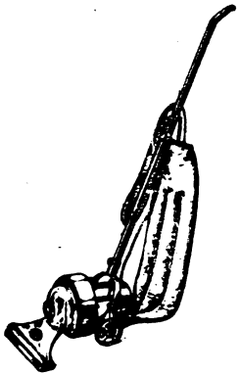
THE B.V.C. CLEANER.

The "Santo" Vacuum Cleaner.

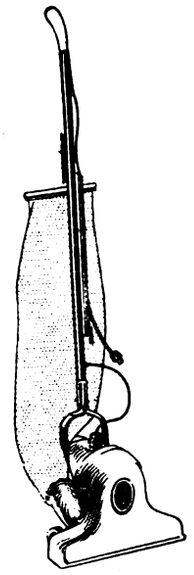
Contractors and retailers will find a wealth of choice in the range of cleaners distributed by DUNCAN WATSON AND CO. They have no less than three machines of the domestic type—the "Santo" the "Econo," and the "Apex." The two former machines are of particular interest because they are designed on quite a different principle to the more orthodox type The mechanical details are also entirely different. The suction is obtained by means of a diaphragm pump. The "Econo" machine (which is made in two sizes) is built on the same principle. All these cleaners are "heavy duty" machines, but Duncan Watson and Co. have not neglected the market for a smaller and lower priced machine. The "Apex" cleaner is built to the popular design of the removable dust bag, which has many excellent features, which, it is claimed, will more than justify the list price of 15 guineas (without accessories).

The "Northern" Vacuum Cleaner.

The merits of the "Northern" cleaner, supplied by the NORTHERN STEEL AND HARDWARE Co., should be carefully gone over before deciding on the season's programme. This is another machine listed at 12 guineas (without accessories.)



VIEW OF THE LITTLE GLUTTON.



THE NORTHERN CLEANSER.

The "Little Glutton" Vacuum Cleaner.

It is no small thing to conjure a trade word that aptly describes the product to which it is to be applied. The EDISWAN ELECTRICAL Co. have, however, been successful on this score in naming their vacuum cleaner the "Little Glutton." Judging from the specification, the machine is a little glutton for dirt, *not* for current consumption. We must not fail to mention that this machine is British manufacture, and is a fine example of a quality product.

The "Hotpoint" Handyvac.

The "Hotpoint Handyvac," marketed by Hotpoint Electric Appliance Co., is original in design, and presents the opportunity for which every *live* retailer is looking, a line "which is different." The "Handyvac" is a powerful suction cleaner made in portable form. It weighs only 6 lb., The cleaner has a multitude of uses, and has the happy knack of cleaning in nooks and corners. In addition to the domestic market, the cleaner is one which will make a ready appeal to other users. It has proved thoroughly useful in many ways, which the Hotpoint publicity will suggest. To mention one which, if we think rightly, does not often occur to the retailer—stables! The cleaner is most efficient for cleaning down horses after currycombing.

The "Hotpoint Aerobell" Washer.

Turning to the second part of our subject the "Hotpoint Aerobell" washer is a machine full of good points. This machine is a material demonstration of the theory of "selling service." After a study of the specification it will be at once realised that this is a machine that will be in service long after the price has been forgotten. Limitations of space prohibit our describing the "Aerobell" in any great detail. The fundamental fact to grasp when planning to handle electric washers is that the modern women is rapidly realising that it is not rubbing that takes dirt out of soiled clothes. It is the process of thoroughly saturating the clothes with soap and water and freeing the dirt that lodges in the pores of the fabric. The suction mechanism of the "Aerobell" does this in a way quite unique to this particular machine. The "Aerobell" is also supplied by the HOTPOINT ELECTRIC APPLIANCE Co.

The "Thor 32" Washer.

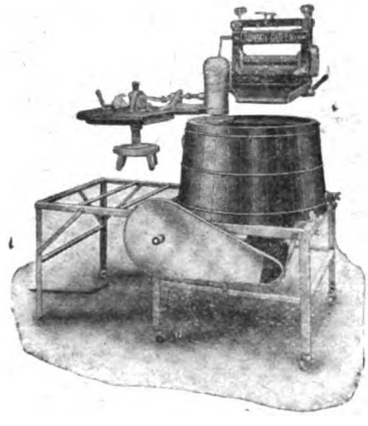
"This Thor 32 marks laundry bills paid," is surely a statement that will catch the interest of housewives who habitually long at springtime for the best labour saving devices. This

THE "THOR" WASHER.

arresting statement is the bold headline of a compelling pamphlet issued by the HURLEY MACHINE Co. to assist retailers to canvas this large turnover business. Here, again, price should not deter the retailer. This is a service device, and can be sold as such. "It will save more than it costs" should be added to the eye-catching claim for the "Thor."

The "Laundry Queen" Washer.

What better opportunity than "spring cleaning" time to present the wonderful labour saving electric washer? One of the types to seek full information on is the "Laundry Queen," supplied by the NORTHERN STEEL AND HARDWARE Co.



THE LATEST TYPE OF "LAUNDRY QUEEN."

The Jackson Wash Boiler.

There is an alternative for the contractor to have up his sleeve if the housewife cannot be persuaded to buy a washer. The alternative is the Jackson wash boiler, manufactured by the JACKSON ELECTRIC STOVE Co. The boiler, is known as Catalogue No. 150, and has a capacity of 10 gallons. It has been designed by the Jackson Co. to make the almost-electric home complete.

The A. B. C. Electric Washer.

The 80E, A. B. C. washer, is distributed in this country by the SUN ELECTRICAL Co. The machine (which is but one of a range of four machines) is listed at £39 10s. These A. B. C. machines present a unique opportunity to the retailer because the Sun Electrical Co. are one of the few wholesale houses in this country selling this high priced apparatus on the "hire purchase" terms.

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Merchandise to Sell and Profit By.

In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

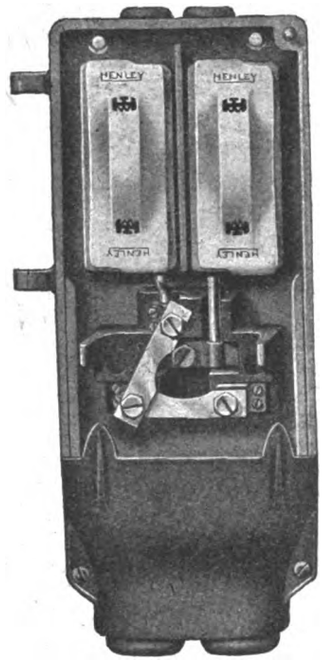
It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

On Reducing Cost of Service.

That the heavy initial cost of an electrical installation is a restraint to all enthusiasm for the "electrical idea" will not be denied, and any apparatus that tends to bring that cost down is worthy of close, and even minute, scrutiny.

It is for this reason that we illustrate the Henley loop-in cut-out manufactured by W. T. HENLEY'S TELEGRAPH WORKS. From one



ONE WAY OF REDUCING SERVICE COSTS.

tapping off the main to a Henley loop-in cut-out, it is possible to loop through the party wall two rubber leads to a pair of fuses in the adjoining house. The saving claimed is (1) one house service box and jointer's time, (2) one length of service cable, (3) half the excavation work, (4) one sealing chamber. The only items to be debited against this saving are (1) two short braided V.I.R. leads and (2) the difference between the cost of loop-in cut-out and the ordinary cut-out.

Credenda "Zincenamel" Conduit.

In a new catalogue just issued by the CREDENDA CONDUITS CO., some interesting notes are given on the Zincenamel conduit which this company is now manufacturing. It is not generally known that this finish was developed during the late war period and was very largely used. Galvanised conduit is usually accepted as the alternative to the black enamelled where conditions are too severe to allow the latter to be used, but this Zincenamel finish will prove a useful alternative with which to pull off a job. It is very often only a matter of a few pounds which decides whether a contract is secured or lost, and therefore the shilling or so difference per 100 ft. (on the

A MARK TO LOOK FOR.

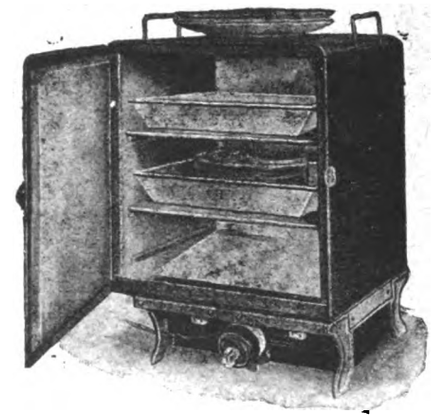
minus side) between galvanised conduit and Credenda Zincenamel will make all the difference to the grand total.

Credenda Zincenamel conduit, after its surface has been thoroughly cleaned and otherwise treated, is served with a coating of pure zinc on its surface by electro-deposition and is then stove enamelled both inside and outside. The reason for the double process is that pure zinc is acted upon by acids, salt solutions and even salt air to form a soluble chloride, so that to make the zinc protection lasting and secure the zinc coated tube is finally finished with the more orthodox "black coat."

It is of interest to mention that Credenda have now joined the ranks of conduit manufacturers who are marketing conduit under a definite trade mark with a guarantee of quality and made in accordance with the British Engineering Standards specification. Each length of Credenda Zincenamel conduit is therefore sent out with a transfer label as shown in our illustration.

A "Utility" Radiator-Cooker-Griller.

The retailer who has to confess his inability to sell cookers on the score of price—for however much he may extol the virtues of the cooker the housewife with small means will not be persuaded beyond her own idea of price and what she thinks she can afford—will now be able to flourish this one-time bugbear as his trump card. For the radiator-cooker manufactured by ELECTRICAL UTILITIES is listed at £5. Not only on price alone will it score. It will cook, it will grill or boil, and it will heat a room.



A USEFUL DOMESTIC HELP.

The "Utility" Cooker-radiator is designed on the "unit" principle and can be supplied in any size according to requiremen ts Standard sizes are the single, double, and triple cooker-radiator.

In order to provide a complete cooking outfit the detachable "Utility" oven has been produced, and this is arranged to fit on the top of the double radiator, or on top of two elements of the triple radiator. This latter combination is listed at £6 10s.

Fuller's Service Stations.

During the last two years the development of car service stations in this country has grown apace. The idea originated in America where experience has shown that "service" is one of the most important factors in selling not only cars, but accessories. As a result of this, and owing to the fact that practically every modern motor-car is fitted with starting and lighting equipment, the care of the battery becomes a factor of increasing importance. Several manufacturers have therefore realised the importance of organising a series of service stations throughout the country.

Among the manufacturers who have adopted this "service" policy is FULLER'S UNITED ELECTRIC WORKS, at whose service stations any car owner can obtain expert advice on the care of batteries. Fuller's have now over 300 such stations in Great Britain and Ireland, and their number is being added to.

Fuller's "service" is thoroughly well organised, and there is a close link between all the stations and the service department at their works. To make the scheme still more complete, Fuller's have a representative continually on the road to consult with service agents and to give them every co-operation and help.

This development of service stations is one to which every electrical retailer should give careful attention, particularly those who have premises in the more important thoroughfares. This business need not be left so much to the garage. Several simple and efficient battery chargers are now on the market (particularly for A.C. circuits), and the battery charging business will come not only from car owners, but from the ever growing crowd of wireless enthusiasts using valve sets. It is the capacity of being able to give "service" for battery charging that will increase the turnover on valve sets. The present demand for crystal sets is not only due to price; it is due to the fact that the amateur has doubts in his mind as to where he can get service for his batteries.

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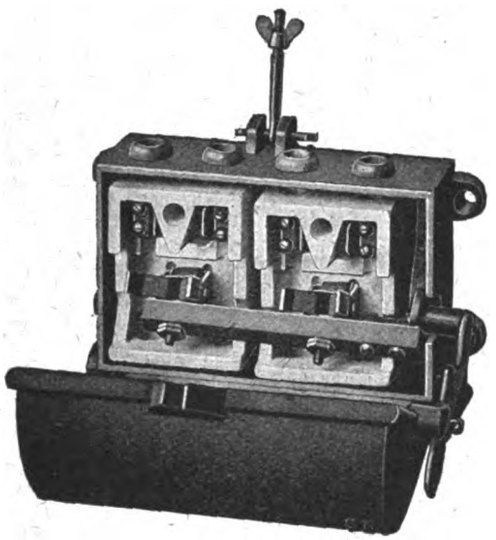
A "Bread and Cheese" Line.

"Bread and cheese" lines of electrical apparatus are the most difficult to buy. The buyer is liable to cultivate the habit of assuming that, because a piece of apparatus has become universally used, or is sold at a competitive prce, there is no need to worry as to who made it. This is a mistake. Even for these "bread and



ELECTRICAL "BREAD AND CHEESE."

cheese" lines, care should be taken to buy the product of a manufacturer whose reputation for quality is well founded and deserved.

We purposely use a "bread and cheese" line to illustrate this note and to point our moral. It is a simple D.P. 15/20 A 250 V ironclad switch manufactured by the VINCENT ELECTRICAL MANUFACTURING CO. It makes no pretence to anything revolutionary in design, but it is none the less a sound and well-made switch at a keen price.

The "Tungar" Battery Charger.

The intriguing word "Tungar" is now almost a household word in the electrical field. We understand that the manufacturers, the BRITISH THOMSON-HOUSTON CO., intend that it shall be a household word. Certainly it will be in a.c. districts. The reasons for this are several, but the manufacturers have great faith in two of these. One reason is the active publicity campaign in form of attractive folders (suitable for overprinting, please note, Mr. Retailer), and press advertising; and the other is the demand which must come from the wireless boom, for a "simple to use" battery charger.

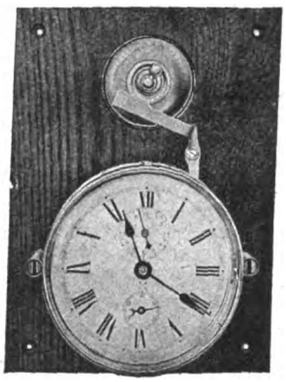
Electrical retailers would be wise to learn all there is to know about the B.T.-H. "Tungar." The demand exists, and the British

THE "TUNGAR" BATTERY CHARGER.

public will be served, even if it be through the departmental stores and large household chemists. It is sound and logical to assume, however, that the wireless amateur will at once think of an "electric shop" when he needs a battery charger, and the British Thomson-Houston intend that he shall ask for (and demand, if need be) a "Tungar." The "Tungar" which we illustrate is the 2A size. It is made in several frequency ratings to provide for all a.c. circuits in this country. It is not, however, our intention to describe in these columns the technical details. We repeat that the British public will be served, and there is no real reason why the electrical retailer should not do that serving with turnover and profit.

A Lesson for Electric Shops.

"Window Effects by Night" is the intriguing title of a folder issued by VENNER TIME SWITCHES. Before, however, the contractor or retailer can go forth and spread the gospel which is the faith of Venner's he must learn the lesson given in this folder and be converted to using a time switch on his own premises. Who shall deny that the average of "electric shop" windows are most miserably lighted, and promptly on time at night even this miserable light fails. It has been said that the rent of a shop in a main thoroughfare can be reckoned in the terms of pounds, shillings and pence per foot run of shop front. There is, however, no limitation to the number of hours the shop front can be used, and if there were any advantage in it the front could be flooded with light 24 hours in the day. There is no object in this, however, and the method is wasteful. For the Venner time switch will do all that is necessary at the right moment and beyond doubt. The reason why electric shops should light their windows late into the night can be simply put. What more subtle suggestion can be made than by a well-lighted window displaying all the wonderful hundred and one things for the "ideal home" which only the electric shop can offer. The only other argument necessary to convince traders of the business pulling value of a shop window well lighted late into the night is a good supply of Venner folders and E.D.A. pamphlet No. 265.

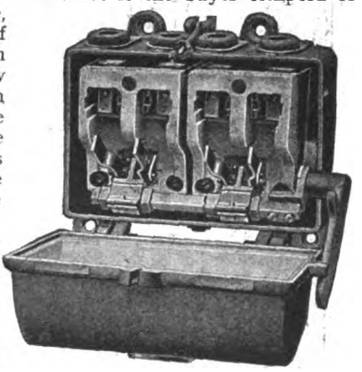


AN ESSENTIAL ACCESSORY FOR SHOPS.

The switch which we illustrate is one which is most suitable for average shop windows, being rated at 5 A and 250 V. The list price is two guineas.

New Pattern "Tucker" Ironclads.

The buying of electrical apparatus on the most economical basis is a difficult task. The qualification of "economical basis" is the condition which makes the task difficult. Apparatus tends to become standardised in the sense that it becomes an article of more or less everday use, and it is such apparatus that it is difficult to buy, because it is human nature to buy on price first. Particulaily when buying ironclad switches is the buyer tempted to buy on price and price alone, because the development of this type of switchgear has been so rapid during the last few years that there is little room for novelty in design. Hence ironclad switches are "as like as two peas," but none the less the buyer must not fall into the temptation of buying on price only.



TUCKER'S LATEST LINE.

The switch which we illustrate is manufactured by J. H. TUCKER AND CO., and is one of a new range made in double, triple and four-pole. Many recent improvements are now embodied in this range of switches. The particular detail which will appeal to all engineers is the handles, which are interlocked with the cover and are permanently and effectively earthed. Each switch in the range is suitable for 500 V circuits and complies with the Home Office requirements. The faults which develop in many ironclad switches after but little use have been carefully studied and kept clear of, and it is believed the many improvements will enable users to buy a "service"—not just merely an "ironclad switch."

The "Nife" Portable Hand Lamp.

The public is becoming sceptical of the practicability of a portable hand lamp for domestic use. This is owing to the fact that many retailers deviated from the sound policy of marketing only a device that is really built for this purpose. This type of device does lend itself to much scamping in manufacture and at once becomes a "novelty" instead of a piece of electrical apparatus. It is not the function of an electrical shop to sell a "novelty" for a hand lamp. The selection of reliable hand lamps is probably not large, but among the best can be counted the "Nife," made by BATTERIES, LTD. This hand lamp contains one of the "Nife" accumulators that have proved so successful for miners' lamps. The accumulator is made of steel and is not affected by rough treatment, and quite unspillable, clean and safe and requires no skilled attention. It contains neither lead nor acid, which is a great selling point.

A NEAT PORTABLE HAND LAMP.

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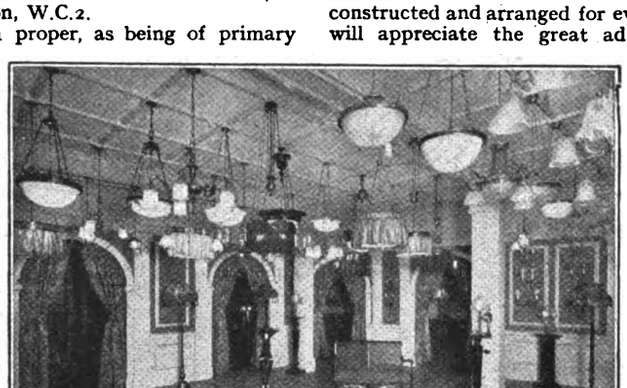
A Modern Electrical Showroom.

Sun Efforts towards Electrical Development.

A good electrical showroom always causes us a double sense of pleasure. In the first place, it is an indication of the spirit of enterprise and consequent prosperity which animates the particular firm concerned. In the second, a good showroom is of importance to the electrical industry as a whole. For both of these reasons, therefore, we are particularly glad to be in a position to give some particulars regarding the considerable extensions which have recently been made to the premises of the Sun Electrical Co., at 118-120, Charing Cross Road, London, W.C.2.

Dealing first with the showroom proper, as being of primary importance, we cannot do better than quote an extract from the company's catalogue to the effect that "Fittings are really displayed—not packed together." This, in itself, is almost sufficient description of the excellent arrangements which the company have made for assisting their customers to sell electrical appliances to the public.

There is, however, one feature which impressed us particularly—viz., the provision of no less than five separate small showrooms each furnished in the style of a particular period, and thus enabling the purchaser to see what a particular fitting will look like under the conditions of his own home. Included among these, "period" rooms are furnished in the Georgian, Jacobean, French period, Adam, and modern styles.



"Fittings Displayed—Not Packed Together."

be omitted that the Sun Electrical Co. are doing large business in wireless receiving sets, and stock a large variety of various types and makes of apparatus.

Following a visit to the showroom, the privileged visitor has an opportunity of seeing the excellent arrangements which have been made in the new warehouses, both for the storing and quick despatch of goods. These warehouses extend to a conside able distance from the front of the pr mises and have all been specially constructed and arranged for every particular purpose. Our readers will appreciate the great advantage of this, as it permits an extremely large number of different kinds of material and finished articles to be stored in such a way that they are easily accessible. At the back of the warehouse goods are received and despatched, thus avoiding all the usual difficulties which occur when goods have to be received from the front through the showrooms and offices themselves.

Leading out of the main warehouse is a special demonstration showroom, which has been arranged for laundry machines. All facilities are available for the actual demonstration of these machines at work. It is encouraging to note that the company are experiencing an ever-increasing demand for washers.

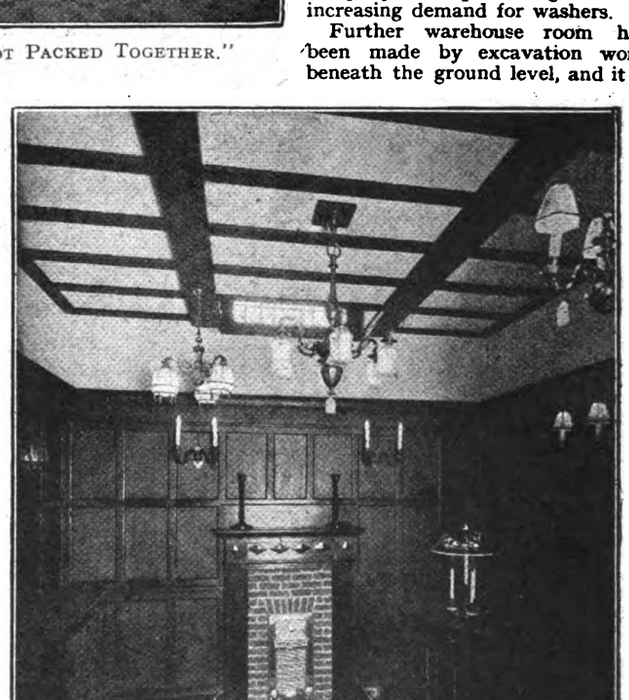
Further warehouse room has been made by excavation work beneath the ground level, and it is interesting to recollect that one of these subterranean rooms was many years ago the complete office and showroom of the company as it then existed.

The ground floor itself is occupied by various trade counters, each dealing with its allotted section of the trade, and owing to the warehouse organisation already mentioned, a quick service of supply is available for any customer wishing to take away his purchase.

In every way the company are to be congratulated, both in the reorganisation which has been effected and also on the great increase in their business which has warranted it.

We are not able to give any but the briefest description of the premises, but we can safely say that any visitor there would be immediately impressed with the sense of efficiency which pervades the whole atmosphere.

Electric Fittings in a Georgian Interior.



A Reproduction of an Early Interior.

The New Showrooms of the Sun Electrical Co.

A further special portion of the showroom is devoted to the display of electrical appliances in the kitchen and for the table. Here, in addition to the usual choice of electric kettles, etc., are also to be found numerous appliances which literally would enable the user to depend upon electricity for his every need and comfort.

The main showroom itself is, of course, largely devoted to lighting fittings, of which the company offers an extremely wide choice, all of them artistic in the highest degree. We may mention here that owing to special arrangements which have been made with a Continental firm, the company is able to supply an extremely large variety of the best Continental fittings. In the main showroom also a handsome fireplace has been particularly constructed for the display of "Magicoal" electric fires.

Before turning to the other parts of the premises; the fact must not

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Henry Ford's Life and Ideas.

By SIR ERNEST BENN.

The life and work of Henry Ford, just published by Doubleday, Page and Co., of New York, would more appropriately be entitled "Utopia," by Ford* This is in my judgment a most extraordinarily valuable book—not because of any particular suggestion that it makes, or any particular opinion that it gives, but because of its utter originality, and the freshness which it brings into the atmosphere. Twenty years ago Henry Ford was a poor man; in 1905 he was making such a nuisance of himself in the streets of Detroit with a motor-car that he had to get special permission from the mayor of the city, and thus became the only licensed chauffeur in America, if not in the world. That is only 18 years ago. To-day Henry Ford is, without question, the richest man in the world, and millions of people, more than sufficient to populate an Empire, are running about the country at their pleasure in motors which they would never have seen but for him and his genius. He employs some fifty thousand persons who are the best-paid workers in the world, and within the short space of the recollection of every one of us has wrought miracles and literally achieved the impossible.

If I started quoting I could fill columns, but here are two or three gems: "John Burroughs was never too old to change. He kept growing to the last. The man who is too set to change is dead already. The funeral is a mere detail." "Edison is easily the world's greatest scientist. I am not sure that he is not also the world's worst business man. He knows almost nothing of business." "Our eight-hour day is a day of eight hours, and not a basis for computing pay." "Lawyers, like bankers, know absolutely nothing about business."

The Idea of Service.

These samples are, perhaps, at least sufficient to show that there is a deal of interest in Ford's book, but it would be a gross injustice to hold them up as samples of the whole. The work has a much more serious value. From cover to cover it breathes the idea of service. The richest man in the world protests that he has never tried to make money, and he makes good his case. He tells us without any qualification that if we will devote ourselves to service we cannot fail to make money.

The Ford car is produced, first, for the user, second, for the well-being of those who help to make it, and third and last, and incidentally, for the stockholders and proprietors of the company. By giving the maximum value to the consumer, the maximum return to the worker, by quoting lowest prices and paying highest wages, Ford has been unable to avoid becoming the richest man in the world. This extraordinary man takes over a railway that is in difficulties and turns it into a great success, simply by imposing upon it and everyone in it the idea of service. In a word, he says to all of us, "Think of the other man, and you will be all right."

One last point: Henry Ford is undoubtedly an autocrat, a despot. The work he has done is due to his remarkable personality; it would not have happened but for Henry Ford. He is in every sense of the word an emperor among men; and this is, perhaps, the most interesting big point in the whole of the book under review. All the way through he uses the word "we." Whatever is done in the Ford works, "we" did it, "we" thought, "we" tried, "we" found. This, if you please, from the lips of the one man among all others who should be entitled to use the first person singular. That simple little detail probably explains the whole business.

The Institute of Patentees.

Help Rendered to Inventors.

Mr. MORGAN MORGAN was re-elected president of the INSTITUTE OF PATENTEES at the annual meeting on March 21st. Referring to the work and progress of the Institute, he stated that the membership now exceeded 1 200, and deplored the tendency on the part of some members to resign when informed that their inventions were not likely to be commercially successful.

The Institute, he said, had now been officially recognised by the Board of Trade, and had been instrumental in securing the recommendation for the grant of Imperial patents, valid throughout the Empire, to British subjects. They proposed shortly to re-open the question of the life of patents. The Act of 1919 only granted a two-year extension, which was inadequate, in view of the years lost owing to the war, when inventions could not be commercially developed. Other countries, said Mr. MORGAN, had extended the life of patents for 20 years. In conclusion, he urged that the fees at present charged by the Patent Office were too high. Their reduction would mean the encouragement of inventors and industry.

Mr. G. R. CHEESMAN said that an inventor was being done good service by the Institute if he was frankly told that his invention was not a commercial proposition.

Several members spoke in high terms of the services rendered to them by the Institute, and the suggestion was made that lectures should be held under the Institute's auspices in London and in the provinces.

At the annual banquet in the evening, Professor A. M. Low, speaking of future scientific progress, forecasted the greatly extended use of electricity for communication and power transmission.

* "My Life and Work," by Henry Ford in collaboration with Samuel Crowther. New York: Doubleday, Page and Co.

B.E.A.M.A. Annual Meeting.

Mr. Longbottom on the Policy of the Association.

The annual general meeting of the BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION was held at the Connaught Rooms, London, W.C., on March 15th, Mr. B. Longbottom, Chairman of the Council, being in the chair.

After the usual business had been concluded the Chairman submitted the income and expenditure account and balance-sheet for the year ended September 30th, 1922, and after observations by him the accounts were adopted.

In submitting the annual report for 1922 (summarised on p. 319 of our last issue), Mr. Longbottom referred to the progress made in the organisation of the Electrical and Allied Engineering Section of the British Empire Exhibition. The amount of space actually let was 60 per cent. of the whole, while an additional 20 per cent. had been applied for.

Mr. Longbottom also referred to the World Power Conference. In this country a committee was being formed to organise the Engineering Section, and representatives had already been nominated by the Institution of Civil Engineers and the Institution of Mechanical Engineers, and were expected from the Institution of Electrical Engineers. Similar arrangements were being made in Canada, U.S.A., France, Italy, Norway and Sweden, thus indicating the magnitude and importance of the Conference. With regard to internal affairs, Mr. Longbottom spoke in high terms of the work done during the year by the Traffic Committee. It might not be generally known that their influence was felt in any transport work undertaken by the Associated Chambers of Commerce and the F.B.I.

After reference to the "B.E.A.M.A. Journal," Mr. Longbottom, in conclusion, said:

"One word more with regard to our Association generally. We are sometimes told that we do not advertise ourselves sufficiently—that we do not come out sufficiently into the open. I can only say that it is not our object to advertise the Association, but to do sound and productive work on behalf of our members, which is the best advertisement, and in this way to benefit the industry as a whole. In most cases we work in conjunction with, and give our support to other less specialised associations, such as the Federation of British Industries, as well as to the kindred bodies, the Institution of Electrical Engineers and the British Engineering Standards Association, and to those more specialised institutions formed for a specific purpose, such as the Electrical Research Association and the Electrical Development Association."

The report was, on the motion of the Chairman, then adopted.

Employers and the E.P.E.A.

National Joint Board Functioning Again.

A conference lasting six hours was held at the Ministry of Labour on Saturday between representatives of electricity undertakings and of the E.P.E.A. Sir David Shackleton presided, and the following official statement was issued:—

"The whole question of the difficulties which had arisen between the two sides of the National Board for the electricity supply industry have been very fully discussed, and, as a result, agreement has been reached which has removed the deadlock, and the matter will be further discussed by the National Joint Board at their next meeting. The case of the Halifax Corporation will be taken up by the National Board now that it is again functioning."

Wages Reduction in West Midland District.

The Secretary of the West Midland District Industrial Council for the Electricity Supply Industry states that the next wages revision, in accordance with the national agreement, is due to operate from April 1st. It will be based upon the index figures of the cost of living published in the "Labour Gazette" for the preceding quarter, and will entail a reduction of a halfpenny per hour for adult workers, 1s. 4d. per week for youths, and 9d. per week for boys. An electrical fitter who was paid 2s. 1d. per hour under the agreement of July, 1920, will, from April 1st, receive 19·14d. per hour at the result of the latest reduction. The average index figure for the quarter is 77 per cent. above the figure for August, 1914.

A card showing the badge worn by the undertaking's inspecting staff and giving the telephone numbers of the head office, sub-offices, power stations and showrooms has been issued by the NORTH METROPOLITAN POWER SUPPLY CO.

A copy of the first number of the "Benjamin Bulletin" reaches us from its publishers, the BENJAMIN ELECTRIC, LTD. Of attractive appearance, the publication is designed to deal with automobile matters in general and the firm's accessories in particular.

THE NORTHWOOD ELECTRIC LIGHT AND POWER CO. have issued a booklet entitled "The 'All Electric' House" whose sub-title is "Use Electricity." It conveys the idea of service to the consumer and indicates by means of illustrative and chatty paragraphs the uses to which electricity can be put in the home. We see the hand of E.D.A. in this, and needless to say, therefore, it is a publication to be recommended.

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Legal Intelligence.

B.T.-H. Patent Litigation.

In the Chancery Division on March 23rd, injunctions were granted to the British Thomson-Houston Co. restraining L. M. Don and the Premier Electrical Stores from infringing their patents for leading-in wires for electric lamps. The injunctions retrained the defendants from parting with possession of the alleged infringing goods.

On March 22nd, Mr. JUSTICE SARGANT gave judgment for the British Thomson-Houston Co. in default of defence against Electric Auto Supplies. Counsel said the action was to restrain infringement of patents relating to leading-in wires.

In connection with an action by the British Thomson-Houston Co. against George Hunt, trading as Forum and Co., Dudley Street, Birmingham, application was made in the Chancery Division on March 23rd for an interim injunction to retrain the defendant from manufacturing the plaintiffs' patent for drawn wire for electric lamps.

Counsel said it was discovered in 1921 that the defendant was selling tungsten wire lamps and other lamps infringing plaintiffs' patents, and writs were issued against him. In one case an injunction was granted by consent against the defendant; in two others Mr. Hunt represented himself as a poor ex-Service man, and the plaintiffs accepted an undertaking from him, and withdrew the actions. He undertook not to infringe the plaintiffs' gasfilled or drawn wire patents. He had, however, continued to sell drawn wire lamps, and when plaintiffs remonstrated he said he thought he had only given an undertaking with regard to the leading in wire patent and the gasfilled lamp patent.

Counsel for defendant said he was under the impression that his undertaking was limited to these patents. This drawn wire patent case, however, was going to be fought. The plaintiffs were secure in their position as to the leading-in wire and gasfilled patents, but with regard to the drawn wire patent the validity of it was challenged. The defendant was backed by the manufacturers, and was anxious to fight the action.

Mr. WATSON (for plaintiffs) said the manufacturers behind the defendant resided in Holland, and they could not be got at. He asked whether they would allow themselves to be added as defendants to the action.

Mr. TERRELL (for defendant) said he thought they would, but he would have to get instructions as to that.

Mr. JUSTICE SARGANT directed the motion to stand over until March 28th, in order that Mr. Terrell might ascertain the intentions of the manufacturers.

Contracts for Mica Discs.

The hearing was concluded on March 26th in the Court of Appeal before Lords Justices BANKES, SCRUTTON and YOUNGER of the appeal of the defendants in the case of the Mica and Asbestos Insulating Co. (of Leroy Street, Old Kent Road, S.E.) *v.* the Fellows Magneto Co. (of Cumberland Avenue, Park Royal) from the judgment of Mr. Justice Coleridge in the King's Bench Division (see THE ELECTRICIAN, December 29th, p. 754).

The plaintiffs brought the action to recover under three contracts £2 460 for goods sold and delivered, the contracts being to supply to the defendants 2 600 000 mica discs. Alternatively the plaintiffs claimed damages for the alleged breach of contract by the defendants in refusing to accept delivery of the goods which were used in the construction of magnetos, and which they said, being cut to the specifications of the defendants, were of no marketable value for any other purpose than that for which the defendants required them, except as scrap material.

Defendants admitted that the orders were given, but alleged that the contracts contained a clause which gave them the right of rejection if the discs should be found to be inferior in quality or in any way defective. They also alleged that a large part of the plates delivered were of inferior quality and unfit for the purpose for which they were required—viz., that they were badly cut and trimmed and did not comply with the specification, and therefore, that they were justified in returning the goods.

Plaintiffs denied that the plates were of inferior quality, or were defective, or did not comply with the specifications.

Mr. Justice Coleridge, after hearing a great deal of conflicting evidence, gave judgment in favour of the plaintiffs for £2 203 11s., with costs, and from this decision the defendants now appealed.

In the result, their Lordships allowed the appeal, and ordered a new trial before an Official Referee. The appellants were awarded the costs of the appeal and the costs of the first trial were ordered to abide the result of the second trial.

On the Red Star liner "Belgenland," which has just left Belfast, the whole of the COOKING IS DONE BY ELECTRICITY.

It is officially stated that Mr. GEORGE BALFOUR has acquired the control of the Grampian hydro-electric scheme for his associated interests.

At BOOTLE last week, Frank William Openshaw was fined £10 for fraudulently obtaining a supply of electric light by tapping the Corporation cable.

Obituary.

Thomas Campbell.

The death took place on March 17th, at the age of 62 years, of Mr. THOMAS CAMPBELL, who was in business with his son, as an electrician, in Hall Street, Southport.

Walter Henry Willcox.

Mr. W. H. WILLCOX, governing director of W. H. Willcox and Co., London, S.E., died on Monday. The funeral will take place to-morrow at Nunhead Cemetery at 11.30 a.m.

William Walker Hood.

The "South Wales News" records that electro-farming was one of the hobbies of Mr. WILLIAM W. HOOD, the South Wales colliery owner, who was killed by falling from a train on Saturday. Mr. Hood had a large estate in Scotland, on which he put electro-farming methods into practice with much success. He was especially proud of the success which he achieved in making hay without sunshine. His theory was that if a mining engineer knew anything at all of his profession he knew all about ventilation; and he claimed that it was because he was equipped with this knowledge that he managed to make stacks of good hay from wet grass by the judicious working of electrical fans.

Gilbert North.

It is with deep regret that we chronicle the death from pneumonia on March 5th, of Mr. GILBERT NORTH, of the Metropolitan-Vickers Electrical Co. He was a very old servant of the company, having joined the British Westinghouse Electric and Manufacturing Co. in 1903. He left them in 1913 and became managing director of the Dickenson Engineering Co. His strenuous work with this firm through the years of the war when labour conditions were so difficult underminded his health and he was far from well when he rejoined his old firm in November last. Mr. North was an adept at meter design, and many features of the present day a.c. meter were originated by him. He was a great moral character and made a marked impression on those with whom he came in contact.

Sir James Dewar.

We regret to announce the death of Sir JAMES DEWAR, which took place in London on Tuesday. Born in 1842, he was educated at Dollar Academy and Edinburgh University, and subsequently studied in Ghent. He was later Jacksonian Professor of Natural Experimental Philosophy at Cambridge, and Fullerian Professor of Chemistry in the Royal Institution, which latter chair was formerly held by Faraday. His researches included an investigation into the physiological action of light. In conjunction with Professor McKendrick, he succeeded in proving that the effect of light on the living retina is to produce a sudden alteration in its electrical condition. In 1891, Sir JAMES DEWAR made a highly interesting communication to the Royal Society. On the occasion of the celebration at the Royal Institution of the centenary of Faraday's birth he gave several beautiful illustrations of the peculiarities of liquid oxygen and subsequently experimented with a view to ascertaining its behaviour in the magnetic field. In conjunction with Professor Fleming, he carried on researches on the electric and magnetic properties of metals and other bodies at low temperatures, as well as investigations for determining the dielectric constants of bodies at and above the temperature of liquid air. He was awarded the Rumford Medal of the Royal Society in 1894, the Albert Medal of the Royal Society of Arts in 1908, and the Davy Medal of the Royal Society for Researches at Low Temperatures in 1909. He was also awarded the Hodgkins Medal of the Smithsonian Institution of Washington.

Personal Items.

Major G. G. EWER, sales engineer of the Stepney electricity undertaking, has resigned.

Mr. C. A. NEWTON is president-elect of the Derby Chamber of Commerce. He is a member of the firm of Newton Bros. (Derby), Ltd.

Mr. GEORGE MARSHALL HARRISS, general manager of the Dublin United Tramways Co., has had the honorary degree of M.A. conferred upon him by Dublin University.

Mr. COLIN MILTON, station superintendent at Loughborough Corporation electricity works, has been appointed borough electrical engineer at Gillingham, Kent. There were 117 applicants for the position.

Mr. EDWARD COX-WALKER, founder and governing director of Cox-Walkers, Ltd., celebrated his diamond wedding on March 10th. An illuminated address was presented to Mr. and Mrs. Cox-Walker by the employees of the firm in honour of the occasion.

Mr. W. S. CROFTS, who during the past two years has been acting as resident engineer of the National Electric Construction Co., has been appointed engineer and manager of Bo'ness Town Council, who are about to take over the works from the lessees whose agreement has expired. There were about 70 applicants for the position, and the salary is £350.

Mr. WILLIAM J. LLEWELLYN was at Newport last week presented with the King's Imperial Service Medal, following his completion of 47 years' service in the Post Office engineering department. He assisted the late Sir John Gavey with the earliest telephone intercommunication service introduced into this country between Cardiff and Newport, and was also associated with early wireless experiments conducted under the Preece-Gavey system.

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The Mullard Valve.

Marconi Appeal Fails.

The Court of Appeal, consisting of the MASTER OF THE ROLLS and Lord Justices WARRINGTON and YOUNGER, on March 23rd delivered considered judgment in the case of Marconi's Wireless Telegraph Co *v.* the Mullard Radio Valve Co., upon the appeal of the plaintiffs and the cross appeal of the defendants from the judgment of Mr. Justice P. O. Lawrence in the Chancery Division (see THE ELECTRICIAN, October 27th, 1922, p. 488, and February 2nd, 1923, p. 123).

The plaintiffs brought the action for an injunction to restrain the defendants from infringing the letters patent granted to H. J. Round in 1913 for an alleged invention relating to improvements in wireless receivers and also of letters patent granted to Michel Peri and Jacques Biguet of an alleged invention relating to improvements in vacuum tubes, the plaintiffs being the registered owners of both patents. Plaintiffs also claimed damages.

Mr. Justice Lawrence held that what the defendants had done did not constitute an infringement of either of the plaintiffs' letters patent, but that the defendants' attack on the validity of those two patents failed. He directed that the plaintiffs should pay the general costs of the action and the costs of the issue of infringement, and that the defendants should pay to the plaintiffs the costs involved by their attack on the validity of the letters patent of the plaintiff company. Hence the present appeal of the plaintiffs and the cross appeal of the defendants.

Judgment.

The MASTER OF THE ROLLS, in the course of an elaborate written judgment, said this was an action in which the plaintiffs alleged that the defendants had infringed two patents of which they (the plaintiffs) were the registered owners, one granted to Henry Joseph Round, No. 28 413 of 1913, and the other granted to Michel Peri and Jacques Biguet, No. 126 658 of 1916. The defendants denied the infringement of either patent, and disputed the validity of both. The patents were quite distinct and required the consideration of different circumstances in each case. Round's patent was the earlier in date and far more important. It was a patent for the improvement of receivers in wireless telegraphy. Claim 3 of the specification was for "A vacuum tube containing a hot filament, a grid formed as a closed cylinder completely surrounding the filament and a third electrode in the form of a cylinder surrounding the grid substantially as described." To appreciate the meaning of the specification it was necessary to look at the state of things prevailing in the industry at the time of the invention, and the kind of vacuum tube then in existence, in order to see what meaning a person who knew about those things would attach to the words used. He (the Master of the Rolls) took that as stated in the judgment of Mr. Justice Lawrence.

What is a "Closed Cylinder?"

Round had improved on von Lieben's patent by making the grid and the anode in the form of cylinders. He agreed with Mr. Justice Lawrence that the grid must be in the form of a closed cylinder, and the anode in the form of a cylinder open or closed. The real question in the case was what the words "in the form of a closed cylinder" meant. Defendants' contention was that they meant "closed at both ends"; the plaintiffs' that they meant "electrically closed." There was, however, no difference in the form of an electrically closed and an electrically open grid in the form of a cylinder; and that being so it was idle to specify that the grid must be in the form of a closed one. In ordinary language "closed cylinder" meant one closed at both ends, and "open cylinder" one open at the ends. At the time when Round's invention was patented all the valves in use were what were called "soft valves," viz., valves containing an appreciable amount of gas and the filament was generally a hairpin filament. Probably it was for those reasons that Round specified a grid in the form of a closed cylinder in the ordinary sense of the word. The physical separation of the spaces as contemplated by von Lieben and effected by a grid in the form of a physically closed cylinder was much less important in the case of a hard valve, free from gas, using a straight filament, the hottest portion of which was in the middle. He (his lordship) thought that the words "closed cylinder" meant "closed" in the ordinary sense, and the words "completely surround" pointed in the same direction.

He could not accept the argument of Mr. Hunter Gray that the cylinder could not possibly be completely closed in the ordinary sense. On that construction there was no infringement of Round's patent, as the defendants' grid was a loosely-coiled wire which could hardly be called a cylinder at all. Round's patent was no doubt a very useful invention, which very likely would have held the field f the use of soft valves had continued, but the introduction of hard valves had made it possible to produce the same result without employing the apparatus which was the subject of the patent.

Construction of Peri's Specification.

His Lordship then briefly referred to Peri's patent, which he said was of much less importance, and in regard to which he said he was in entire agreement with the judgment of Mr. Justice Lawrence that the claim there was an exceedingly narrow one. The defendants' valve completely differed from that of Peri. He thought that Mr. Justice Lawrence's construction of the specifications was the correct one, and that the defendants had not infringed either of the patents. In the circumstances it was not necessary to consider the validity of either patent.

Lord Justice WARRINGTON also delivered a long written judgment to the same effect. He agreed with the judgment of Mr. Justice Lawrence that the defendants had not infringed either of the plaintiffs' patents, and he also agreed with the learned judge on the issue of validity.

Lord Justice WARRINGTON read the judgment of Mr. Justice YOUNGER to the same effect, and accordingly both appeals were dismissed.

It was arranged that the question of costs should be argued on the first day next sitting.

Rights of a Supply Company.

Judgment against Southport Corporation.

The Court of Appeal, consisting of the MASTER OF THE ROLLS and Lords Justices WARRINGTON and YOUNGER, on March 23rd, delivered a considered judgment in the appeal of the Attorney-General against a judgment of Mr. Justice Eve, in an action at the relation of the Birkdale District Electric Supply Co., for an injunction to restrain the defendant corporation from supplying electricity for traction in the urban district of Birkdale, or for the lighting of the public lamps there. The judgment of Mr. Justice Eve, against which the Attorney-General appealed, dismissed the action. (See THE ELECTRICIAN, July 28th, 1922, p. 108, and January 26th, 1923, p. 99).

In 1912, Southport absorbed Birkdale, which was previously a separate district, and the Southport Corporation as a consequence became liable under all contracts by which the Birkdale Urban District Council was bound, and the contention of the appellants was that on the construction of one of the agreements and of Section 23 of the Electric Lighting Act of 1909, the Corporation of Southport was entitled to supply electrical energy for the purposes of tramways in what was previously the Urban District of Birkdale. The contention was that both by contract and by Act of Parliament the Urban District Council of Birkdale was precluded from supplying electrical energy for the purpose of driving the cars, or for other purposes, and the Corporation of Southport was in the same position.

On the other hand, it was contended on behalf of the Corporation that it was in a position to make use of any energy it generated, and that such use was not a "supply" within the meaning of the Act.

Judgment.

The Master of the Rolls, in giving judgment allowing the appeal, explained that the main ground of the defence was that the defendants in supplying themselves and their own tramways with electricity were not "supplying" within the meaning of Section 23 of the Electric Lighting Act, 1909. To "supply," it was said, meant supplying by one person to another, and involved a supplier and a supplied. Mr. Justice Eve, said his lordship, had upheld defendants' contention, apparently against his own opinion, on the authority of "the West Surrey Water Co. *v.* the Guardians of the Chertsey Union," but he (the Master of the Rolls) could not see that that case could govern the present case, which was upon a different Act, and in which all the circumstances and provisions were different. The meaning of the word "supply" was the main question in this case, and that meaning must be governed by the circumstances and the context. By Section 23 of the 1909 Act, it was provided that:

> "Where in an area a local authority, company or person is authorised to supply electricity under Act of Parliament or under licence or Provisional Order granted under the Electric Lighting Acts, it shall not, after the passing of this Act, be lawful for any other local authority, company or person to commence to supply or distribute electricity within the same area unless such supply or distribution is authorised by Act of Parliament or by licence or Provisional Order granted in terms of the Electric Lighting Acts."

Construction of the word "Supply."

By Section 3 of the Electric Lighting Act, 1882, with which the Act of 1909 had to be construed, the purposes, both public and private, for which the local authority might supply electricity were defined, and by Section 4 the Board of Trade was empowered by Provisional Order to authorise a local authority to supply electricity for any public or private purposes within any area. In 1891 the defendants obtained such an order, but said that the Order was quite unnecessary to enable them to provide electricity for their own purposes, and that when they were so providing electricity they were not acting under the provisions of the Order at all. He (his Lordship) could not agree with that. Power was given to the defendants to supply electricity for public purposes, viz., lighting streets—which was a supply for their own purposes. And they also had the power under the Order to break up streets and do other things which they could not do without the Order. In the Order, the term "supply" was used in its most general sense and not in the restricted sense of supplying a person distinct from the supplier. The defendants, his Lordship thought, in this case were supplying energy under the powers of the Order, and the word "supply" could not have the restricted meaning of supplying to some person other than themselves. The defendants were, in his opinion, acting in violation of Section 23 of the Act of 1909, and the plaintiff was entitled to a declaration to that effect, and, if necessary, an injunction. The appeal would be allowed, with costs.

Lords Justices WARRINGTON and YOUNGER concurred, and judgment was given by them to the same effect.

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Imperial Notes.

AUSTRALIA.

The Burrinjuck Electrical Scheme.

It is stated that important developments regarding the proposed HYDRO-ELECTRICITY SCHEME AT BURRINJUCK (New South Wales), which are expected shortly, will greatly affect Wagga, Junee, Cootamundra and a number of smaller towns. Wagga recently installed a plant which has cost ratepayers already about £80 000, and which, it is believed, may shortly be superseded by the Burrinjuck scheme. An officer of the Public Works Department stated recently that tenders had been opened for the plant for Burrinjuck. A British firm submitted the lowest tender, £35 000, which is less than half the price quoted three years ago, and it is not expected there will be any hitch about the acceptance of the British tender.

Electric Supply Company of Victoria.

For the three months ended December 31st last, the receipts of the ELECTRIC SUPPLY CO. OF VICTORIA amounted to £37 058 and the expenses to £24 574.

CANADA.

Hydro-Electric Progress in 1922.

From figures compiled by the Dominion Water Power Branch of the Department of the Interior, Ottawa, it is shown that during 1922 the total WATER POWER INSTALLATION in Canada grew to approximately 3 000 000 H.P., of which 240 000 H.P. were installed during the year. This figure does not include 190 000 H.P. installed during 1921 but only brought into operation after that year closed.

The most significant feature of 1922 from the hydro-electric standpoint was the initiation of new development. Projects are under way which will have an ultimate capacity of over one million horse-power, thus indicating in no uncertain manner that the progress maintained through the war and post-war periods largely by the extension of existing developments will be sustained and probably stimulated by entirely new enterprise.

Attention may be called to the storage developments on Stave Lake and Falls Creek in British Columbia to increase the output of existing plants; the development of the Manitoba Power Co. at Great Falls on the Winnipeg river, where the first unit of a 168 000 H.P. development was put into service in December; the rapid increase of installation by the Ontario Hydro-Electric Commission at Queenston; the great activity in Quebec, which includes immense developments under way on the Saguenay river and at Gres Falls on the St. Maurice; also the steadily maintained progress in the Maritime Provinces.

Northern Electric Company's Results.

The report of the NORTHERN ELECTRIC CO. for 1922 states that, after providing for depreciation of plant, interest and Government taxes, the net profit for the year amounted to 129 897 dollars, which has been carried to surplus account.

Gold Mines and Hydro-Electric Power.

At the annual meeting of the Hollinger Consolidated Gold Mines on March 6th, the president, Mr. N. A. Timmins, announced that the Ontario Government had granted the company's request for a site on the Abitibi River for HYDRO-ELECTRIC POWER DEVELOPMENT. The scheme is expected to cost between three and four million dollars, and the site will be either at Island Portage or Long Sault. At the former point, which is 76 miles from the Hollinger mine, 30 000 H.P. or over could be developed, and at the latter point, which is only 56 miles away, the development of 25 000 H.P. is possible.

Foreign Notes.

EUROPE.

French Subsidy for Power Distribution.

The "Financial News" states that as a result of a Bill passed by the French Chamber on March 15th, the Government is GRANTING A SUBSIDY of six hundred million francs to enterprises for the distribution and application of electrical power.

French Railway Electrification Progress.

Summarising recent railway electrification progress in FRANCE, the "Information Financière" states that on the Culoz-Modane section of the P.L.M. Railway, the contract for the supply of the necessary current by private enterprise was approved last May. The final scheme for the equipment of the line is about to be submitted and the work will be begun as soon as this has been approved in order that it may be completed at the beginning of 1926.

On the Paris–Les Aubrais section of the Orleans Railway, the work now in progress consists of replacing the present current of 650 V with current of 1 500 V on the line from Paris to Juvisy and Bretigny. This stage of the scheme will be completed this year. The equipment of the other sections of the line from Paris to Les Aubrais (Orleans), the construction of the distributing lines of 90 000 and 150 000 V, and the manufacture of the necessary engines, are being actively carried out in order that the electrification of the whole line from Paris to Orleans may be completed in 1925.

So far as the Midi Railway is concerned, the equipment of the lines of thefirst section is in progress. At the end of last year electric trains were running from Pau to Tarbes, and in the course of the present year the line will be worked electrically from Pau to Montrejeau, and possibly to Toulouse. The distributing lines of 150 000 V will be completed during the current year and various hydro-electric stations will be in full activity.

State of the German Electrical Industry

A report of the Prussian Chambers of Commerce on German trade and industry during February states that in the ELECTRICAL INDUSTRY the inland purchasing power is still weak. Neither official nor private customers dare place orders for large plant and machinery. Further, the partial fall of prices is causing some customers to hold back in the hope of further reductions. Foreign countries are, for the most part, showing reserve, in so far as the German prices, which have partly reached the world's market level and partly already exceeded it, admit of any competition. Accordingly a general falling off in orders is noticeable in high pressure current articles, machinery, apparatus, calculators, installation materials and cables. With regard to measuring instruments and electro-medical apparatus, the position is no better, owing to customers' loss of purchasing power. The outlook for railway safety appliances is bad. The sale of electric lamps at home and abroad shows no improvement. Sales of electro-technical coal products are, in general, satisfactory.

LATIN-AMERICA.

Cartagena Electric Plant.

Speaking last week at an extra-ordinary general meeting of the CARTAGENA (COLOMBIA) WATERWORKS, LTD., the chairman, Mr. S. H. Jenks, said:—"With reference to the electric light and power plant, the first plant—I should say 'the new plant,' because the municipality have already had a plant which has not been very successful—is being installed with the idea of extension, and the estimate of the profit from this plant for the first twelve months is £14 000 per annum, but we anticipate an immediate expansion of profits until they get in the neighbourhood of £25 000 to £30 000 per annum."

Parliamentary Intelligence.

No Extension to Central Telegraph Office.

In a written answer to Mr. MIDDLETON on March 21st, Sir J. BAIRD stated that the scheme for providing an additional storey to the Central Telegraph Office building is not being proceeded with. Alternative proposals are now being discussed by the Post Office.

Special Orders Approved.

In the House of Commons on March 20th, the following Special Orders under the Electricity (Supply) Acts were, on the motion of Col. ASHLEY, approved:—

(*a*) Confirming an agreement between the Slough U.D.C. and the Slough and Datchet Electric Supply Co. (*b*) In respect of the urban district of Hoole and parts of the rural districts of Chester and Tarvin. (*c*) In respect of the urban district of Aberayron. (*d*) In respect of the urban district of Crook. (*e*) In respect of the burgh of Invergordon and part of the parish of Rosskeen. (*f*) In respect of the continuance and extension of the generating station at Limehouse.

Marconi Licences.

Mr. MIDDLETON asked the Postmaster-General on March 22nd whether he would lay upon the table the terms of the temporary licences granted to the Marconi Co. to send, receive and transmit public messages.

Sir WILLIAM JOYNSON-HICKS: As the hon. member was informed on December 12th last, no formal licences have been issued, but provisional permission has been given to the company to carry on wireless services with France, Spain and Switzerland. This permission was given by letter, and is subject to withdrawal, without giving rise to any claim for compensation, if a suitable agreement is not come to between the Government and the company as to the conditions on which licences for such communication will be granted. Any agreement that may be arrived at will be laid before Parliament.

Broadcasting—Methods and Policy.

On March 20th and March 22nd numerous questions were addressed to the POSTMASTER-GENERAL concerning broadcasting generally and the contract between the Post Office and the British Broadcasting Co. Sir WILLIAM JOYNSON-HICKS did not admit the assertion of Lieut.-Col. MOORE-BRABAZON that the programmes provided were inadequate or that they were inferior to those transmitted from French stations. Nor did he see his way to installing a listening-in set in one of the House of Commons Committee rooms. He denied that the North Foreland Wireless Station sent out untuned waves, but stated that such interference as was caused by the station was inevitable.

On March 22nd, Capt. BERKELEY called into question the contract between the Post Office and the British Broadcasting Co., asking whether it did not set up a monopoly in the manufacture of wireless instruments. The POSTMASTER-GENERAL intimated that the contents of the contract had been available for inspection for some time, whereupon Mr. P. HARRIS asked whether it was advisable that such important contracts, binding the country for a very long period, should be made without the sanction of the House. The POSTMASTER-GENERAL replied: I think that it is quite impossible that every individual contract dealing with Government matters should come up to be sanctioned by this House.

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Electricity Supply.

Extensions and Developments.

OLDHAM Town Council has received sanction to a loan of £30 000 for mains.

KEIGHLEY Town Council is seeking sanction to a loan of £7 000 for sub-station equipment.

A new turbo-alternator was brought into use at HUDDERSFIELD electricity works last week.

BRADFORD Electricity Committee proposes to spend £98 000 on a new turbo-alternator and condenser plant.

BELFAST Harbour Board has approved the erection of an electricity sub-station on a site in the Harbour estate.

MORECAMBE Town Council has decided to apply for additional powers to borrow £15 000 for electricity mains and services.

PRESTON Electricity Committee has decided that a retaining wall be constructed at the new power station at a cost of £2 126.

WALSALL Town Council is to spend £9 000 on additional plant at the generating station and on extending the area of supply.

LEICESTER Electricity Committee proposes extensions at the new generating station, including a new 10 000 kW set, at an estimated cost of £210 000.

It is proposed to install additional plant at FALKIRK electricity works at a cost of £30 000. The matter has been referred to a sub-committee of the Town Council.

The Heating and Lighting Committee of EDINBURGH Town Council has agreed to improve the lighting of the streets by increasing the wattage of the electric lamps from 150 to 300. This improvement will affect 660 lamps, at a total estimated cost of £2 710 per annum.

A further stage in the development of WREXHAM's electrical undertaking was marked last week, when the current was switched on from Gresford colliery to the central power station in the town. For some time past the capacity of the Corporation's plant has been inadequate to meet the demand, which now amounts to one and half million kWh per annum, and the Gresford scheme is an expedient pending a permanent solution of the problem of supply, which rests between the enlargement of the present station, together with the substitution of more modern plant, and a bulk supply from either Dolgarrog or Chester.

Alterations in Charges, Proposed and Actual.

GREENOCK shipbuilders are urging the Corporation to reduce the present charges for electricity.

BURNLEY Electricity Committee has been instructed to consider the question of reducing electricity charges for all purposes.

Charges have been again reduced at WIMBLEDON to 6d. per kWh (lighting) and to 1d. per kWh (summer) for heating and cooking.

HORNSEY Electricity Committee recommends that the additional charge of 40 per cent. over pre-war rates be reduced to 30 per cent.

In the accounts for the March quarter, CARDIFF electricity charges are to be reduced to 5½d. per kWh (lighting) and to 1¼d. per kWh (summer) and to 1½d. (winter) for heating and cooking. The power charge is to be 1¾d. per kWh.

ALDERSHOT Town Council has reduced the charge for electricity for lighting from 10d. to 9d. per kWh and the minimum charges to 11s. 3d. for the winter quarters, and 7s. 6d. for the summer quarters. The charge for power and heating remains at 4½d. or 2¼d. per kWh according to the amount used.

Tapping New Areas.

LEES is to be supplied with electricity by Oldham Corporation.

CALNE Town Council has engaged Mr. James Perkins to prepare an electric light scheme to lay before the Commissioners.

Torquay Electric Supply Co. has offered to erect a generating station at AXMINSTER for the purpose of supplying electricity locally.

SAFFRON WALDEN Town Council has approved the arrangements made by the Electric Lighting Committee with regard to the proposed generating station.

Residents at TWYFORD (Berks) have passed a resolution urging the parish council to do all in their power to further the development of the supply of electric lighting in the district.

HEADINGTON Rural District Council have informed the Oxford Electric Co. that they have no objection to the proposal to extend their mains to Headington, Cowley, and Littlemore.

HOLYWOOD (co. Down) Urban Council has decided to proceed forthwith with the scheme for the erection of an electricity generating station. The estimated cost of the scheme is £8 000.

WIGAN Electricity Committee is seeking powers authorising the Corporation to supply electricity to the houses existing and in course of erection or contemplated, in the district of Standish.

The South Metropolitan Electric Traction and Lighting Co. is to give a supply of electricity to WALTON-ON-THE-HILL, TADWORTH and BANSTEAD, and it is hoped that a supply will be available for next winter.

Inquiries and Orders.

The arbitration inquiry in connection with the acquisition by the NEWTON ABBOT Urban Council of the local electricity undertaking has been concluded, and the decision will be made known at a later date.

STROUD (Glos.) Rural Council has decided to put in an objection to the application of the West Gloucestershire Electricity Supply Co. for powers to supply electricity in the Council's area, so as to be in a position to oppose either this application or a similar one being made by Edwards and Armstrong, of Stroud.

CHADDERTON Urban District Council have applied to the Electricity Commissioners to amend the draft of a Special Order for the supply of electricity in Chadderton urban district by the substitution of a new list of streets for those given in the second schedule to the draft Order. Objections to the Secretary, Electricity Commission, Whitehall, London, by April 7th.

The LLANELLY AND DISTRICT ELECTRIC LIGHTING AND TRACTION Co. have applied to the Commissioners for a Special Order extending the area of supply under the Llanelly Electric Lighting Orders, 1891 and 1912, by adding the parishes of Llangenneeh and Llanedy, in Llanelly rural district. Objections to the Secretary, Electricity Commission, Whitehall, London, by April 14th.

A joint electricity scheme for taking over and controlling the generating stations in the WIRRAL peninsula has been prepared by the Electricity Commissioners. The proposal is to constitute a committee for the district on which Birkenhead will have three representatives, Wallasey three, Bebington and Bromborough one, Hoylake and West Kirby one, and the Wirral Rural Council and the Neston Urban Council one between them. The Commissioners propose holding an enquiry, and May 3rd has been provisionally fixed. The Wirral Council is to press for separate representation.

Miscellaneous Supply Items.

LEICESTER City Council is to appoint a special committee to inquire into the production and distribution of light, heat, and power by its Electricity and Gas Committees, particularly as to whether it is most economical to define, limit, or encourage competition between the two.

DALKEITH Town Council have had under consideration certain matters in relation to the electricity supply for the burgh. In a letter from the consulting engineers who have been acting for the Local Authorities in the Edinburgh and Lothians Electricity District in their arrangements with the National Electrical Construction Co., it was stated that the company's financial arrangements had now been completed, and so the construction of trunk lines and sub-stations would be immediately begun. It was further stated in the communication that it was expected a supply of the current would be available by about October. The Town Council are to communicate with the company who at present supply the current in Dalkeith as to their future intentions.

Forty Years Ago.

"The Electrician," March 30th, 1883.

ELECTRIC LIGHTING IN NEW ZEALAND.—The New Zealand Electric Light Co. are to light Lyttelton with sixteen Brush lights, equal to 3 200 candles, says the "Colonies and India."

THE ELECTRIC LIGHTING ACT.—Major R. Y. Armstrong, of the Royal Engineers, at present stationed at Chatham, has been appointed by the Board of Trade to superintend the carrying out of the provisions of the Electric Lighting Act of last session. Captain P. Cardew, R.E., has been appointed instructor in telegraphy at the School of Military Engineering, Chatham, in the place of Major Armstrong.

THE LAW COURTS.—The lighting of the Law Courts is now complete throughout, with the exception of a few trifling fittings. Twenty-two courts, the whole of the bar corridors, and staircases, approaches, robing and refreshment rooms are lighted by means of Swan lamps. The central hall has six Crompton arc lamps of the latest pattern, but at present it is not found necessary to use these on account of the light afternoons and evenings. Some of the courts, however, are so dark on a cloudy afternoon that steam is always kept up and light supplied whenever required. As our readers are well aware, the whole of this work has been carried out by Messrs. R. E. Crompton and Co., engineers to the Swan United Electric Light Co.

LONG DISTANCE TELEPHONY.—A telegram from the "Standard's" New York correspondent appeared in a recent issue of that paper, giving an account of a telephone trial which took place between New York and Chicago on the 25th inst. over a distance of 1 000 miles. The telegram went on to say: "Previously the longest distance over which a message had been sent was 700 miles, between New York and Cleveland. The present result is not due solely to the telephone, although that possesses some novelty, but is mainly due to a novelty in the conductor; this consisted of a steel wire core copper plated, the electrical resistance of which to Chicago was only 1 522 ohms, against upwards of 15 000 ohms, the average resistance of ordinary iron telephone wire." All this may or may not be true. Time will show. In the meantime, and until further details have come to hand, we advise our readers not to swallow too much of the information given above. As far as telephoning over 1 000 miles of wire goes, the Americans have been beaten by Australia. We have it on the best authority that 1 500 miles and more have been telephoned over in that country and speech distinctly heard. Whether the success of the trial in America really did lay with the wire used time alone can show.

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Tenders Invited and Accepted.

UNITED KINGDOM.

SALFORD CORPORATION. April 5th.—Supply, laying, etc., of about 5 200 yards of l.t. cable. Particulars from the Borough Electrical Engineer.

MANCHESTER CORPORATION, April 7th.—Two 300 kW rotary converters and four electrically-driven centrifugal pumps, etc. Particulars from the Secretary, Waterworks Offices, Town Hall, Manchester.

COMMISSIONERS OF HIS MAJESTY'S WORKS, ETC., April 10th.—Ceiling type electric light fittings for new Science Museum, London. Forms of tender from Contracts Branch, King Charles Street, S.W.1.

COVENTRY CORPORATION, April 19th.—Pipework for 1 000 kW turbo-alternator. Specification from the Engineer and Manager of the Electricity Department.

BAPTIST CHURCH, BINGLEY.—Wiring and fitting for electric light. Specifications from Mr. R. W. Preston, 26, Priestthorpe Road, Bingley.

IRELAND.

CAVAN COUNTY HOME AND HOSPITALS, April 10th.—(Sec. 4) Sterilising apparatus and heating of theatre; (sec. 6) electric lighting of theatre and residence. Specification from the Registrar, County Home Office, Cavan.

AUSTRALIA.

NEW SOUTH WALES RAILWAY DEPARTMENT, SYDNEY, April 18th—Electrical equipment for two 30-ton overhead travelling cranes. May 23rd.—Eight water-tube boilers for White Bay power-house. June 13th.—2 000 kW 50-cycle, 11 000 V turbo-alternators for White Bay power-house.

VICTORIAN ELECTRICITY COMMISSION, April 28th.—100 and 250 kVA 6 000 V transformers and spares.

SYDNEY MUNICIPALITY, April 30th.—Protective apparatus for generating end of parallel feeders, for Pyrmont power-house.

POSTMASTER-GENERAL'S DEPT., BRISBANE, May 11th*.—185 cable terminal boxes (Queensland stores schedule 576, technical specification 374).

MELBOURNE AND METROPOLITAN TRAMWAYS BOARD, May 16th.—Motor equipments and air brake equipments for bogie cars.

ROUMANIA.

DIRECTION GENERALE DES CHEMINS DE FER L'ETAT ROUMAINS, Rue Victoire, 124, Bucharest, April 14th.*—50 000 porcelain insulators.

SOUTH AFRICA.

CAPE TOWN CORPORATION, May 7th.*—5 000 25 A single-pole ironclad service cutouts.

PORTSMOUTH GUARDIANS have accepted the tender of H. A. Evans for electrical fittings, £46 16s. 6d.

SWINDON CORPORATION have accepted the tender of the Western Electric Co. for 2 225 yds. of l.t. cable at £436 4s.

J. Walton and Son have been given a contract for installing electric light at ST. PAUL'S CHURCH, OSWALDTWISTLE.

The tender of W. T. Henley's Telegraph Works Co. has been accepted by FAVERSHAM CORPORATION for cable, £400.

EAST HAM CORPORATION are recommended to accept the tender of the Enfield-Ediswan Cable Works for cables and fittings at £1 844.

MANCHESTER HOUSING COMMITTEE have accepted the tender of W. Spreadborough for wiring and fitting houses on Gorton Mount estate.

KIRKCALDY CORPORATION have accepted the tender of Fraser and Chalmers for a 3 000 kW turbo-alternator, £11 500, and a 3 000 kW condensing plant, £4 090.

The tender of British Insulated and Helsby Cables, Ltd., for cables, £10 089 5s. 10d., has been accepted by BETHNAL GREEN (LONDON) BOROUGH COUNCIL.

Adamson and Co.'s tender for sewage ejectors, with automatic electric compressing plant, has been accepted by PORT ELIZABETH (CAPE PROVINCE) MUNICIPALITY.

SHEFFIELD CLEANSING COMMITTEE recommend the Council to purchase nine chain-driven 5-ton electric vehicles from R. Garrett and Sons at £830 each, and one worm-driven ditto at £1 100.

WIMBLEDON CORPORATION have accepted the tender of Gwynnest Ltd., for a pump required in connection with new 3 000 kW alternator, £430; and that of Pooley and Austin for motor for driving same, £277 8s.

The following tenders have been accepted by SIDMOUTH URBAN DISTRICT COUNCIL: T. Hood and and Co., electrical plant, £4 287 13s. 0d.; Craven and District Private Telephone Co., mains, poles, etc., £1 437 5s.

The tenders of W. T. Henley's Telegraph Works Co. for 12 miles of 0·1 sq. in. cable, £2 610, and the Edison-Swan Electric Co. for 24 miles of 0·05 sq. in. cable, £934 16s., have been accepted by BIRKENHEAD CORPORATION.

* Particulars from the Department of Overseas Trade.

MANCHESTER EDUCATION COMMITTEE have accepted the following tenders: Power and Lighting Supplies, Ltd., wiring Oswald Road, Lily Lane and Charlton Central Schools; Electrical Maintenance Co., wiring Byrom Street School; J. V. Pyatt, wiring Lancastrian School.

SHEFFIELD CORPORATION have accepted the following tenders for tramway material: Forest City Electric Service Supply Co., copper bonds; Hadfields, Ltd., tiebars, points and junctions; Edgar Allen and Co., points, etc.; Cammell, Laird and Co., fishplates; G. Cooper and Sons, fish-bolts, nuts, etc. Titan Trackwork Co., junctions.

The following tenders have been accepted by WOLVERHAMPTON CORPORATION: Ferguson, Pailin Ltd., two converter cubicles, £167 7s. each; Cambridge and Paul Instrument Co., instruments, £133 4s.; J. Hopkinson and Co., valves, £520; H. Green and Co., two steam meters, £166 14s.; Lea Recorder Co., four coal meters £160.

HOLLINGS AND GUEST have received contracts from BIRMINGHAM SALVAGE DEPARTMENT for a hydraulic scrap bundling press and motor-driven pumps for Lifford depot, and a hydraulic paper baling press, a scrap metal bundling press, two sets of motor-driven pumps and a hydraulic accumulator for Brookvale depot, and from the BIRMINGHAM AND DISTRICT TAME AND REA DRAINAGE BOARD for a sludge pump.

LIVERPOOL CORPORATION are recommended to accept the following tenders: Pulsometer Engineering Co., two electric pumps in connection with 6 000 kW generating sets; Tudor Accumulator Co., battery, booster, etc.; Mather and Platt, two 500 kW rotary converters, switchgear, etc., for Lodge Lane substation and a rotary converter, switchgear, etc., for Waterloo station; English Electric Co. 100 40 H.P. tramway motors; H. Jones, wiring and fitting tenement flats, £150.

GLASGOW CORPORATION have accepted the following tenders:—British Thomson-Houston Co., two 1 500 kW rotary converters, £11 027; British Electric Transformer Co., two 400 kVA transformers, £441 each; Elliott Bros. (London), ammeters; Fleming, Birkby and Goodall, insulated belts; British Insulated and Helsby Cables, Ltd., insulated bolts, trolley and d.c.c. copper wire and trolley feeder cable; J. McMillan and Co., telephone sets.

MARYLEBONE (LONDON) BOROUGH COUNCIL are recommended to accept the tender of British Insulated and Helsby Cables, Ltd., for the supply of cables at the following rates per 1 000 yds., for the year ended March 31st, 1924: (*a*) 600 V lead sheathed, jute served, £14 267; (*b*) 600 V lead sheathed and armoured, £15 774; (*c*) 6 600 V lead sheathed only with B.O.T. earth sheath, £2 336; (*d*) 6 600 V lead sheathed and jute served, with B.O.T. earth sheath, £2 502; (*e*) pilot, 1 000 V, lead sheathed and jute served, £776. Highest and lowest quotations received were (*a*) £14 829 and £13·259; (*b*) £16 983 and £14 548; (*c*) £2 604 and £2 336; (*d*) £2 742 and £2 443; (*c*) £816 and £705.

MARYLEBONE (LONDON) BOROUGH COUNCIL are also recommended to accept the following tenders: G. and J. Weir (lowest tender) for two 20 000-gallon turbine pumps, £1 152 (four tenders were received, highest £3 549 10s.); Brightside Foundry and Engineering Co. (lowest tender) for supply of discharge pipework and valves out of ⅜ in. steel plate, £11 839 13s. 3d. (seven tenders received, highest £15 912); Babcock and Wilcox, high pressure steam mains, valves and traps, £7 400.

STEPNEY (LONDON) ELECTRICITY COMMITTEE recommend the Council to accept the following tenders:—W. T. Henley's Telegraph Works Co. (lowest), ½ mile 0·04 4-core armoured cable and ½ mile 0·1 lead-covered single cable, £362 10s. (three tenders received, highest £378); Stanton Ironworks Co. (lowest), water piping, £149 (three tenders received, highest, £171); General Electric Co. (lowest), 1 000 2-core cut-outs, £404 3s. 5d.; 250 3-core ditto, £156 5s.; 100 4-core, £95 16s. 8d.; and W. T. Henley's Telegraph Works Co. (lowest), 2 500 15/30 A cut-outs, £395 16s. 8d., and 1 500 30/50 A ditto, £306 5s. (In the case of the last item the General Electric Co. figure was the same.) W. T. Henley's Telegraph Works Co., 12 months' (estimated) supply of cable, £16 615 4s. 8d. (eight tenders received, ranging from £14 670 7s. 10d. to £17 920 7s. 2d.); Babcock and Wilcox (lowest), river water screening plant for Limehouse station, £3 598 (one higher tender received, £4 490, and also one lower, which did not comply with specification); Edison Swan Electric Co. (lowest), d.c. switchboard (with Weston instruments), £1 790 (ten tenders received, highest £2 660).

Business Items.

CARROLL, MAYNE AND CO. have acquired the goodwill of Sanders, Rehders and Co., fuel economy instrument makers, in liquidation.

The SALISBURY ELECTRIC LIGHT AND SUPPLY CO. have opened new offices and showroom premises at 27, Market Place, Salisbury.

The Rex House Wireless Co., Glasgow, have opened a branch at Cadzow Street, Hamilton, under the management of Mr. James P. Brown.

All communications for the European Engineering Department of the INTERNATIONAL WESTERN ELECTRIC CO. should now be addressed to Connaught House, Aldwych, London, W.C.2. Telephone: Central 7345; Inland telegrams: Relay, Estrand, London; Cables: Relay, London.

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Wireless News.

Lord Gainford on Licence Evasion.

Presiding at the statutory meeting of the BRITISH BROADCASTING Co. on March 22nd, Lord Gainford said that many people possessing sets had not yet taken out a licence, while others ignored some of the terms of the broadcast licence, thus preventing the company improving the quality of programmes. Dealers were said to be pushing the sale of sets employing reaction to customers who did not hold the experimental licence. Not only were thousands of people apparently content to listen-in for nothing, but there were still in many districts people wholly preventing their neighbours through reaction from enjoying what was broadcasted. The company wished to provide a constantly improving programme, but that could only be done with increased revenue, and when they knew that thousands of people were satisfied with contributing a few shillings a year by taking out a licence, it seemed the public were not dealing with the company quite fairly when they were endeavouring to get round the regulations which had been imposed by the Post Office. He asked that the company should have fair play.

Broadcasting in Sweden.

The Commercial Secretary to H.M. Legation at Stockholm reports that the SWEDISH TELEGRAPH ADMINISTRATION (RADIO BUREAU) have now published their views on the general question of broadcasting. The system proposed by them conforms more or less to that adopted in the United Kingdom. The licence fees will be paid to a single large broadcasting company, which will arrange programmes under a concession for a term of five to ten years.

The Government will establish broadcasting stations, at first in Stockholm, Gothenburg, Malmö, and Orebro, and later in a number of other towns. These will be rented by the broadcasting company, which, at the desire of the Telegraph Board, is to be specially formed for the purpose. In order to foster a Swedish radio-telephone industry, it is proposed to protect it from foreign competition for a period of two years on lines similar to those adopted in the United Kingdom. Installations already existing will be allowed to remain upon payment of the licence fee.

The initial cost of each station is put at 115 000 kr. They will work with a wave length not exceeding 425 m. Seven hours a day will be allotted to the broadcasting programme of the company, and one half-hour is to be reserved for the use of the Government between 6 p.m. and 9 p.m. in case they wish to make any announcement in this way. Advertising by broadcasting will not be permitted.

Certain alterations in existing wireless legislation (Law of March 31st, 1907) will be necessary, and the Telegraph Administration have therefore requested the Government to lay this question, together with their proposals, before the Riksdag.

Miscellaneous Wireless Items.

A battleship was successfully STEERED BY WIRELESS at manœuvres of the United States fleet last week.

Sir William Bull and Mr. W. W. Burnham have been elected directors of the BRITISH BROADCASTING Co.

The LONDON BROADCASTING STATION is to be moved from Marconi House as soon as a more convenient site can be found.

Manchester Wireless Exhibition.

Good Designs in Receiving Sets.

A striking feature of the wireless exhibition at Manchester, which closed on March 24th, was the beauty of design which has been achieved in radio apparatus. Such exhibits as the "Leyway" cabinets of RICHARD WHALEY, LTD., the ELWELL "Aristophone" cabinets, the gramophone loud speaker combinations exhibited by BRITISH RADIO SALES, LTD., and many others, combined excellent technical layout and workmanship with the pleasing design and finish of high-class furniture. The sectional bookcase principle is well utilised in the "Polar" cabinet set of the RADIO COMMUNICATION Co. exhibited by E. O. WALKER AND Co., Manchester. One of the most interesting exhibits of this kind was the "Surprise" Tingey Set exhibited by FINNIGANS, LTD., in which the action of opening the top doors raises into view a multi-valve panel. After use the panel sinks slowly down into its recess and the doors close automatically over it.

Excellence of design is shown also in the various exhibits of the less pretentious crystal and valve receiving sets. As recent developments the B.T.-H. combination valve-crystal set (high frequency amplification), the new VR2 MARCONI set with reaction and the M.V. one or two-valve L.F. amplifiers, which fit into the telephone recess of the crystal set, featured in the very effective and comprehensive display of A. FRANKS, LTD.

Many stands were devoted to the display of constructional parts for "the man who makes his own set." The PETO SCOTT Co. claim to be the originators of the unit system and exhibit sets of components for construction of practically every type of apparatus. The Saville condenser exhibited by the MANCHESTER ELECTRIC WAREHOUSE has an ingenious arrangement for obtaining the main and vernier adjustment by one tuning handle, and the Saville triple rheostat with master switch contains in one unit means for adjusting filament resistance for three valves. DUBILIER condensers were shown for all purposes and the Ducon attachment for enabling the electric wiring installation of a house to be utilised as an aerial.

The CHLORIDE ELECTRICAL STORAGE Co., who claim for their batteries the honour of having sent the first S.O.S. ship signal in 1909, the first pre-arranged trans-Atlantic telephony and the Covent Garden opera broadcasted in January, 1923, exhibited batteries for all purposes, the newest feature being a line of 16, 24 and 32 V high tension sets to replace dry batteries for valve illumination. The well-known FULLER "Block" type batteries were exhibited in ebonite and celluloid, and Alklum nickel iron accumulators were shown by ALKLUM ELECTRICS, LTD., Halifax, who claim many advantages for this type over the more familiar lead batteries.

Electric Traction.

Tramway Extensions and Developments.

Top covers, constructed at the Corporation depot, are being fitted to BIRKENHEAD tramcars.

Tramway managers from different parts of the country last week inspected the new EDINBURGH electric tramway system. It is hoped to complete the electrification of the whole system by March 16th.

At a meeting of the LONDON County Council on March 20th it was stated that there would probably be a surplus on the working of the tramways for the present year and that the Highways Committee would shortly consider seeking powers for new routes.

Members of the SOUTHEND Council Light Railways Committee recently visited Birmingham to inspect the railless car system. They were favourably impressed, and came to the conclusion that a similar system would be suitable for certain routes in Southend. The tramways engineer is to present a report on the three available systems—tramways, motor omnibuses and railless cars. Southend Council has decided not to run through cars to and from Leigh during the summer.

Fares, Receipts and Passengers.

During the week ending March 17th, LONDON tramways under "Underground" control took £37 472 in receipts, as against £42 441 in the corresponding week last year.

It has been suggested to the BRADFORD Corporation tramways Committee that 1d. fares should be charged in place of the existing 1½d. minimum during the quieter hours of the day.

As the result of reduced fares on the LIVERPOOL tramway system, over three million more passengers were carried from January 1st to March 10th than in the corresponding period last year. Receipts, however, were down by £9 821.

Experience of the change-over from cable to electric tramway traction in EDINBURGH shows that the estimates of reduced working expenses in the new compared with the old system are to be realised. When the electrification is complete the saving, it is estimated, will be about £125 000 per annum, which represents 5d. per car mile.

Electric Railway Items.

Traffic receipts on the MERSEY railway for the week ending March 17th amounted to £4 235. The total from January 1st is £50 176.

Questioned by Mr. Ede in the House of Commons last week concerning the continued closing of the railway through TOOTING JUNCTION, Col. Ashley stated that the Southern Railway Co. were considering the re-opening of the line for passenger traffic in connection with the S.E. and C. Railway suburban electrification scheme.

With the placing of contracts for material and current a start has now been made with the long deferred electrification of the suburban lines of the South-Eastern section of the SOUTHERN RAILWAY. The most important contract which has been let is with the Cargo Fleet Iron Co. for 7 500 tons of conductor rails, of which early delivery is to be made. Current will be transmitted from the Deptford power station of the London Electric Supply Corporation through a new main cable to Lewisham and thence to a number of railway sub-stations throughout the suburban area. At the sub-stations the current will be converted from three-phase to d.c. and delivered to the conductor rail at a pressure of 660 V. It is intended to provide, for the operation of the electrical services, about sixty eight-car trains, each composed of 62 ft. compartment vehicles, carried on bogies of modern design, and seating about seven hundred passengers. The trains will be equipped with eight 300 H.P. motors.

Institution Notes.

The annual social of the PAISLEY ASSOCIATION OF ELECTRICAL ENGINEERS was held on March 20th. Mr. R. W. Dodson presided over a large gathering of members.

At the annual meeting of the CHEMICAL SOCIETY, on March 22nd, Professor W. P. Wynne was elected president for the ensuing two years. Sir James Walker presided at the annual dinner held in the evening.

The FARADAY HOUSE OLD STUDENTS' ASSOCIATION held its annual smoking concert at the Hotel Cecil, on March 22nd. The attendance broke all previous records, and an excellent musical programme was provided. Mr. P. V. Hunter occupied the chair. The concert followed the third annual dinner of the Faraday House Sports Club.

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Companies' Meetings, Reports, etc.

WESTERN UNION TELEGRAPH CO.—Quarterly dividend of 1¾ per cent., less tax.

BRUSH ELECTRICAL ENGINEERING CO.—Dividend recommended of 10 per cent. for 1922 (against 15 per cent.).

MIRRLEES WATSON CO.—Dividend recommended of 10 per cent., less tax, carrying forward £4 086. The net profit for 1922 was £2 929, plus £14 911 brought in.

COUNTY OF DURHAM ELECTRICAL POWER DISTRIBUTION CO.—Dividend recommended of 6 per cent. for the year on the ordinary shares, leaving £1 317 to be carried forward.

BROLT, LTD.—The accounts for 1922 show a loss on working of £16 898, after providing for depreciation of buildings, plant and machinery and for all bad and doubtful debts.

BRITISH ENGINE, BOILER AND ELECTRICAL INSURANCE CO.—Final dividend proposed of 15s. per share, less tax (10s. interim dividend was paid in July, 1922), transferring £17 000 to reserve, £8 180 to pension fund, carrying forward £14 552.

CLYDE VALLEY ELECTRICAL POWER CO.—Net profit for 1922 was £151 638, plus £51 547 brought in, making £203 185. After transferring £50 000 to the contingency fund, and £4 482 to the second preference share special reserve, the directors recommend a final dividend on the ordinary shares of 5½ per cent., making 8 per cent. for the year.

MIDLAND ELECTRIC CORPORATION FOR POWER DISTRIBUTION.—Final dividend recommended of 6 per cent., making 10 per cent. for the year, carrying forward £44 016. The net profit for 1922 was £139 876, making, with balance brought in, £170 480. Allocations include depreciation £16 088, special depreciation £30 000, and reserve £5 000.

Reyrolle's Increased Profit.

The report of the directors of A. REYROLLE & Co. states that after providing for depreciation, etc., the trading for the year, including interest received on investments and loans, resulted in a profit of £70 739 12s. 6d. compared with £54 826 5s. 10d. in 1921; adding the amount brought forward from 1921, £12 190 0s. 9d., less amounts voted at the last annual meeting to Royal Victoria Infirmary and Armstrong College, Newcastle, £650, there is an available profit of £82 279 13s. 3d. compared with £61 661 13s. 10d. in 1921. The directors recommend that this should be dealt with as follows:—In payment of a dividend of 7 per cent. per annum on 40 000 preference shares, including the shares issued during the year from the dates on which they were paid up; of this an interim dividend amounting to £1 385 12s. 8d. was paid in September, 1922, £2 775 0s. 7d.; in payment of a dividend of 12½ per cent. per annum on 280 000 ordinary shares, £35 000; in transferring to the reserve account for general purposes, including equalisation of dividends, £25 000; in writing off goodwill account, £2 534 18s. 8d., leaving a balance to be carried to next year's accounts of £16 969 14s., compared with £12 190 0s. 9d. in 1921. Sales of the company's manufactures showed a considerable increase, due to the completion of several large contracts, and the profits earned were consequently higher than in 1921. The aggregate value of the orders received in 1922 was slightly higher than in the previous year, but prices were greatly reduced. The large proportion of the company's resources at present in loans and bank deposits is a reflection of the depression in trade, but there has been an improvement in demand during the current year. Preparations are being made to extend the works on additional land which was acquired two years ago, so as to provide greater facilities for production.

The Metropolitan-Vickers Report.

Following the dividend announcement last week (12½ per cent. for the year, less tax), the report of the METROPOLITAN-VICKERS ELECTRICAL CO. for 1922 shows a net profit of £225 057, compared with £337 103 for the previous year. The balance available, including £92 815 brought forward, amounts to £317 872, against £395 926 for 1921, when £58 823 was brought in. The directors have placed to general reserve £35 000, carrying forward £105 310. The directors state that orders received during the year, notwithstanding the prevailing trade conditions, show an improvement as compared with the previous year. Shipments from the works, however, show an important falling off as a consequence of the engineers' lock-out, which occasioned a considerable dislocation of works in progress during the three months for which it lasted. The directors, having regard to these circumstances, consider it a matter for satisfaction that the accounts show as well as they do. It was decided to redeem the outstanding £142 700 of prior lien debentures, and prescribed notice was given to the holders. This notice expired on December 31st, 1922, so that this debenture liability has disappeared from the balance sheet.

New Companies.

RHAYADER ELECTRIC LIGHT AND POWER CO., LTD.—Private. Reg. March 19th. Cap. £2 000 in £5 shares. To carry on at Rhayader and elsewhere in Radnorshire the business of an electric light company in all its branches. Reg. office: Midland Bank Chambers, Rhayader.

WIRELESS SUPPLIES, LTD.—Private. Reg. March 16th. Cap. £500 in £1 shares. Buyers, sellers and wholesale and retail manufacturers, assemblers, erectors, installers and repairers of all wireless apparatus, telegraphic and telephonic apparatus, etc. Reg. office: 58, City Road, London, E.C.1.

VAUXHALL ELECTRICAL MANUFACTURING CO., LTD.—Private. Reg. March 20th. Cap. £2 000 in 5s. shares. Manufacturers of, agents for and dealers in electrical, wireless, broadcasting, telephonic and telegraphic apparatus, etc. Reg. office: 28, Albert Embankment, London, S.E.11.

WELLINGTON ELECTRICAL AND RADIO ENGINEERING WORKS, LTD.—Private. Reg. March 16th. Cap. £500 in £1 shares. To adopt an agreement with N. Clinton and W. J. Oliver to carry on the business of manufacturing engineers carried on at Arthur Street, Aldershot, and also the business indicated by the title. Reg. office: 4, Station Road, Aldershot.

British Insulated and Helsby Cables.

Excellent Trade Prospects: 15 per cent. Distribution.

The twenty-seventh ordinary general meeting of the BRITISH INSULATED AND HELSBY CABLES, LTD., was held at Liverpool on Monday, Mr. James Taylor, chairman of the company, presiding.

The chairman, proposing the adoption of the report and accounts for the year ended December 31st, referred to the loss the company had sustained by the death of his brother, Mr. George Crosland Taylor, who had been a director of the company since the amalgamation 22 years ago, and was associated with the Telegraph Manufacturing Co. from its inception.

The balance sheet showed a profit for the year of £346 617, as against £502 524 for the previous year, a decrease of £155 907 as compared with the previous year's profits. It had to be borne in mind, however, that there was for 1921 an increase over 1920 of £161 811, so that last year's profits were £5 904 more than those for 1920. It might be of interest to recall that the profits for 1914 were £277 428.

Under all the difficult and trying circumstances of the past year the Board had reason to be satisfied with the actual results obtained, and he was justified in saying that so far as the present year had gone things looked better than twelve months ago in the sense that they had more work on the order book. There had indeed been what one might almost term a small "spurt" in the trade, but whether it would continue throughout the year was one of the things quite impossible to foretell with certainty.

Contracts Present and Future.

The engineering and contracting department had been fairly busy, and present prospects entitled the belief that it would be quite busy this year, as there was good reason to believe further contracts would later appear on the order book. The very large contract of over £700 000 for the electrification of the Melbourne Railways had been completed, with an intimation from the Government Commissioner in charge of the work that he was fully satisfied with the creditable manner in which it had been carried out.

A large contract of a similar nature had been obtained in connection with the electrification of the State railways of South Africa, upon which they were busily engaged. They had been fairly busy in the accessory departments, and as a consequence of large capital expenditure two years ago they were now in a strong position to meet the requirements of the trade as it improved. Very large quantities of copper wire were manufactured, and it was interesting as serving to emphasise the importance of this branch of their activities to mention that the length of finished copper wire produced averaged between 5 000 and 6 000 miles per day. Recent developments included the entry into the electric lamp business by the acquisition of a separate company managed by B.I. directors.

Wise Conservation of Finances.

Dealing with the disposition of profit and carry forward, which totalled £708 840, the chairman said £40 000 was to be placed to depreciation account, £50 000 to reserve account and £5 000 to debenture stock redemption. £109 665 was required for debenture interest, preference and interim ordinary dividend, directors' and trustees' fees, etc. A dividend of 6½ per cent. on ordinary shares and a bonus of 5 per cent. was proposed, making with the interim dividend already paid a total distribution of 15 per cent. for the year. There would remain a balance of £391 675 to carry forward. He emphasised that depreciation of plant and buildings was wisely on a liberal scale, and that there was nothing in the balance sheet for goodwill and patents. The company's investments had been revalued on safe lines and the position of subsidiary companies—the Midland Electric Corporation, the Electric Supply Co. of Victoria, and the Automatic Telephone Manufacturing Co.—was satisfactory.

The difficult conditions prevailing last year still existed, and for that reason it was felt that the policy of consolidating the financial position of the company should be maintained in order the better to meet any conditions of bad trade that might arise.

The chairman concluded with a warm expression of thanks to the staff for their hearty co-operation, with special mention of Mr. Sinclair, general manager, Messrs. Nisbett, Brotherton and Bates, and the secretary, Mr. Kerfoot.

Sir John Harmood Banner seconded the motion and the report and accounts were approved.

Mr. James Taylor and Sir Arthur Stanley were re-elected directors.

The proceedings closed with a vote of thanks to the chairman.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

BISHOP, Mr. F., 21, Essex Street, Luton, master electrician. £10 17s. 5d. February 13th.

SHAW, A., 49, Lark Hill, Blackburn, electrical contractor. £34 12s. 2d. February 9th.

WILTON ELECTRICAL CO., 76, High Street, Wembley, electrical engineers. £17 4s. 8d. February 7th.

WRIGHT, Robt. (trading as ROBT. WRIGHT AND CO.), 34, Oxford Street, W., electrical engineer. £41 os. 1d. January 18th.

Receivership.

SMITH AND MORTIMER, LTD. J. P. Emett, of 34, Carnarvon Road, Redland, Bristol, was appointed receiver and manager on March 13th, 1923, under powers contained in debentures dated March 31st, 1919.

Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

ACME ELECTRIC TRACTION CO., LTD., 700, Seven Sisters Road, London, N. At the statutory meeting of creditors in this voluntary winding-up the liquidator, Mr. E. H. Hawkins (Poppleton, Appleby and Hawkins, 4, Charterhouse Square, E.C.), reported that the liabilities totalled £2 764, of which £2 717 was due to unsecured creditors, against assets appearing in the books at £1 834. It was pointed out that in the event of a forced realisation taking place nothing like the book values of the assets could be obtained. No resolution regarding the liquidation was passed, but it was decided that subject to the two directors withdrawing their claims until the other creditors had received 10s. in the £, the liquidator should be authorised to agree to the company's business being continued for a period of three months. A committee was also appointed consisting of the representatives of Donald Scott and Co., Ltd., Hawkins Bros. and Co., Ltd., The London Electric Wire Co. and Smith, Ltd., Spicers, Ltd., and Jenson and Nicholson, Ltd. The following are creditors:—Clark, R. I., and Co., Ltd., London, £45; Curtis, T., London, £240; Hawkins Bros. and Co., Ltd., London, £513; London Electric Wire and Smiths, Ltd., London, £284; Legal Insurance Co., Ltd., London, £36; Mica Manufacturing Co., Ltd., Bromley, £58; McLennan, J. and Co., London, £31; Micanite and Insulators Co., Ltd., London, £81; Spicers, Ltd., London, £142; Scott, D. H., and Co., Ltd., London, £273.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Bankruptcy Information.

BOULD, David, Burn Croft, Birchencliffe, Huddersfield, electrical engineer. Receiving order March 20th. Creditor's petition.

CARTWRIGHT, Thomas Stanfield, carrying on business as T. S. CARTWRIGHT AND CO., 90, Wellington Street, Stockport, electrical contractor. Receiving order, March 21st. Debtor's petition.

Notice of Dividend.

COOKSON, Eugene, trading under the name of W. TURNBULL AND CO., Express Magneto Repair Works, Elizabeth Street, and Charles Street, Blackpool, electrical and mechanical engineer. First and final dividend of 5s. 2d. per £, payable March 31st, Official Receiver's offices, 13, Winckley Street, Preston.

Partnerships Dissolved.

CITY ELECTRICAL CO. (Stanley Thomas COOPER, John William GOULD and John William RATTLE), electrical engineers and contractors, 24, Porter Street, Kingston-upon-Hull, by mutual consent as from March 1st, 1923, so far as J. W. Gould is concerned. Debts received and paid by S. T. Cooper and J. W. Rattle, who will continue the business.

H. CLARK AND CO. (Henry CLARK and John Thomas RANDS), electrical engineers, 42, Limehouse Causeway, Limehouse, E.14, by mutual consent as from February 19th, 1923. Debts received or paid by H. Clark, who continues the business.

COVENTRY ELECTRICAL AND ENGINEERING CO. (Harry Norman REYNOLDS and Frederick William SKIDMORE), electrical engineers, 23 and 24, Hertford Street, Coventry, by mutual consent as from March 1st, 1923. Debts received and paid by H. N. Reynolds, who will continue the business.

SHAW AND SMALLSHAW (Allison Hedley SHAW and Harry SMALLSHAW), 14, Legh Street, Warrington, electrical engineers and contractors. July 31st, 1922, mutual consent. Debts discharged or received by A. H. Shaw, who will carry on the business in his own name.

SMITH AND SON (William SMITH the Elder and William SMITH the Younger), electrical engineers, Nantwich Road, Crewe, by mutual consent as from March 1st, 1923. Debts received and paid by William Smith the Younger, who will continue the business.

THE NORMAND ELECTRICAL CO. (Donald William ROBERTSON, Peter William JACOMELL, and William SCOTT), electrical and mechanical engineers, Normand Works, Greyhound Road, West Kensington, London, by mutual consent as from February 22nd, 1923. Debts received and paid by W. Scott except as provided for in the last clause of the deed of dissolution.

Edinburgh Gazette.

MENZIES, John, electrical engineer, 208, Quarry Street, Hamilton. Estates sequestrated March 7th. Meeting to elect trustee and commissioners, 11 a.m., on Tuesday, March 20th, Law Agents' Room, County Buildings, Hamilton.

PARKER AND TURNBULL, electrical engineers, 81, Shakespeare Street, Dumfries. Partnership dissolved as at February 10th, 1923, by mutual consent, by the retiral of Douglas Howard Parker. John Kidd Turnbull will carry on the business on his own account and under his own name, at the same address.

REID AND JACK, electrical engineers, Albert Drive, Renfrew. Partnership dissolved at March 3rd, 1923, by retiral of Robert Jack. William Reid and George Carrick have entered into partnership, and will carry on business under the firm of Reid and Carrick.

Bankruptcy Proceedings.

PARR, Harold, 2, Strawberry Dale Square, and 1, Back James Street, Harrogate, electrician. The statement of affairs shows gross liabilities of £1 155, of which £814 is expected to rank for dividend, against assets of £670, or a deficiency of £144. Debtor attributes his failure to small profits owing to keen competition in business, bankruptcy of three book debtors, and pressure by creditors taking proceedings. He commenced business as an electrical engineer three years ago at Back Mayfield Road, Harrogate. About twelve months ago he removed to 1, Back James Street. When he commenced business he had cash savings amounting to £32. He borrowed £50 from his father, and in July, 1921, a similar sum from another relative. For the first year of his trading a profit and loss account was kept, which showed a profit of £113. At his public examination debtor stated that he had been losing money all the time he was trading. He continued in the hope that matters would improve. (See ELECTRICIAN, 16/3/23, p. 293.)

WEEKS, William Edward, 59, Victoria Street, and 12, Filton Avenue, Horfield, Bristol, wholesale electric dealer. The receiving order in this matter was made on March 13th on debtor's own petition. The statement of affairs shows liabilities of £1 693, against assets of £977, or a deficiency of £716. Debtor attributes his failure to slump in trade, bad debts and want of capital. It appears that after being employed by an electric supplies company which went into liquidation, debtor, on November 1st, 1920, took over the stock-in-trade, about £200, and office furniture at £90. He then commenced business as a wholesale electric dealer at 59, Victoria Street, with about £50 capital in cash. The stock-in-trade was invoiced to him on the usual credit terms, and the £90 for the office furniture was payable by monthly instalments. Debtor states that after the first year, owing to depression in trade, his business was carried on at a loss. He states that he did not become aware of his position until two months ago.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—Special Spring Number: "Period Furnishing and Decoration"; "Modern Furniture Design"; "Veneering," by J. H. Rudd; "Woodworking Machinery"; "The Chippendale Family."

THE CHEMICAL AGE.—Fourth Annual Spring Number: "Survey of World Chemical Trade"; "The 'Premier' Mill and its Application to the Chemical Industry"; "Rubber Latex Precipitates and Dispersions," by G. C. Calvert.

THE EUROPEAN COMMERCIAL.—"The Commercial and Financial Position of Finland"; "Rumanian Mineral Resources"; "Signs of Prosperity in Poland."

THE FRUIT GROWER.—"Propaganda for Fruit and Vegetables"; "National Conference at Sheffield"; "Silver Leaf Disease."

THE GAS WORLD.—"Promoting the Sales of Gas"; "Development in Gas Appliances"; "Effect of Atmosphere Pollution on Health."

THE HARDWARE TRADE JOURNAL.—Special Spring Number: "How Manufacturers and Retailers View Trade Prospects"; "Labour-saving in Small Houses"; "Seasonable Window Displays."

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

190 218 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Photo-electric devices. (12/9/21.)
190 222 L. J. AND T. R. HANCOCK. Electric furnaces. (12/9/21.)
190 226 R. PÖRSCKE. Electrolytes for galvanic elements. (12/9/21.)
190 227 METROPOLITAN-VICKERS ELECTRICAL Co., A. J. HALL and R. BROOKS. Collectors for electric traction systems. (13/9/21.)
169 694 M. DE CONINCK. Apparatus for converting electric currents. (30/9/20.)
190 244 ZSCHAUER METALLWARENFABRIK and O. GRUNTHAL. Water supply connections to electric water-heaters. (16/9/21.)
169 443 AUTOMATIC TELEPHONE MANUFACTURING Co. Telephone systems. (22/9/20.)
169 456 R. H. MARRIOTT. Radio receiving systems. (22/9/20.)
190 259 J. H. TUCKER AND Co. and J. E. GAFFNEY. Fuse boards or distribution boards. (23/9/21.)
190 260 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Electric control systems. (23/9/21.)
190 262 CHLORIDE ELECTRICAL STORAGE Co. and B. FORD. Storage battery plates. (23/9/21.)
190 280 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Wireless signalling receiving systems. (5/10/21.)
190 . 89 G. AND J. OLDHAM. Electric connections or couplings. (10/10/21.)
170 305 C. L. DUBOIS and C. REYNOLD. Electric cut-outs. (14/10/20.)
190 305 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Utilising intermittent physical manifestations, such as sound or light waves, to close a relay in a work circuit. (18/10/21.)
190 306 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Apparatus operable at high voltages in an enclosed tank. (21/10/21.)
190 316 J. KELLY. Respirator mouthpieces and telephone transmitters. (31/10/21.)
172 000 SIEMENS AND HALSKE A.-G. Meters for telephone systems. (26/11/20.)
190 337 V. SHEARER. Electric ignition timers or distributors. (21/11/21.)
190 344 WESTERN ELECTRIC Co. Selective electric signalling systems. (24/11/21.)
190 346 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Switches. (26/11/21.)
190 378 WESTERN ELECTRIC Co. Transformers. (9/1/22.)
190 385 V. BOSCATO. Ignition starting devices for magnetos. (30/1/22.)
181 324 O. MEYER-KELLER ET CIE. Electrodes for heating liquids. (9/6/21.)
190 408 W. E. MARSHALL and P. G. P. MCCULLOCH. Electric head lamps for motor cars. (27/4/22.)
183 118 GENERAL ELECTRIC Co., LTD. Metal filaments for incandescent lamps. (13/7/21.)
190 505 R. B. RANSFORD (SOC. FRANCAISE RADIO-ELECTRIQUE). Wireless receivers. (24/6/21.)
190 512 N. MANCINI. Electrical and magnetic treatment of plants and animals. (8/8/21.)
190 521 LANCASHIRE DYNAMO AND MOTOR Co. and H. B. WHITMORE. Electrical machines. (17/9/21.)
190 532 J. P. PRANGNELL. Inductance coils. (21/9/21.)
190 542 BRITISH POWER RAILWAY SIGNAL Co., H. TINSLEY and D. C. GALL. Transformers. (23/9/21.)
190 554 A. BJERKE. Charging stations for electric-automobile batteries. (28/9/21.)
170 289 C. PASTEUR. Electric switches. (12/10/20.)
190 577 W. E. E. HABANN. Producing high-frequency electric vibrations or oscillations. (15/10/21.)
190 596 J. H. RUNBAKEN and W. TORRANCE. Means for varying intensity of illumination of road vehicle electric lamps. (3/11/21.) (Cognate Application, 32 499/21.)
190 597 A. H. CALEY and P. S. TALBOT. Commutators or distributors for use in electric ignition systems. (7/11/21.)
190 599 C. A. KING. Motors for dental engines, etc. (8/11/21.)
190 604 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Insulating elements. (10/11/21.)
190 613 CHAMBERLAIN AND HOOKHAM and S. JAMES. Instruments for measuring or indicating a.c. wattless component. (21/11/21.)
190 616 R. HADDAN (F. NEUMEYER AKT.-GES.). Electric-starters for engines. (22/11/21.) (Addition to 152 355.)
190 619 N. E. G. MEIJER. Coupling generators in parallel. (23/11/21.)
180 295 BRITISH THOMSON-HOUSTON Co. Producing oscillating currents. (18/5/21.

APPLICATIONS FOR PATENTS.

March 12th.

7 017 A. M. TAYLOR. Electric power transmission systems.
7 018 A. M. TAYLOR. Junction boxes for electric power transmission systems.
7 028 S. T. HEADLEY and J. TEE. Aerials for wireless telegraphy.
7 047 E. CLARK. Repairing bonds for permanent way of tramways.
7 048 E. SEREGNI. Electric heating apparatus. (11/322, Italy.)
7 051 G. W. HALE. Receiving broadcasted signals.
7 052 J. JOANES. Telephone or headpiece terminal board.
7 055 SIR D. L. SALOMONS. Electric light bracket.
7 056 E. BONELLA. Wireless receiver.
7 067 T. YAMAMOTO. Motors.
7 072 R. J. W. HEATH. Combined filament rheostat and holder for wireless valves.
7 075 T. L. JONES. Switches for variable electric resistances, etc.
7 083 W. J. GIBBONS. Contacts for knife switches.
7 093 J. C. ROUND. Aerials for wireless telegraphy.
7 103 C. CHILOWSKY. Producing progressive breaking of currents. (16/3/22, France.)
7 106 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Switches.
7 109 L. MURPHY. Plates for electrolytic cells.
7 114 L. GERNIGNON and G. SCHAULY. Electric heating device.
7 117 TELEPHONE MANUFACTURING Co. and E. A. V. SANFTLEBEN. Crystal detectors.
7 118 C. A. SIMPSON. Fire alarms.
7 122 A. E. BAWTREE and S. B. MARSHALL. Electric light fitting.
7 131 AKT. GES. BROWN, BOVERIE ET CIE. Exciting and igniting arcs in metal-vapour rectifiers. (11/3/22, Germany.)
7 146 G. C. HUBBLE. Voltage controlling device for dynamos.
7 151 P. E. WELLS. Electric condensers.
7 154 P. G. MITCHELL and H. J. WILLIAMS. Earthing overhead conductors.

March 13th.

7 159 A. E. WATKIN. Variable condenser for wireless telegraphy.
7 167 T. F. WALL. Conductors for alternating current.
7 190 H. F. V. STAGG. Wiring strips.
7 192 A. R. ANGUS. Charging accumulator cells.
7 202 F. W. W. BAKER and C. E. GREEN. Switches.
7 203 COVENTRY AUTOMATIC TELEPHONES, LTD., and W. CORNELL. Automatic telephone systems.
7 220 W. WEEKES. Electric heating element.
7 222 E. C. CADETT and J. E. NEALL. Amplification of audible waves or vibrations in wireless receivers.
7 235 G. POULTON. Wireless receiving apparatus.
7 252 E. C. R. MARKS (AMERICAN MANGANESE STEEL Co.). Electric furnace melting of manganese scrap.
7 258 FINSPONGS METALLWERKS AKTIEBOLAG. Electric furnaces. (29/3/22, Sweden.)
7 259 SOC. ANON. LE CARBONE. Electric cells. (4/5/22, France.)
7 293 H. H. GROVES. Crystal detectors.
7 295 and 7 296 SOC. ANON. ELECTROLABEN. Electric machines. (13/3/22, France.)

March 14th.

7 314 A. J. WHEELER. Metering telephone calls.
7 317 T. F. WALL. Introducing capacity effects in a.c. systems.
7 334 N. MILNES and F. WEAVILL. Electrically illuminated signalling apparatus for vehicles.
7 341 W. BURKE. Electric apparatus for lighting fires.
7 343 W. WHITEHEAD. Accumulators.
7 350 METROPOLITAN-VICKERS ELECTRICAL Co. and N. E. NORTH. Magnetic blow-out devices for circuit-interrupters.
7 360 B. HARRISON. Electric burglar alarms.
7 372 V. S. ROBERTS. Wireless telegraphy.
7 381 METROPOLITAN-VICKERS ELECTRICAL Co. Electric iron. (23/3/22, U.S.)
7 383 R. W. G. MORRISON. Electric wire connections.
7 398 SIR C. A. PARSONS and J. ROSEN. Dynamo-electric machinery.
7 405 G. PALMER. Loud-speaking and sound-collecting apparatus.
7 413 E. W. HYNES. Wireless aerials.
7 436 BRITISH THOMSON-HOUSTON Co. Sealing-in machines. (24/4/22, U.S.)
7 437 BRITISH THOMSON-HOUSTON Co. (CIE. FRANCAISE THOMSON-HOUSTON). Electric soldering irons.

March 15th.

7 452 H. J. BROOKES. Mountings for telephone receivers, etc.
7 455 H. J. DEAN-OSGOOD. Switches.
7 458 AUTOMATIC SCALE Co. and E. L. BLICK. Electric contacts for weighing scales.
7 460 A. N. HADDOW and A. P. RUTHERFORD. Carrier for electric lamp shades.
7 488 J. M. SCOTT-MAXWELL. Generation, distribution and control of electric power.
7 492 J. Y. FLETCHER and J. B. KRAMER. Electric advertising signs.
7 493 J. R. QUAIN. Transmitting, recording or reproducing sound electrically.
7 504 AIR LIQUIDE SOC. ANON. (PROCEDES G. CLAUDE). Generation of electrical energy. (8/5/22, France.)
7 515 E. Y. ROBINSON. Vacuum electric tubes.
7 521 THOR ELECTRIC SAFETY LAMP Co. Detecting presence of explosive gases.
7 525 ENGLISH ELECTRIC Co., H. BARNES and J. C. WILSON. Electric converting apparatus.
7 526 SIEMENS BROS AND Co., F. BAKER and E. A. PETITHORY. Number dials for automatic telephone systems, etc.
7 536 A. BOGAERT and A. NOCQUET. Electric burglar alarms.
7 545 R. C. GRASEBY. Coin-actuated switch mechanism.
7 547 BRITISH THOMSON-HOUSTON Co. and A. S. FITZGERALD. Protective apparatus for a.c. systems.
7 548 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Switches.
7 552 F. R. BUTT AND Co. and C. M. ROBERTS. X-ray apparatus.

March 16th.

7 562 C. LEIGH. Loud speaking telephones.
7 565 H. J. DEAN. Electrostatic condensers.
7 568 G. A. FARMER and H. W. HEMMINGS. Telephones.
7 579 I. H. PARSONS. Electric terminals.
7 587 SUNDERLAND FORGE, ETC., Co., W. PARK and H. WIGHT. Electric light fittings or lanterns.
7 601 AUTOMATIC SCALE Co. and E. L. BLICK. Controlling electric circuit of scale mechanism.
7 606 J. B. BOLITHO. Receiving apparatus for wireless telegraphy, etc.
7 609 MAVOR AND COULSON and A. W. DAVIES. Motor-driven apparatus for haulage, etc.
7 610 W. KIMPTON. Wireless telegraph apparatus.
7 621 CALLENDER'S CABLE AND CONSTRUCTION Co. and A. A. BELL. Overhead electric transmission lines.
7 622 H. H. M. SHURLOCK. Telephone receivers.
7 631 NEDERLANDSCHE KABELFABRICK. Multi-core h.t. cable. (18/3/22, Holland.)
7 636 A. MASSEY ALLEN and R. B. NORTH. Magneto-electric machines.
7 637 L. CHAWAY. Inductance coils for wireless receivers.
7 651 CHLORIDE ELECTRICAL STORAGE Co. and H. DEAN. Accumulators.
7 662 J. SOUSEDEK and R. SUEZEK. Motor starters. (17/3/22, Czecho-Slovakia.)
7 672 ELECTRICAL IMPROVEMENTS, LTD., and L. C. GRANT. Lightning or surge arresters.

March 17th.

7 691 BURTON, DELINGPOLE AND Co. and J. T. TILLEY. Crystal detectors for wireless telephony, etc.
7 704 C. CLARKE and A. C. JAMIESON. Electric indicator for road traffic.
7 725 H. E. FOARD. Electric cut-outs.
7 730 GENERAL ELECTRIC Co. (PATENT TREUHAND GES. FUR ELEK. GLUHLAMPEN. Wire-drawing dies, etc.
7 733 ENGLISH ELECTRIC Co. and R. A. R. BOLTON. Control of electric machines.
7 746 SOC. INDUSTRIELLE DES PROCEDES W. A. LOTH. Determination of direction of magnetic fields. (18/3/22, France.)
7 752 C. SEYMOUR, H. MORRIS-AIREY, G. SHFARING and C. MATTHEWS. Generation of waves for wireless telegraphy, etc.
7 762 J. F. MONNOT. Storage batteries.

Arrangements for the Week.

FRIDAY, MARCH 30th. (To-day.)

INSTITUTION OF CIVIL ENGINEERS.—SHEFFIELD.

7 *p.m.* At the Royal Victoria Station Hotel, Sheffield. Paper by Mr. W. J. Hadfield.

WEDNESDAY, APRIL 4th.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.

At Newcastle-upon-Tyne. Address entitled "Works Organisation," by Mr. N. H. Phillipson.

LIVERPOOL ENGINEERING SOCIETY.

At the Royal Institution, Colquitt Street, Liverpool. "The Combustion of Fuel," by Professor G. E. Scholes. "Consideration in Design and Application of Surface Heaters," by Mr. B. Stephenson.

FRIDAY, APRIL 6th.

INSTITUTE OF TRANSPORT.

5.30 *p.m.* At the Institution of Electrical Engineers, Victoria Embankment, London. Paper on "The Influence of Trans-shipment on Railborne and Road Traffic, with special reference to the most economical methods of labour-saving appliances," by Mr. C. Bentham.

INSTITUTE OF METALS (SHEFFIELD LOCAL SECTION).

7.30 *p.m.* At the University, Sheffield. Annual General Meeting. Lecture on "The Heat Treatment of Non-Ferrous Alloys," by Professor F. C. Thompson.

EDINBURGH ELECTRICAL SOCIETY.

8 *p.m.* At Philosophical Institute, 4, Queen Street, Edinburgh. Apprentices' Night. Competition Papers for Society's Prize.

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CONTENTS.

Notes of the Week	357
Electric Ship Propulsion	359
A New A.C. Potentiometer. By Douglas C. Gall. Illustrated	360
Electric Ship Propulsion. By W. L. R. Emmet. Illustrated	362
Taxes versus Improvements	365
Atomic Projectiles and their Properties. Illustrated	366
Co-operation between Manufacturer and Retailer	367
Correspondence	368
Works Production	371
Conditions for Second Electrician Competition	371
Parliamentary Intelligence	374
Legal Intelligence	374
East Midlands Electricity District	374
N.A.S.E. Prizes	374
Ernest Benn, Ltd.	374
Taxation and Trade	375
The Bann Hydro-Electric Scheme	375
Newport Electricity Undertaking	375
Electricity in City and Home	375
Imperial Notes	376
Foreign Notes	376
Electricity Supply	377
Forty Years Ago	377
Obituary	377
Personal Items	377
Tenders Invited and Accepted	378
Institution Notes	378
Electric Traction	379
Wireless News	379
Telegraph and Telephone Notes	379
Companies Meetings, Reports, etc.	380
New Companies	380
Business Items	380
Commercial Intelligence	381
Prices of Metals, Chemicals, etc.	381
Patent Record	382
Arrangements for the Week	382

Notes of the Week.

International Telephony.

We are glad to see that the idea of international telephony is receiving attention. As already mentioned, a conference has been sitting in Paris to consider the problem in its European aspects; and now it is announced that the Postmaster-General has appointed a Committee "to consider in the light of recent progress in wireless science the possibility from a technical standpoint of transatlantic wireless telephony of sufficient reliability for commercial use, and to advise what practical steps, if any, can at present be taken to develop this means of communication." This problem, as distinct from that dealt with in Paris, is of course a "wireless" one. Physical laws prevent the transmission of speech by submarine cables of the length necessary between this country and the United States, and the chief duty of the Committee will therefore be to examine what has already been done in the way of radio telephonic communication, and to add the weight of their knowledge to that of American investigators. For that reason, if for no other, we are glad to learn that the telephone authorities in the United States are willing and anxious to co-operate in any studies aiming at making telephonic communication across the Atlantic a practical means of commercial intercourse. We hope that much good may come from these joint efforts.

The Paris Conference—Some Technical Results.

We are now able to give some further information regarding the agreement on international telephone matters arrived at during the Paris Conference to which we referred last week. An international unit of reference and a standard specification for the subscriber's transmitter, receiver and induction coil are to be established. In all cases the specifications will conform with present practice in Great Britain, France, and the United States. The unit of reference will be the equivalent of one mile of standard cable having an attenuation constant of 0·106 at a frequency of 800 cycles per second. The quality of speech transmission to be provided is not to be inferior to the audibility contained in a circuit consisting of two standard telephones separated by 32 miles of international standard cable, though in special cases where the traffic is small a tolerance of not more than 6 miles of standard cable will be permitted. For the present, it has been decided to regard 1 000 miles as the limiting distance for telephone lines wholly in cables, and in cases where greater distances are involved aerial cables will be provided; we hope only as a temporary measure. Telephone repeaters with thermionic valves will be used on both aerial lines and cables and it was agreed that repeaters should be so designed as to give a constant amplification factor over the whole range of frequencies comprised within the limits of the speech band. When distortion correcting devices are necessary they will be provided as independent units. The various administrations represented at the Conference have agreed to undertake a special study of the regulations required to protect long distance telephone communication from disturbance by electrical power transmission systems. These are useful preliminary results, and we congratulate the conference on its work.

"The Electrician" Competitions.

During the past few days we have been much interested in examining the solutions received for the first Electrician competition—that for a wiring scheme for an "All-Electric" House. As might be expected, they exhibit a great variety in talent, but they one and all show that much interest has been taken in the problem and that much hard work in the preparation of the designs and specifica-

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tions has been expended. The judges are now deliberating upon and re-examining the most meritorious of the schemes sent in and we hope to be able to publish the results of their conferences at an early date. We think that they will be found of real interest ; and we hope that they will do a good deal to clear up differences of opinions and haziness on this important question. We do not propose to say any more upon this competition at the moment, except to thank the competitors for the trouble they have taken. Later, when the judges have decided on the prize winners, we shall have something to add to their report on the general aspects of the way in which the competition has been carried out ; and to give what we hope will be useful hints for future guidance.

Electrical Hot Water.

WE say future guidance, for the " All-Electric " House competition is only one of a series. On another page of this issue we publish the conditions for the second competition, that for dealing with electrical hot-water supply and the plans of the house which is to be so equipped. Intending competitors must make a point of obtaining a copy of The Electrician containing these as they will not be re-issued in pamphlet form. It will be noticed that this house, a typical middle-class house, is the same as that used in the last competition. But we do not think the entrants will derive much help from that. Our idea, in this instance, is to arrive at the more technical features of the hot-water installation, and in the elucidation of that problem we shall expect the help, not only of electrical, but of water engineers. We have been told more than once that to provide hot water electrically is impossible economically and very difficult technically. Frankly, we do not believe it, and we are sure that the results of this competition will confirm our scepticism. Finally, might we suggest that competitors should get to work early? Scamped work is bad work ; the results of the first competition bear that out.

Swedish Traction—An Interesting Decision.

SWEDEN has always been looked upon as the home of single phase traction, and it is therefore not surprising to find that a Committee which was appointed in 1920 to examine the question of systems has reported in favour of this arrangement, on the ground of general superiority. But in Sweden, as elsewhere, the problem of railway supply cannot be divorced from that of more general supply, and on the Stockholm-Goteberg line the energy required will be obtained from the main three-phase distribution lines of the country, and motor generator stations will be erected to supply the necessary single phase current at 16 000 V and 16⅔ cycles. It will therefore be seen that one of the great advantages of single phase traction, static transformation, will be voluntarily relinquished ; we think rightly, as on the balance it is more likely to be satisfactory economically. In order to overcome disturbances to telegraph and telephone lines these lines will be removed to at least 200 m. from the railways and booster track transformers of an improved type will be used in the trolley circuits. We understand that these arrangements have proved satisfactory under working conditions, but we hardly expect that similar action will be taken in this country.

Some Curious Photo-Electric Effects.

IN a recent scientific paper issued by the Bureau of Standards, U.S.A. (No. 462, 1922), Dr. W. W. COBLENTZ gives the results of investigations of the photo-electric properties of a variety of molybdenum sulphides. Apparently, all the wet and dry process preparations of MoS_2 are sensitive, but less so than some samples of the natural mineral. The property cannot be accounted for by chemical analysis and seems difficult to explain. Treatment by heat and alternating current had no material influence on sensibility. A remarkable feature of certain samples was that the sensitivity is practically uniform over a wide range of the visible spectrum. Certain barium and strontium cells have even maxima at 0·42 and 0·39 μ respectively, and Dr. CASE, who has developed such cells, has found that by the use of a suitable yellow glass screen a spectral response curve coinciding closely with that of the human eye is obtained. This result might prove of utility as a basis for a suitable physical photometer, though we imagine that in view of the low order of currents furnished the apparatus would be primarily of use in the laboratory.

Half a Million Horse Power Connected.

THE position of electricity supply on the North-East Coast, as shown by the results of the Newcastle-upon-Tyne Electric Supply Co.'s operations, must always be of interest to electrical engineers. The area served by the company is an electricity district in being, and its industrial importance, as reflected in the balance sheet, is an indication of the prosperity of a state of affairs which, we hope, will become more general. As will be remembered, the coal strike of 1921 adversely affected the company's success after many years of prosperity. In 1922 the engineers' lock-out had a bad—though not so bad an effect. Fortunately, the latter part of the year showed a steady increase in output, though, while the total was materially better than in 1921, it was still some 3 per cent. less than in 1920. With the revival in trade which is now setting in we hope that 1923 will see that figure well exceeded. Nevertheless, the results put forward for the area served by the Newcastle company and its associates are sufficiently impressive. During 1922, 33 713 H.P. were connected, with the result that the total connections are now 527 893 H.P. The profit was £513 263, or £166 045 more than in 1921, and generally there is every prospect of an excellent future in both the power and the domestic fields. Our hearty congratulations!

"B. and K." Results.

WE always study the results of the Brompton and Kensington Electricity Supply Co. with interest. For they are increasingly attractive as the years go on, and they show what can be done by enterprise and vision to extend the domestic electric idea. The year 1922 was no exception to the rule we have just enunciated. Sales of current and gross receipts increased by 10 per cent., and as the expenditure was less the balance to the credit of the net revenue account, after making a large allowance for repairs and contingencies, was upwards of £10 000, or 25 per cent. more than the year before. That being so, the directors have taken the very wise course, which we wish others would follow, of reducing their lighting price from 8d. to 7d. per kWh, the domestic rate being already at the low figure for London, at any rate, of 1½d. per kWh. The Accessories Co. also are doing well, and generally credit is due to all concerned for what is a very good showing.

Finance and Taxation.

Now that the Easter holidays are over, one of the most burning questions, if not the most burning question of all, is : Is taxation going to be reduced? Feelers that have been put out from inspired quarters show that the Chancellor of the Exchequer is still doubtful on this point. For, in spite of the fact that the yield on the income tax for the financial year that is just ended will make the surplus about £130 000 000, it is suggested that the wiser policy will be to proceed on the lines of debt liquidation rather than tax reduction. In this connection attention may be drawn to a speech which Sir ERIC GEDDES recently delivered at Birmingham. He called attention to the general improvement in trade conditions and ascribed this to the lessening of international disturbance, to the reconstruction and reorganisation of industry, and, above all, to decreased

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taxation and lower transport charges. Unemployment, he added, could only be alleviated by greater capital expenditure, and greater capital expenditure was only possible if taxation were reduced. Reduction in taxation was in fact "absolutely imperative" if the trade of the country was not to be strangled. We agree with all emphasis in these remarks. To reduce our debt is an ideal. To reduce taxation is a practical policy of which the benefit will be immediate, and then we can begin to think about ideals.

Railway Rates and Trade.

NOT less important than the reduction of taxation is the reduction of railway rates. Once again we may quote from what Sir ERIC GEDDES said at Manchester on the Tuesday before Easter. The present rates, he pointed out, were 75 per cent. above the pre-war level and were hampering trade. The rates should be at once reduced to 33⅓ per cent. above pre-war level, and such reduction would stimulate industry and need not, therefore, mean a reduction in revenue. With their large reserves such a policy would be possible and in the end remunerative. Once again we agree. A reduction in taxation and railway rates would allow industry to expand in a way possible by no other method. It would give a tonic that is badly needed, and in our own case would allow a reduction in the prices of electricity and of electrical equipment which would be for our own good and the general benefit.

Electric Ship Propulsion.

In the electrical industry history has a habit of repeating itself. Ten or fifteen years ago we used to be told that electric power in the factory was undoubtedly a thing of the future. But that for the moment it was too expensive and too experimental even to be considered by the up-to-date manufacturer. Yet electric power became more and more of a necessity and, though in essentials it has not altered since the period we have mentioned, it is now recognised as being the best and most economical agent for workshop operation. Though the same stage has not been reached in the domestic field we can see it coming by the same road, until in a year or two we shall expect to be able to chronicle as great or even greater progress than has been obtained in the power field. On the other hand, in the matter of electric propulsion of ships we are still in the dark ages and, after the discussion on Mr. W. R. L. EMMET'S Paper at a recent meeting of the Institution of Naval Architects, were we not convinced that precedent will not play us false and that what we are now told is uneconomic, if not impossible, will have become an accomplished fact we should be rather pessimistic. As it is we believe that before long the advantages of electric propulsion will be recognised in this country as they have been in the United States and in Japan.

Some Hints to Naval Architects.

Mr. EMMET'S Paper, of which we give an abstract on another page of this issue, begins by reciting the advantages of electric propulsion. This recital, though perhaps not necessary for electrical engineers, is certainly necessary for naval architects; and in the course of the discussion Mr. H. R. MCLELLAND, director of electrical engineering at the British Admiralty, did well to reiterate what the electric drive can do better than anything else. The advantages of electric propulsion really centre round the well-known quality of flexibility. The boilers and generators can be placed in the most convenient position; and this position is not determined, as with the usual turbine drive, by the relationship of the prime mover to the propellor. The motors themselves can be placed right aft, and reversing, interchangeability and speed reduction can be effected in the simplest possible manner. But more important than these, especially on a warship, where the speed is constantly varying, is that at any speed the overall efficiency is high and that, in contradistinction to the statements made by the advocates of the geared drive, any speed can be obtained easily, quickly and economically. If any breakdown occurs the possibilities of interconnection permit the ship to be brought home on one turbine at half speed, while on a ship using geared turbines the best speed that could be hoped for would be a crawl conducted under difficult circumstances. We must apologise for putting forward these elementary facts, but they are so little realised or appreciated by naval architects and engineers that there is some need for calling attention to them.

The Space and Weight Troubles.

We do not wish it to be supposed that we think the electric drive has no disadvantages in comparison with the geared turbine. As Mr. EMMET admits, both the space required and the weight are greater, but even so the fuel consumption is less, and on the balance it may therefore have a great military value in a light high speed ship where any increase in the weight of the machinery might at first sight seem to rule it out. In general, however, the best fields for the electric drive for the moment are the battleship, the cruiser and the larger type of warship, where the extra weight matters less and more space is available; and where the constant variations in speed are more easily and more economically obtained than with any form of geared drive. Even accepting the figures given in the discussion that to put them on an equality the electric transmission system would have to be not less than 15 per cent. more economical than the geared installation at all speeds, if an equally effective fighting vessel is to be obtained, the factors we have just mentioned provide substantial advantages which must not be overlooked.

Kipling Adapted.

A great point was made of the fact that the experience of British naval authorities has shown that for all practical purposes the steam turbine in association with gearing is as efficient as the electric drive. But what do they know of gearing who only gearing know? The experience of our naval authorities with electric propulsion has been exactly nothing and we therefore hope that in spite of Washington conferences, and in spite of the unreasoning prejudice which exists to this form of drive means will be found to adopt Mr. MCLELLAND'S suggestion and build two similar ships, one with the electric and the other with the geared drive and compare the results obtained after extended trials. As is well known, this form of practical demonstration has been successfully tried in the United States and as a result of such trials the electric drive is being more and more adopted. Now, either we are right and the Americans are wrong or the contrary is the case. Which is right can only be proved by adopting a trial by ordeal of the kind which we have just outlined. Up to the present our naval architects and engineers have been content to scoff, but not to do, and that should be changed without delay.

The Commercial Aspect.

There is a more important reason why it is necessary that the application of electrical equipment should be increased. Japan has become much interested in the possibilities of the electric drive, and, as is well known, has had built in the United States an electrically-propelled ship, the "Kamoi," whose trials have been entirely satisfactory. One of the results of this success is that the Japanese are turning from us to the Americans for their ships and unless we mend our ways and pay proper attention to modern progress what has been one of our staple industries will suffer. For ourselves, we are quite persuaded of the advantages of the electric drive for many classes of ships and for every reason therefore we should like to see naval architects and shipbuilders consulting with electrical engineers on the best means of tackling the problem. At the least it would be a change from the inert prejudice which is now so general.

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A New A.C. Potentiometer.

By DOUGLAS C. GALL.

The potentiometer is such a valuable instrument for direct current measurement that its application to alternating currents has always been attractive. There are, however, a number of difficulties which arise in making the application. Direct current measurements of potential have the great advantage of the existence of the standard cell, as a means of fixing the basis of e.m.f. comparisons, whereas no alternating current standard cell is at present available. With the direct current potentiometer for the highest degree of precision, means of comparing resistances

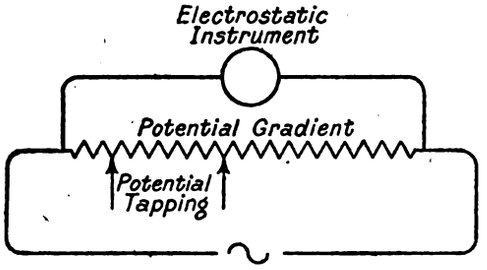

FIG. 1.

for equality alone are necessary, and as it is possible to make such comparison to one part in ten million a potential gradient can be produced accurate to less than one part in ten thousand without insuperable difficulty, so that the subdivision of the volt as represented by the standard cell follows to the limit of its certified value.

Limitations of the A.C. Potentiometer.

In the case of the a.c. potentiometer, however, the accuracy of the potential gradient depends upon rather more than the resistance of the potentiometer winding measured with direct current, and must include the effects of coil-impedence, mutual-inductance, cross capacity and earth capacity effects. These elusive qualities make the application of the potentiometer to extremely high frequencies very problematical. Not only is there difficulty in obtaining an accurate potential gradient, but there follows the difficulty of standardising the e.m.f. upon the potentiometer without an alternating current standard cell. A further, and perhaps the most intriguing difficulty, arises from the need of measuring not only the magnitude of an alternating e.m.f., but its phase relationship with regard to some datum. No standards of alternating current or potential being available relations have to be established with direct current. This may be by means of electrostatic equality, electro-magnetic equality, or thermal equality. The practical application of the first method (Fig. 1) introduces higher potentials than are

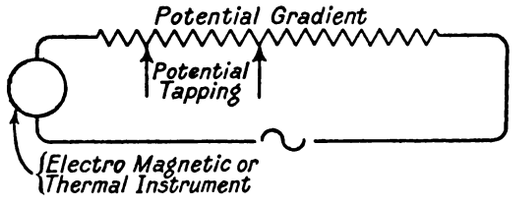

FIG. 2.

desirable and an accuracy of comparison between alternating and direct current closer than 1 per cent. calls for elaborate electrostatic instruments.

In all these methods of comparison only the effective alternating value will be obtained, which will not be solely due to the fundamental sine wave of the e.m.f. should harmonics exist, so that the accurate use of the alternating current potentiometer is restricted to sine wave circuits. Electro-magnetic comparison of a.c. and d.c. by means of deflectional instruments free from iron can be made with an accuracy of 0·2 per cent. up to about 2000 cycles, and with the thermal methods to an accuracy of 1 per cent. up to considerably higher frequencies.

By using a suitable instrument of the above type in series with a non-inductive resistance-gradient, a system for reproducing alternating potential of the same effective value as a direct potential can be devised, depending for its accuracy upon the non-inductive and electrostatic properties of the resistance-gradient and the purity of the magnetic system of the instrument in series.

This permits of indirect fixation of the effective alternating potential in terms of the standard cell, by similar effective currents, with an accuracy depending upon the instrument (which for convenience may be called the dynamometer), and the freedom of the resistance-gradient from inductive effects.

Superposition of Two Known E.M.F.'s.

In order to produce an exactly determinable phase rotation of the e.m.f. of the potentiometer the isochronous super-position of the two known e.m.f.'s presents a method of determinate accuracy. If the e.m.f.'s derived from two such potentiometers shown in Fig. 2 are superposed, the sum of the e.m.f.'s can be determined. If the currents flowing in these two potentiometers are displaced in phase

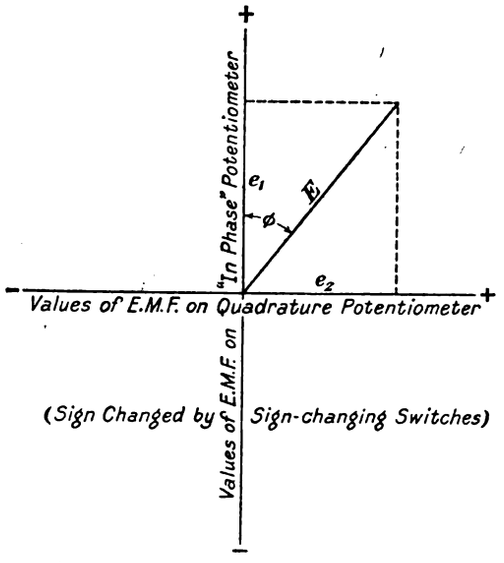

FIG. 3.

to a known degree the phase of the resultant e.m.f. can be found with respect to either component. A convenient phase relationship between the e.m.f. of the first potentiometer E_1 and that of the second E_2 is quadrature.

In these circumstances the sum of the two e.m.f.'s will be $E=\sqrt{E_1^2+E_2^2}$, and its phase relationship with respect to E_1 will be the angle $\varphi=\tan^{-1}.\frac{E_2}{E_1}$

The accuracy of the resultant e.m.f. E and the phase angle φ will depend upon the accuracy with which E_1 and E_2 and the phase displacement between them are known. The current and potential relations between the windings of a mutual inductance form one of the closest standards of quadrature and can be applied.

A Practical Instrument.

Having regard to the foregoing difficulties a potentiometer has been constructed which consists of two such potential systems, shown in Fig. 2, employing a special type non-inductive resistance coil, and with special non-inductive switches. The instrument is illustrated in Fig. 4, and the theoretical diagrams are shown in Figs. 3 and 5. Two separate potentiometers are contained in the complete

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instrument. One, which may be termed the " in phase " potentiometer, is supplied with alternating current through a sensitive dynamometer, thus allowing of indirect comparison to be made against a standard-cell upon direct current. The second potentiometer is supplied with alternating current in quadrature with the first, producing the conditions outlined in the foregoing.

In order to procure this condition of quadrature a method of phase adjustment is provided usually in the form of

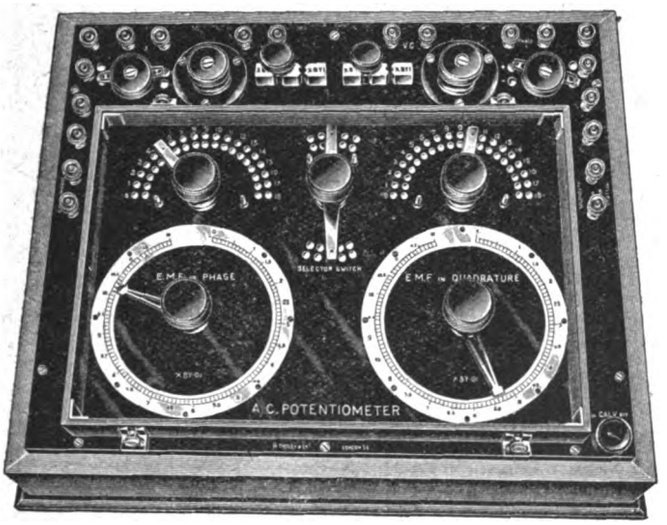

FIG. 4.—GENERAL VIEW OF INSTRUMENT.

a condenser in one potentiometer supply circuit external to the instrument, while rheostats are provided for adjusting each potentiometer current in the instrument itself. Instead of connecting a dynamometer into the second potentiometer circuit, the primary of a mutual inductance takes its place. If the e.m.f. induced in the secondary winding of this mutual inductance is balanced against the e.m.f. of the " in phase " potentiometer, the current in the first will be in close quadrature with the second. It still remains so to adjust the current flowing in the quadrature potentiometer to give correct values of e.m.f. The e.m.f. induced in the secondary of the mutual inductance will be $2\pi f.M.i.$ volts where f=frequency, i=current in amperes and M=mutual inductance in henries.

It follows, therefore, that a value of M can be chosen which gives a round value of induced e.m.f. in terms of frequency.

Thus at 50 cycles a balance is obtained at 0·5 V.
" 60 " " " 0·6 V.

By providing two secondaries in ratio of 10 to 1 to each other, a balance at 500 cycles is obtained at 0·5 V.

Absolute E.M.F. Indirectly Compared.

In this way the absolute value of the e.m.f. in phase is referred by indirect comparison to the standard-cell. The e.m.f. in quadrature is compared with the e.m.f. in phase by the current relationship between mutual inductance and e.m.f. involving frequency, but the quadrature is independent of an accurate knowledge of either frequency, mutual inductance or current, and depends only upon the purity of the mutual inductance.

A reflecting dynamometer has been specially constructed to provide sensitivity sufficient to utilise the full range of potentiometer. It is a torsion head type of instrument free from metal and a micrometer adjustment is added to facilitate fine balancing. As it is only for comparison of current, numerical calibration is not important, and a square law has been utilised to give a very open scale with the working current. The temperature coefficient is also of no great importance. It is arranged so that the reflecting dynamometer spot is in a convenient position when using the potentiometer, so that the steadiness of conditions is under constant observation.

Principal Errors Involved.

The following is a summary of the principal errors involved in the two components measured by this form of potentiometer :—

1. Error between d.c. and a.c. comparison.
2. Errors due to resistance gradients of potentiometers.
3. Error due to mutual inductance.
4. Error in frequency.

If an error of $\psi°$ exists in the quadrature relations of the two components the following corrections must be applied. e_1 and e_2 are the two e.m.f.'s indicated by the potentiometer. Then the correct value of E_1 and E_2 in true quadrature would be :—

$$E_1 = e_1 \cos \psi$$

and $$E_2 = e_2 + e_1 \sin \psi$$

and the resultant value of e.m.f. $E = \sqrt{e_1^2 + e_2^2 + 2e_1 e_2 \sin \psi}$

and the phase angle $\varphi = \tan^{-1} \dfrac{e_2 + e_1 . \sin \psi}{e_1 . \cos \psi}$.

Errors in knowledge of current, mutual inductance, and frequency produce errors in the values of e_1 and e_2 shown by the potentiometer of :—

$$\delta e_1 \propto \delta i \, . \cos \psi$$

$$\delta e_2 \propto \delta m, \ \delta f, \text{ and } \sin \psi \delta i$$

where δi. is " in phase " potentiometer current error, δm. is mutual inductance error and δf. is frequency error

Balancing the E.M.F.

The e.m.f. is balanced by means of a vibration galvanometer, and the readings are obtained as two components of e.m.f. The sign of each of these components is controlled by two small switches at the top of the instrument. thus an e.m.f. of any phase can be balanced by the two components by changing the sign of one or both.

In this respect the instrument forms a simple demonstration of co-ordinate representation of alternating currents.

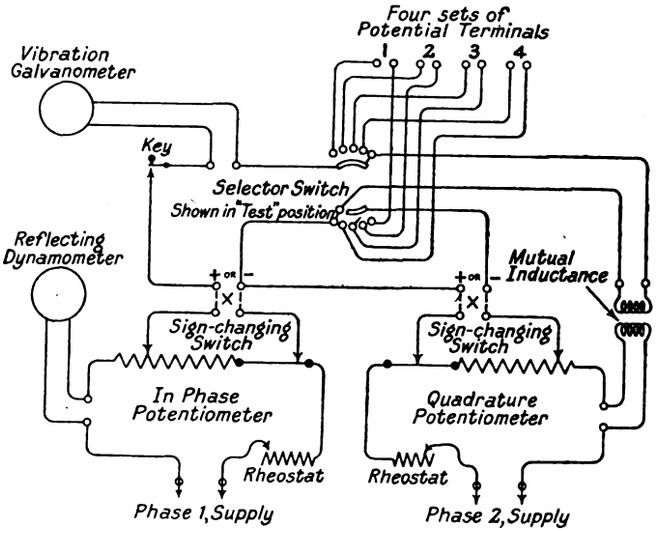

FIG. 5.

The changing of the sign of the components by the switches referred to affords a valuable check upon angular measurements. The reversal of polarity, if it may be so termed, gives a standard electrical angle of 180°, which, unlike any other electrical angle, is independent of reactive apparatus. Angles produced by reactive means can be built up and compared against the standard 180°, produced in this way by reversal of sign. Moreover, by reducing the current through one potentiometer to a fraction of the other, small angles can be measured with a corresponding magnification.

The instrument described above, with its special non-inductive features, has been designed by the writer, and is manufactured by H. TINSLEY AND CO.

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Electric Ship Propulsion*

BY W. L. R. EMMET.

Much has been published concerning the details of the electric ship propulsion installations of the U.S. Navy and the advantages which they have sought to afford. It is only through the study of detail in specific cases that sound ideas can be formed as to relative merits of different kinds of machinery for different ships. In this paper it is intended to show the possibilities of turbo-electric drive application in a type of ship in which it has never been used—namely, a large passenger ship—but before doing so it may be well to review some of its advantages in warships.

Advantages of Electric Propulsion in Warships.

The adoption of electric propulsion enables us greatly to simplify the turbine, using a plurality of units with the speeds which are most convenient, and to place these units in positions which are safest and most convenient. Reversing turbines are avoided and very large reversing power is afforded. Interchangeability is afforded which makes possible continuation of operation when part of the apparatus may be damaged, and also makes possible running at reduced speed with only a part of the apparatus in use.

With electric drive changes of connection can be made which afford a change in ratio of speed reduction, and this feature, in combination with the ability to use only a part of the generating units at reduced speed, gives a very large gain in economy at such reduced speeds as must be used in cruising, where fuel consumption governs the effective radius of action. Electric drive involves no mechanical function other than simple rotation. Lubrication becomes simple and inexpensive, and labour and maintenance are reduced to a minimum. Large electrical apparatus of such voltages as are used in ships is extremely simple and rarely gives trouble. Such apparatus, when damaged, is generally easy to repair.

Case of a High-Speed Cruiser.

An example of the possible expediency of electric drive to a type of warship—a 32-knot cruiser using 120 000 H.P. at full speed—in which geared turbines have their best and simplest application may be interesting. If this ship were equipped for electric drive the machinery would weigh about 10 lb. per H.P. more than a suitably geared turbine equipment. She would have four generating units; could run about 29 knots with three of them, 26 knots with two, and 19 knots with one, and the steam consumption per horse-power at all these speeds would be very nearly the same. At 19 knots, with one generator, with motors arranged to give the best turbine speed, the turbine efficiency would be actually better than at full speed, because the turbine would be less congested. With suitable arrangements and voltage adjustment the efficiency of electrical transmission will be as good at 19 knots as at full speed. One of the greatest advantages of the electric drive under these conditions would be that three of the four sets of auxiliaries used at full power would be shut down entirely. In a geared ship all of the turbines and gears, with their auxiliary equipment, would at 19 knots be operating at one-half speed and one-eighth load.

With this low power and speed, the efficiency of a turbine is greatly impaired. A ship turbine designed for best adaptation to such work will use about 52 per cent. more steam per H.P. with the lower speed and power. The gears will be at least 3 per cent. less efficient at this very low load and, in most turbine-driven warships, the auxiliaries at such speeds add 25 per cent. to the water rate. Thus, without saving through the use of cruising turbines, we might expect to use 80 per cent. more steam. By the use of cruising turbines this might be reduced to 60 per cent. For comparison we will assume 50 per cent. as the minimum difference that could exist between properly designed equipment under these conditions. On this assumption the electric ship will use for all purposes, at 19 knots with saturated 250 lb. steam, 0·85 lb. of oil per shaft H.P.-hour. A geared ship with similar merit in turbine design could not do better than 1·27 lb. of oil per shaft H.P.-hour.

Military Value.

The difference of weight between the two equipments will be about 535 tons, and this at 19 knots will be compensated for in 3 600 miles of run. And the comparison at lower speeds would be about similar. Such an electric ship could run at 19 knots from England to the Falkland Islands and, starting with 2 300 tons of oil fuel, would have 200 tons left on arrival. A similar geared ship, filled to equal displacement by carrying 2 835 tons of oil, could not reach at this speed within 700 miles of the distance. These figures, which are conservative, show that such qualities as are afforded by the electric drive may have great military value, even in a light, high-speed ship where the weight increase of machinery might at first sight be thought prohibitive.

Statements and Proofs.

The comparison which is here made may seem inconsistent with some claims of low-speed economy made by builders of geared ship machinery. It nevertheless agrees with the attainable facts, and it should be remembered that turbo-generators are constantly being tested by the manufacturers, while ship turbines without generators are not. Many claims entirely inconsistent with the known possibilities have been made in connection with ship turbines. In all the large naval vessels equipped with electric drive the results shown by careful tests have agreed closely with those predicted and indicated by calculations and by shop tests.

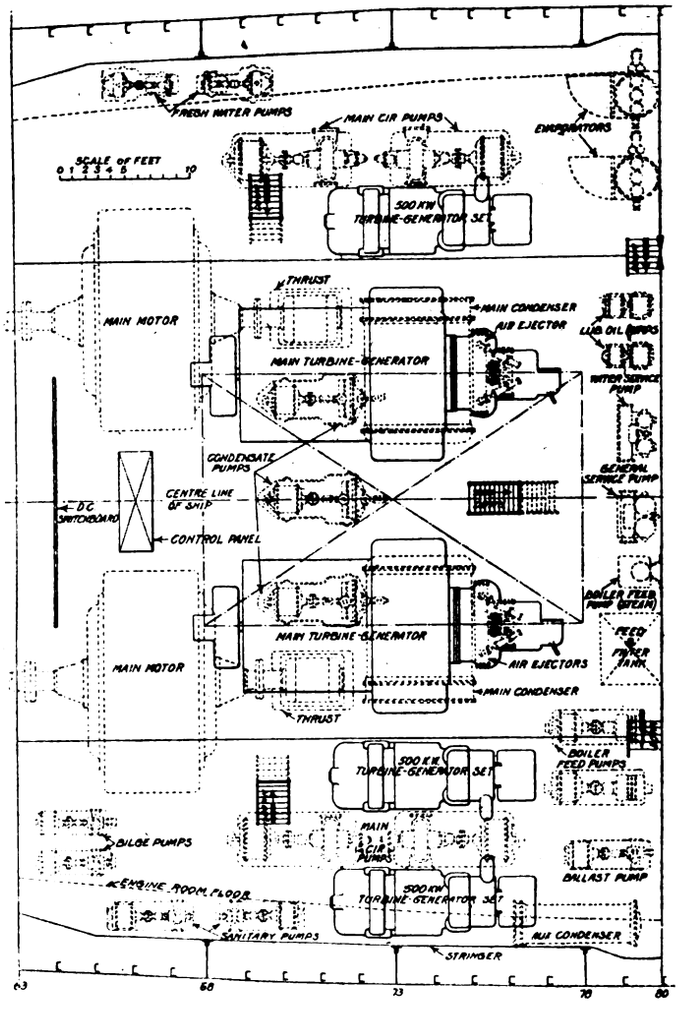

FIG. 1.—ENGINE-ROOM, 24 500 H.P. TURBO-ELECTRIC SHIP.

Gear Limitations.

While it can be said that with suitable knowledge geared turbines can probably be applied with success to almost any type of vessel, it must also be said that such application involves more possibilities of trouble than has been generally supposed. Distortions of gear casings, installed in the solidest manner, have been observed in heavy weather, and these movements have been large enough to indicate very large variations of strain distribution. Vibrations of ships, particularly in heavy weather, are imparted to gears and through the inertia of the parts affect the evenness of engagement. Low-speed turbines are safer and easier to apply through

* Abstract of a Paper read before the Spring Meeting of the Institution of Naval Architects.

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gearing than high-speed turbines, but they are also heavier, more complicated and less efficient than high-speed turbines.

A Passenger Ship.

As an example to illustrate the possibilities of electric drive in a large passenger ship the case of a vessel like the "Empress of Canada" has been taken. The machinery of this ship was well illustrated in "Engineering," September 1st, 15th and 29th and October 13th, 1922, and for comparison an illustration, Fig. 4, from that article, showing elevation of machinery and space, is here given. Figs. 1, 2 and 3 are also given, showing the possible arrangement of electric drive machinery in such a ship. In these all the machinery is shown in an engine-room made as short as possible. Such an arrangement with

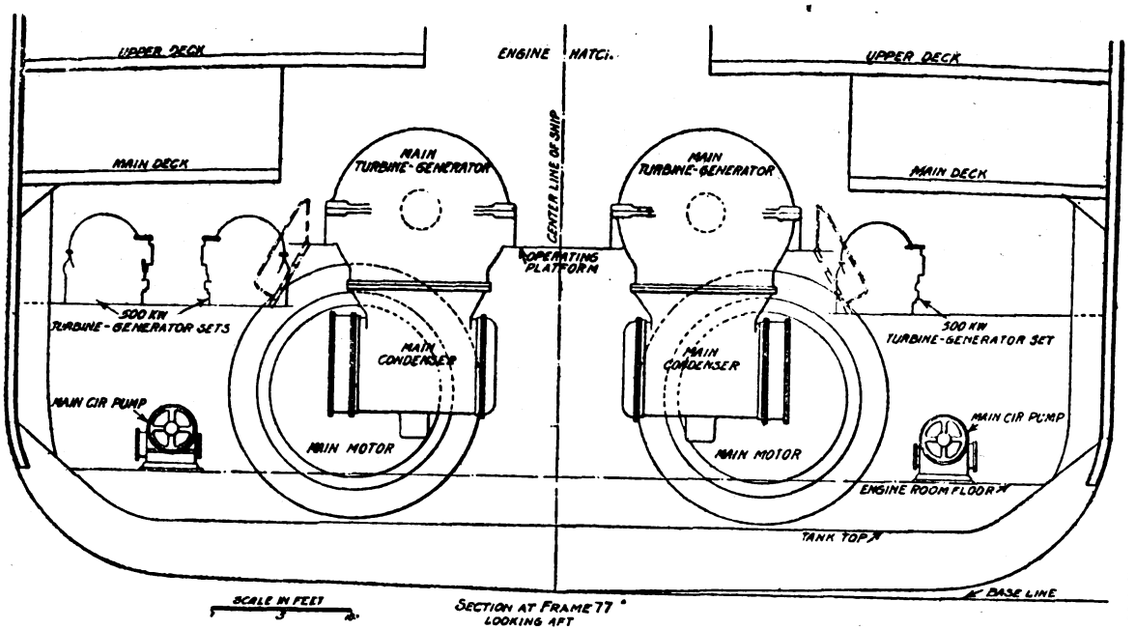

FIG. 2.—SECTION OF ENGINE-ROOM OF 24 500 H.P. SHIP.

generating units on a higher level is often very desirable, but various other arrangements could be used. Motors could be put in separate spaces nearer the propellers, which might effect some saving in shafts, etc.

Fuel Consumption Figures.

Fig. 5 shows the fuel rates for all purposes which should be given by such a ship when operating with two generators and with one. For purposes of comparison and verification of the claims here made a curve and test figures from the fuel ship "Kamoi" of the Japanese Navy are also given (Fig. 6). The figures were obtained by test during her first voyage. The differences between the performances of the "Kamoi" as shown and of the larger ship are fully accounted for by the difference in size of the generating units and by more advantageous auxiliary and feed heating arrangements. The results reported from the "Kamoi" are in good agreement with calculations based upon the factory test of her generating apparatus and clearly indicate that the figures for the larger ship are conservative.

DISCUSSION

ENGINEER VICE-ADMIRAL DIXON said electric propulsion had received the attention of the British Admiralty as far back as 1906, when a specific design was prepared for one of the capital ships of the then current programme. Since that time the matter had been closely followed and touch had been kept with all developments, but it had not been considered that the system promised sufficient advantage to warrant the change in any class of warship. With the recollection of many far-reaching claims made by various advocates during this period, he was particularly struck by the fact that many of them had not been substantiated after experience. The tendency was to lose sight of the main purpose for which the vessel was designed and to provide for fittings and devices which could only usefully be employed under peace conditions and did not add to the value of the vessel as a fighting weapon. Heavier machinery or machinery requiring a greater space led to a larger ship and thus to a slower ship, and this could only be discounted if the type of machinery allowed of full speed. That was an important distinction, speed being everything. It was stated in the paper that the 32-knot cruiser equipped with electric drive would weigh about 10 lb. per shaft H.P. more than a suitably geared turbine equipment. The electric transmission system would therefore require to be not less than 15 per cent. more economical than the geared installation at all speeds if an equally effective fighting vessel was to be realised. The experience of the British naval authorities went to show that the turbine, in association with gearing, could be made, for all practical purposes, just as efficient as in its application to electric generators, if not more so. Experience during the war had shown that during by far the greater part of war vessel service, full speed must be available at very short notice, although the requirements of the moment might call for only a relatively small speed. The deductions drawn as to the advantages of the electric system, in the paper, therefore, were not substantiated on British warships, either at full speed or at lower speeds. From an examination of a number of designs within the range of power to which the electric system was applicable, it appeared that it would require an extra floor space of not less than 20 per cent. in comparison with the geared drive. It had been urged in extenuation of the electric system that a very much greater sub-division of plant was possible and a greater latitude in the position of the propeller shaft line. In practical warship design these advantages were more apparent than real.

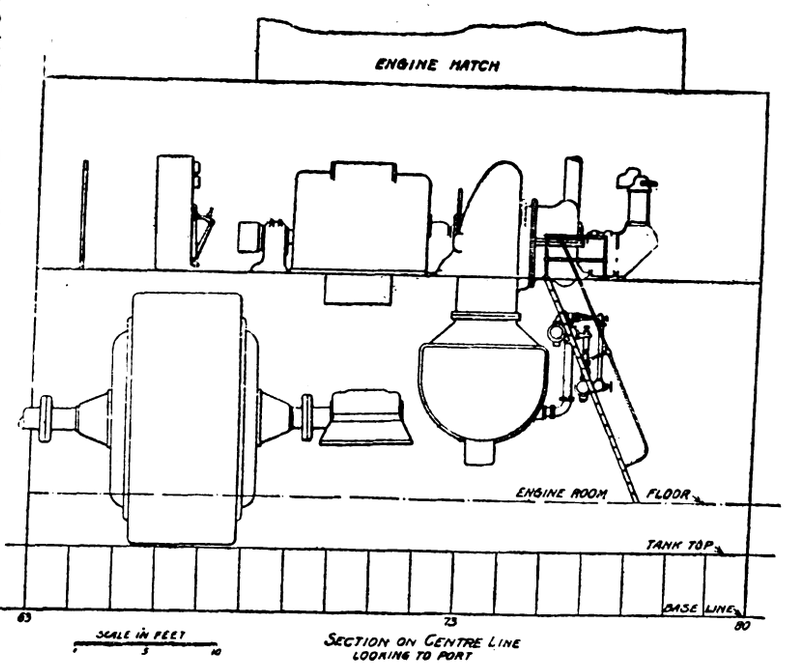

FIG. 3.—SECTION ENGINE-ROOM OF 24 500 H.P. SHIP.

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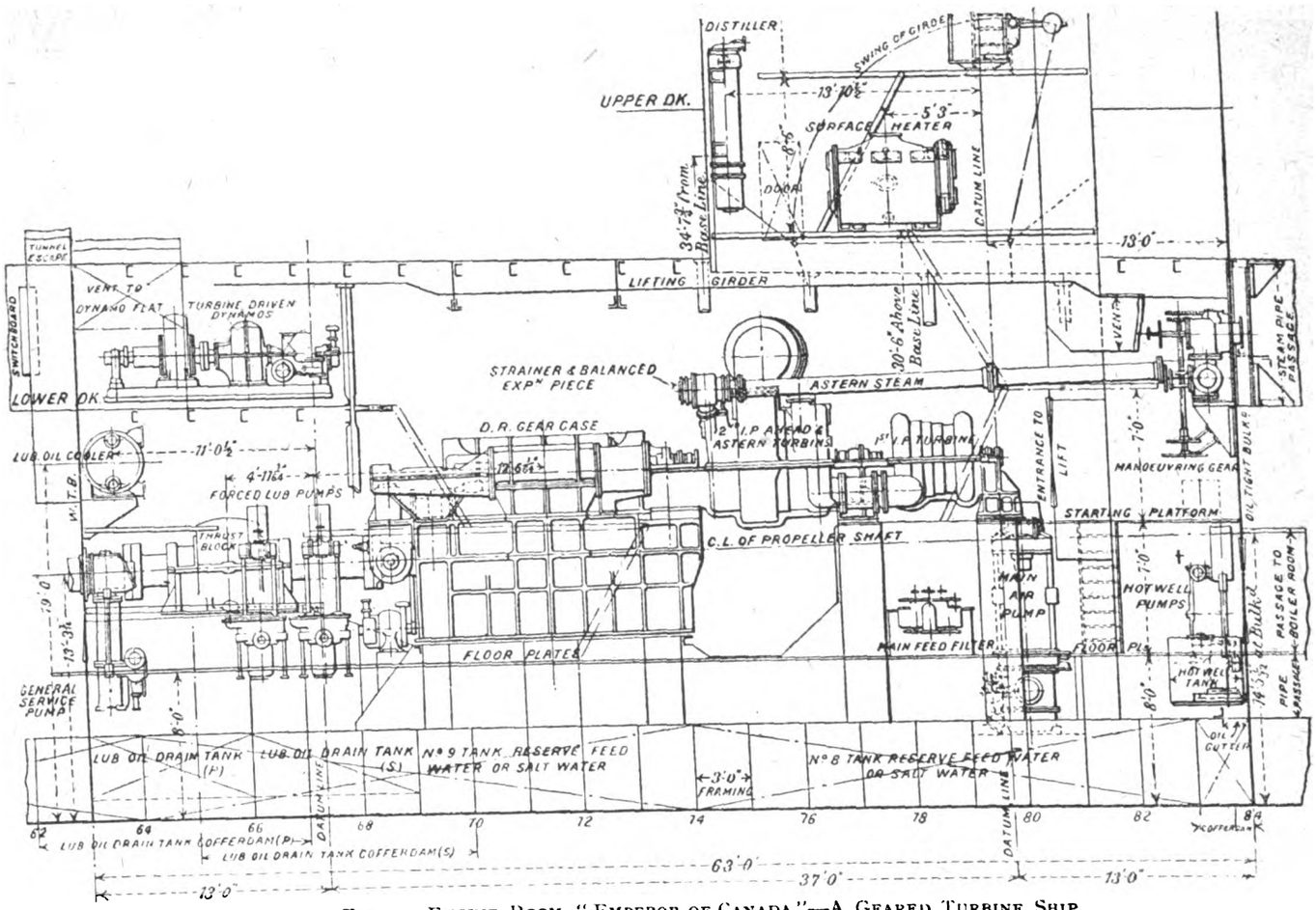

FIG. 4.—ENGINE ROOM, "EMPEROR OF CANADA"—A GEARED TURBINE SHIP.

Reliability and robustness of machinery were of the first importance in warships. It was known that the geared turbine had stood the shock of battle and the stress of four years' war in a markedly successful manner, and although we in this country would watch the progress of electric transmission and, indeed, consider it for future ships, at present it did not appear that its advantages outweighed its disadvantages.

An Advocate of Diesel Engines.

SIR THOMAS BELL said though the same economies could be obtained with a Parsons geared turbine, a better efficiency could be obtained than that shown by the author between the motors and the dynamo and in the power needed for excitation. If, moreover, Diesel engines were installed for generating

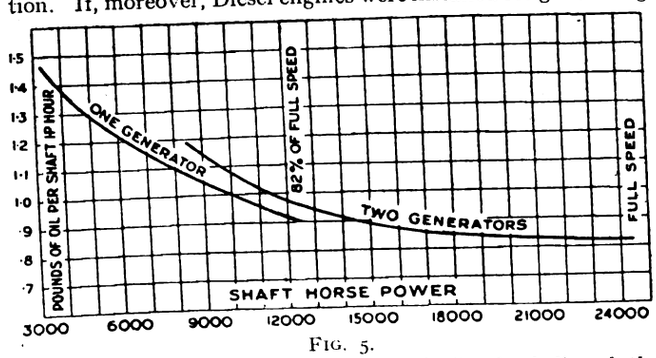

FIG. 5.

current to drive the auxiliaries electrically, he believed the author's final figures of economy could be surpassed. Therefore, he failed to see what advantage could be claimed for the author's electric system, which was heavier and more costly. Neither did he believe the author would, in reality, adopt the design of a superimposed turbine generator shown in one of the illustrations. It did not provide that same roomy design as was adopted in the "Kamoi," and another disadvantage was that the centre of gravity was raised, which, in many cases, might be a serious disadvantage when it was wanted to steam at higher powers.

The Weight Disadvantage.

SIR EUSTACE D'EYNCOURT said in the case of some of the largest light cruisers which we were permitted to build under the Washington Conference, up to 10 000 tons, and also to the battleships, which were allowed up to 35 000 tons, the question of weights and space was of the utmost importance. In the regulations of the Washington Conference fuel did not count. Therefore, the extra weight of the electric machinery was dead weight against the efficiency of the fighting qualities of the ship.

Nothing but Enthusiasm for Electric Drive.

MR. H. R. MCCLELLAND, Director of Electrical Engineering at the Admiralty, said that 15 months ago he visited the United States and inspected the electrical equipment of the

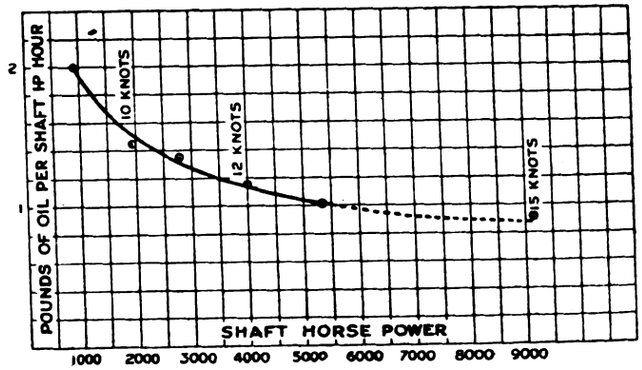

FIG. 6.—CURVE SHOWING OIL CONSUMPTION FOR ALL PURPOSES ON JAPANESE FUEL SHIP "KAMOI" AS INDICATED BY TESTS MADE ON VOYAGE BETWEEN NEW YORK AND HONOLULU.

battleships and the equipment for a battle cruiser and was able to discuss in detail with the American naval advisers, from the engineer-in-chief to the officers actually controlling the machinery, and also with Mr. Emmet and the engineers of the General Electric Co., the whole position. The naval officers, from highest to lowest, had nothing but enthusiasm for the electric drive, and he was quite sure, from what he had heard out there, that there were no such troubles as had been described earlier in the day in connection with the geared turbine. The question of weight and space was difficult to discuss unless one had specific cases to deal with, though in

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most cases the electric drive would necessitate a slightly additional weight and a slightly additional space. The fact that the Americans could get away from preconceived ideas and design their ships from first principles had enabled them to reduce the weights of their machinery far more than we had ever contemplated in this country. The author had furnished some useful information concerning the fuel consumption of the hypothetical 120 000 H.P. ship, and it showed that the efficiency of the electrical transmission was as good at 19 knots as it was at 32, which was the full speed. The paper also showed that the increased quantity of fuel to make up for the increased weight was not important, because such a vessel would have 200 tons on board at the end of the journey, whereas the other type of vessel would not reach within 700 miles of its destination on roughly the same amount of fuel.

A Definite Comparison Necessary.

He would like to see a definite comparison by British engineers of what they could do as against the hypothetical ship mentioned by Mr. Emmet under the same conditions. The author had assumed that the advantages of the electric drive were accepted in this country because he had laid very little emphasis upon these advantages in the paper. With the electric drive the boilers and generators could be placed in convenient positions in the ship; the electric system permitted of very big motors being placed as far aft as possible. If they had a geared ship with four turbines, and three of the turbines were put out of action in a fight, that vessel, if she could get out of range of the enemy, would have to crawl home at 5 or 6 knots. With the electric drive, three of the turbo-generators could be out of action and the remaining one could supply the four motors and the vessel could get back at half speed, which was very important. Further, the electric system did away with large diameter and heavy steam pipes and long and heavy propeller shafts with shaft spaces. Also, where the draught of the ship permitted of a large diameter propeller, it was possible to get a greater ratio of speed reduction than with a single reduction gear drive. Therefore, a higher propeller efficiency was obtained. As to reversal, with a geared turbine, the turbine was reversed, whereas with the electric drive, the motor was reversed, the turbine always running in the same direction. A higher degree of superheat could probably be used with turbines running in one direction, as in the case of the electric drive, as compared with a reversing geared turbine. These requirements must make the geared turbine less efficient than the turbine designed for electric drive.

Reliability Now Assured.

As to reliability, the Americans had without doubt taken the electric drive beyond the experimental stage. For large ships greater reliability could probably be obtained with the electric drive owing to plurality of units, and the operation of the electric drive would be quite simple. All the switches would be interlocked, so that there could not be any mistakes, and as to the availability of full speed at short notice in time of war, the electric drive would permit of full speed being run up as quickly as with the geared type. Personally, he had very little doubt as to the future of the electric drive. In some ships the Diesel electric drive would be the best and for others the turbine electric drive would be best. He did not suggest that all ships could be electrically propelled regardless of their duty, but he thought the time had arrived when this form of electric drive should be given careful attention for new ships here, not only as regards first cost and efficiency in service, but also in regard to maintenance and upkeep. He had information from the books at the American Naval Bureau that the cost of upkeep of the electrical equipment of the naval vessels was practically negligible. Some of them had been running a considerable period, and personally he would like to see two ships, one electrically driven and the other gear driven, experimented with, and he was sure such a piece of enterprise would be justified by the results. When the "Kamoi" was completed, a representative of Japan had said that whereas the Japanese had previously purchased ships from Great Britain, with the development of the electric drive, Japan had gone to America.

Improvements Necessary.

MR. S. V. GOODALL said he also had been to America and discussed this matter with the engineers there and had also taken a trip in the "New Mexico," the first battleship to be driven by electric motors. The result was that he was all but convinced of the advantages of the electric drive. He said "all but" because as a constructor he would like to see vast improvements in propelling machinery. The author admitted the electrical machinery was heavier than the geared drive. The electric propelling machinery on the "Lexington" class, however—the 180 000 H.P. ship—occupied space which allowed 14·2 shaft H.P. per sq. ft., which was appreciably less than the geared turbine installation of the "Hood," of 150 000 shaft H.P. Nevertheless, in his opinion, the machinery of the "Lexington" was very much more cramped than in the "Hood." The effect of the introduction of the electric drive on our battle cruisers would have been to make the ship 50 per cent. longer and her light displacement more by 3 500 tons. Supposing the military characteristics of the vessel were to remain the same, it would have to be 20 per cent. longer and the displacement would have to be 36 000 tons instead of 35 000 tons. Therefore, it would appear to be impossible to design these ships under these conditions.

Taxes versus Improvements.

Their Relationship to Street Lighting.

The following extracts are taken from an interesting paper published by Mr. CHARLES J. STAHL, of the Westinghouse Co. (U.S.A.), and will particularly appeal to supply engineers and others in the electrical industry who have to struggle with the problem of better street lighting against the "Anti-Waste" and "Geddes' Axe" parties on the local councils. It will help and hearten them in their struggle.

Higher Rates or Less Service.

"In most any city or village throughout the country there are those who claim that the present state of taxation is too high. A discussion on the subject usually leads to comparison between past and present rates, on which basis it is, of course, plain that taxes are higher and in most communities are going to be still higher. Further thought on the subject soon leads to the conclusion that we should not judge by the old standards and that we must expect advanced rates or diminishing services at the old rate, when the purchasing power of dollars grow less. None of us, however, are satisfied to accept diminishing services from the State, County and Municipal Administrations, in fact, quite the reverse is true, for, as our plane of living advances, governmental operations must adjust themselves and advance accordingly. The traffic squad is an added expense, but no one advocates its elimination under the present intensive use of automobiles.

"It is not the purpose of this article to advocate high taxes but rather to accept what tax rate becomes necessary in order not to fall far behind in public improvements. No doubt some people are drawn to a community having a reputation for low taxes rates. Like attracts like: in other words the community that is saving above all else attracts the man whose main ambition is to save.

A Progressive City.

"Business men embarking on new ventures, however, will look first of all for a progressive city. It is true that they may enquire as to the tax rate, and if it is low and the other qualifications are present in fair measure, so much the better. But when it becomes choosing between a city of low tax rate, and subnormal public improvement as against a progressive and thoroughly modernised city with a higher tax rate, they invariably choose the latter, for taxes, after all, are a small item in operating costs, and the characteristics of the community are of the utmost importance.

"Let no merchant whose shop faces on a poorly-lighted street persuade himself that this is a small matter, even if he does close his doors at nightfall! People learn to avoid his street at night and they unconsciously obey the same instinct in daylight.

Street Lighting—Civic Economy.

"Let no citizen whose community still does without modern street lighting believe that such denial is in the interests of true civic economy; for the well lighted towns are the well linked towns; and the real gains in value and business that follow installation of modern street lighting equipment offset its very low costs many times over.

"And what about the benefits that modern street lighting brings to all the people in a community? It means safety for women and children who must traverse the streets alone after nightfall; the prevention of many painful and costly and even serious accidents; the enhancement of property values and the betterment of living conditions.

"Does the highwayman select a well-lighted street for his operations? There is more for the overworked policeman to do in one poorly lighted block than in four that are properly illuminated.

Modernising the Appearance of the Community.

"Ornamental street lighting does more towards modernising and enhancing the appearance of a community than any other improvement of equal cost. An ornamental street-lighting installation works 24 hours per day, for if properly selected it improves the appearance of the street by day as well as by night. It beautifies the city, develops civic pride and makes knockers boosters. The feeling of safety and cheerfulness alone are worth the cost, and after all in its final analysis the best thing we do on this earth is to build a good home for ourselves and families. A good comfortable and safe home in a thriving community is about the most that we can hope for. In our home and home town we derive our greatest satisfaction, and no town having once experienced the benefits of good street lighting is ever satisfied with less."

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Atomic Projectiles and their Properties.

In this article we give an account of the third lecture of the course on "Atomic Projectiles and their Properties," which Sir Ernest Rutherford recently delivered before the Royal Institution. In it he deals with the properties of "jumped" electrons and illustrates his remarks by numerous experiments. He also considers the general theory of spectra and high speed electrons.

Coming back in the third lecture to the "jumped" electrons, Sir Ernest Rutherford pointed out that, if the impinging electron had not sufficient energy to remove a struck electron entirely from the atom, it might yet jump the electron into a "transition" state, in which it would remain stable for 0·001 or 0·0001 second, then to fall back into its original position while emitting a single-line radiation defined by the quantum relation. By submitting a gas to an intense bombardment by electrons emitted from a hot filament, we

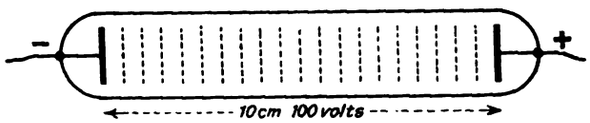

FIG. 9.

could arrange for a large number of atoms being in that transition state able to give out the special radiation. When a unit of that radiation was absorbed by a normal atom, one of the electrons of that atom would be jumped; a new pulse of that radiation was then emitted, and in this way it was possible to produce cumulative ionisation by bombarding already excited atoms with electrons carrying less energy than the true ionisation potential required. Thus the ionisation potential of mercury vapour was 10 V, but once the discharge was established, an arc could be maintained in the vapour by electrons of 5 V energy. The case of helium was still more striking; the normal ionisation potential was 24 V, but an arc once set up could be maintained with 4 V. The ionisation potentials varied from one kind of atom to another, but not by very large numbers.

Potential and Electronic Bombardment.

That the excitation potential was governed by electronic bombardment was further illustrated by reference to the diagram Fig. 9. A straight glass tube, 10 cm. long, contained mercury vapour at atmospheric pressure and a Wehnelt kathode and anode in a circuit of 100 V. The electrons emitted by the kathode would, in moving towards the right, have a very short free path, because they would suffer thousands of collisions per cm. with the abundant mercury atoms. These collisions would be of the elastic type, and the electrons would lose little energy in their zig-zag movements; 5 mm. from the kathode (i.e., after a potential fall of 5 V, the gradient being 10 V per cm.) they would hence have acquired

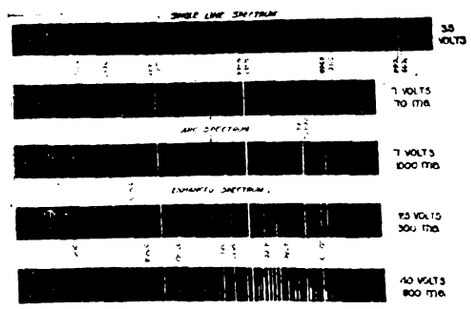

FIG. 10.

enough energy of acceleration to cause luminescence, and the tube was striated with bands of a green luminescence, 5 mm. apart (Grotrian). Thus in sufficiently dense gases luminescence was excited at potentials far below the ionisation potential.

General Theory of Spectra.

To extend these considerations to the general theory of spectra, Sir Ernest showed the spectra, (Fig. 10), which Foote and Mohler observed (1922) by firing electrons into potassium vapour. Below 4·3 V (the ionisation potential), at 1·5 V and more a single (really double) line appeared; above 5 V the arc spectrum, and above 30 V the enhanced or spark spectrum was observed. There was first only jumping, then a removal of more than one electron, leaving the atom with two charges. Similarly other series spectra could be explained, but he only referred to the energy diagram of hydrogen. That atom had only one electron, which might temporarily be stable, however, at many levels (Fig. 11). The level 1 corresponding to the innermost circular orbit was marked Lyman in the diagram;

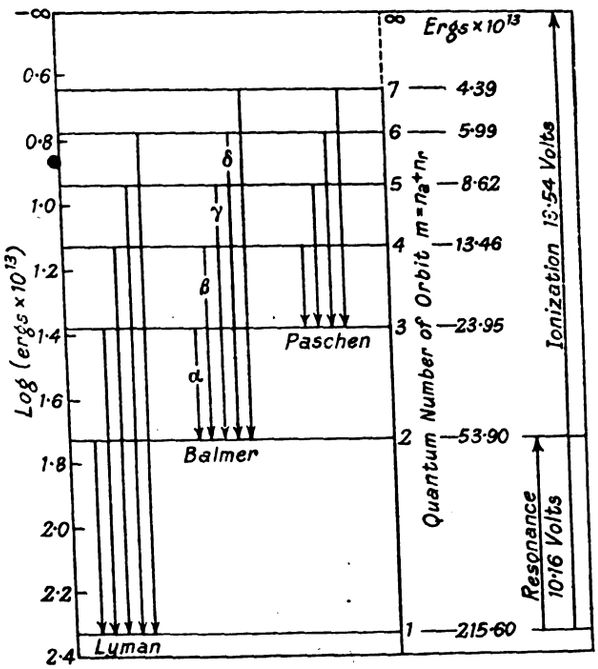

FIG. 11.

to remove the electron from that level to infinity (at the top of Fig. 11) required the full ionisation potential of 43·5 V, and the falling back electron gave the Lyman lines. Smaller potentials would jump the electron to intermediate levels of transition states, returning from which the electron would give rise to the α, β, γ, δ lines of the Balmer series and to the lines of the Paschen series, according to the level they reached. The levels were defined by the quantum relation. How the atom was able to remain in any of these states for a short period we did not know. Every atom was only in one state

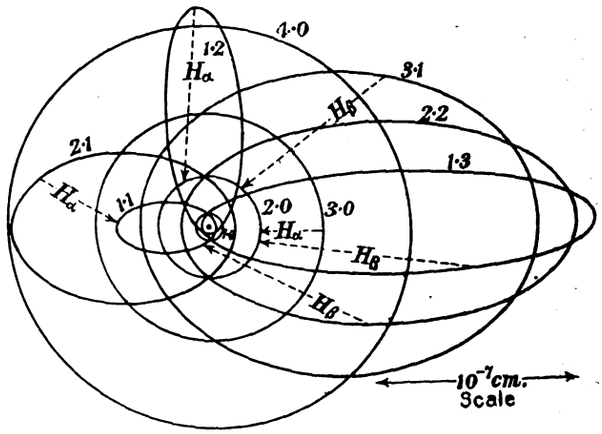

FIG 12.

at any moment, but the many radiating atoms in a mass of gas together gave the complete multiple spectum. How complex the movements were even for hydrogen was further exemplified by Fig. 12, which might be accepted as an instantaneous photograph of the possible states, whilst a time exposure would give a solid field of ink on account of the progressive motions. The various ellipses were all inclined to one another, and the orbits were disturbed; there was further an Einstein relativity effect, as in the progressive motion of the Mars perihelion. In the case of the heavy elements, with 80 or 90

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electrons, these orbits would become exceedingly complex. The falling-in was from a level of higher quanta to levels of lower quanta.

High Speed Electrons.

So far, Sir Ernest remarked, he had only considered the effects of slow electrons of say 30 V. When we went up to 100 000 or 200 000 V, we passed from ordinary optical effects into X-ray effects, which concerned the levels right in the centre of the atom. But the general arguments still held. In the case of a heavy metal represented by the diagram

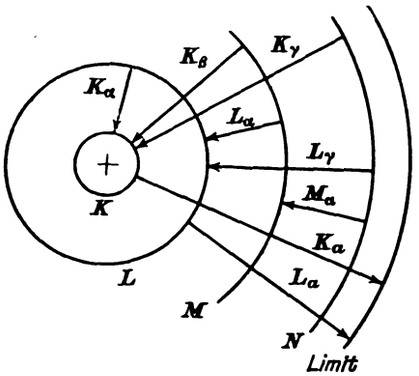

FIG. 13.

Fig. 13, the X-ray levels corresponded to the *K*, *L*, *M*, *N* orbits, the ordinary visible spectrum levels being much further out. In the case of the oxygen atom previously referred to, the *K* electrons would be the two innermost electrons; they were the most difficult to remove. When a swift electron of 90 000 V had removed a *K* electron, the whole atom would be disturbed, but it would tend to return to its initial state; an *L* electron would fall in, itself replaced by an *M* electron, etc., or an *M* or *N* electron might drop directly to the *K* level, and each falling-in electron would set up some X-radiation according to the greater or smaller energy they acquired in returning. Siegbahn's photographs of the *K* lines (Fig. 14) showed that there were two strong lines, $K\alpha$ and $K\beta$, and, further to the left of β, a faint $K\gamma$ line; similar lines, more widely spaced, were observed, as we proceeded from rhodium (atomic weight 103) to arsenic (75). In the case of lead the highest level corresponding to the shortest *K* line was 86 400 V;

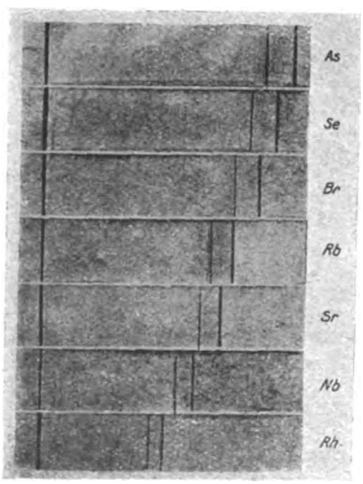

FIG. 14.

the L_1, L_2, L_3 radiations would be excited by potentials of 13 000, 15 200, and 15 800 V, the *M* line by 2 500 V.

Source of High Speed Electrons.

The fastest speeds known, not yet obtainable by high potentials, through experiments had gone up to 200 000 and possibly 300 000 V, were those of radioactive particles. The energy of β rays would correspond to as much as 3 000 000 V; the energy of the bigger α particles was still greater, 7 600 000 for RaC, and even 8 500 000 V for ThC. A convenient source of such α particles was a disc or wire exposed to emanation which was then deposited upon the metal in the form of a film or rather of isolated specks of scattered atoms. All the α particle from one element had the same speed, which he had long ago measured by deflecting the particles by electric and magnetic fields at right angles to one another—first, say, upward and then downward on the same plate and taking the mean of the two deflections. Those measurements had given the value 4·820 for e/m in the case of α particles from RaC, whilst the value calculated for the helium atom carrying two charges was 4·826. Further, the magnetic field of intensity *H* would turn the path of the particle into a circle of radius ρ, such that $H\rho = mu/e$, where *u* was the velocity of the particle; that formula gave $u = 19{\cdot}22 \times 10^9$ cm. per second. Electrons were much more easily bent or cured up, or were, in other words, much less stiff than α particles. Since very strong magnetic fields were difficult to produce, it was more convenient to determine the speed of particles by Geiger's relation $u^3 = k \times$ range in air in cm.

That α particles had definite ranges had first been shown by Bragg, and when that range was exceeded all the photographic, phosphorescent and other effects observed vanished. Fig. 15 gave G. H. Henderson's observed and calculated (dotted curve) ranges and ionisation values for air at 760 mm. and 0° C; the range 6·59 cm would rise to 7·07 at 20° C.; at short ranges, at which the speed of the particle was high, the ionisation was relatively low, but part of the curve was practically a straight line, and the ionisation reached a maximum quite near the end of the range, then to drop off completely. That the range in heavier gases is smaller than in air was shown by replacing the air in the chamber containing the gas by carbon dioxide. The effects and numbers of single α particles could be studied with the aid of the string galvanometer and of Geiger's counter; both were described by Sir Ernest last year, and we refer our readers to page 502 and Figs. 7, 8, and 9 of our issue of April 28th, 1922.

(To be continued.)

Co-operation between Manufacturer and Retailer.

At the meeting of the INFORMAL SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS, on Monday, March 19th, a discussion was opened by Mr. W. S. Caine and Mr. H. T. Young on "The Need for Co-operation between Manufacturer and Retailer."

Mr. CAINE began with an outline of the systems of distribution from works to consumer, and criticised the alternative methods of mail order, branches and agents, and of the ordinary channels with factors and retailers. He did not claim that the last method was flawless, but thought that it was best for the industry to-day, and he appealed for the fullest support from the retailer upon the general principles of team work and co-operation, purchases on a stock basis, preference for British made goods, and a reasonable profit.

Mr. YOUNG, who followed, believed it to be the duty of the manufacturer to supply the user by the most economical method. And he thought that the contractor retailer was the correct channel to ensure this. While admitting that the industry was getting better organised, he was able to give instances of many flaws in the system of distribution.

Mr. W. R. RAWLINGS showed that some other industries were much more considerate of their retailers, and he suggested for the electrical trade a basis of prices with a progressive discount for a small order, for a quantity over a period, and for cash on strict terms. Manufacturers want to sell in quantities, and he felt that if the retailer were prepared to stock quantities he should get best terms.

Mr. A. WINDIBANK believed the contractor was often to blame that the manufacturer was not considerate. His experience was that many contractors were incapable of properly handling an inquiry for plant.

Mr. E. C. WANSBROUGH suggested that all sections of the industry should give fuller support to the Electrical Development Association, and he hoped to see them unite upon a first-rate publicity campaign.

The PRESIDENT, Mr. F. Gill, said there must be found some way of best serving the public, and this must include a reasonable profit. He defined a reasonable profit as a return which would provide the additional capital required to carry on the business. With regard to the problem of distribution, it must be possible to find a solution if the existing channels have failed, and we should adopt the methods of the engineer. He did not believe electrical apparatus could effectively be sold without demonstration. We had the duty of educating the public, and except by the E.D.A., the industry had no co-operative advertisement schemes.

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Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

MODERN BOILER HOUSE PRACTICE.

To the Editor of THE ELECTRICIAN.

SIR,—I have read with considerable interest Mr. David Brownlie's article on "Modern Boilerhouse Practice" in your issue of March 16th.

At first sight, the details of this very large power-station, published by Mr. Brownlie, incline me to say that it is impossible to obtain the guarantees given by the contractors; but one has to know all the facts before being able to form an opinion about these guarantees, and Mr. Brownlie would oblige me, and probably many other readers, by giving full particulars about this plant.

I quite agree with Mr. Brownlie that the method of boiler plant testing in this case is of the utmost importance, and that the codes in use here are such that it will be practically impossible to come to a trustworthy result. By making the tests in accordance with these codes, the contractor will perhaps be able to arrive at the guaranteed performance, but such results would not convince me that the efficiency of the plant is really as high as that.

The standard method for boiler plant testing, used on the greater part of the Continent (Holland, Scandinavia, Germany, Austria, etc.), was inaugurated by the Institute of German Engineers (Verein deutscher Ingenieure), and the International Concern of Boiler Controlling Institutes in the year 1899. Although a little old-fashioned in some respects, it is certainly much better than the code of the British Institution of Civil Engineers, and tests made in accordance with this code, or with the Belgium code, which was made by the Société Vincottes, and which differs only slightly from the code 1899, are certainly trustworthy.

Apart from the question of which code is going to be used, it would be interesting to hear something more about this installation to get an idea of the possibilities of the new boiler plants. If 85 per cent. efficiency can be obtained with a fuel having a higher heating value of 10 800 B.Th.U., it seems reasonable to expect an efficiency of nearly 90 per cent. with high-class coal. Could Mr. Brownlie perhaps publish the exact analysis of the fuel?

Mr. Brownlie raises the question of what is to be done if the heating value of the fuel during the test is higher than 10 800 B.Th.U. In my opinion, it is not so much the heating value of the fuel as the percentages of ash and moisture and the size of the fuel, which have an important influence on the efficiency, and of these the ash percentage is predominant. To illustrate this I should like to call attention to the losses in boiler plants. These losses are in the chimney, in radiation, in flue dust and in unburnt coal in ash pit.

For this special plant the chimney losses are very low as the flue gases leave the air-heater at 236° F.; as the percentage of CO_2 in the flue gases is mentioned in the article, the amount of these losses is easily calculated.

As regards radiation, the losses are more or less uncertain, but the contractors know by experience the percentage of heat units lost in this way for a certain type and size of boiler.

The losses in flue dust depend greatly on the size of the coal; therefore I suppose that a certain size is fixed in the contract. If so, what allowance is made in case the fuel is of a smaller size?

I now come to the losses arising from unburnt fuel amongst the ashes and clinker. As the guarantees are really unusually high, I suppose that riddlings are not considered as a loss as they can be used again, and that therefore the total amount of heat units supplied to the grates is reduced by the heat units of these riddlings.

Then there are only the losses of unburnt coal amongst the clinker in the ash pit to be considered. These losses vary considerably for different fuels, and depend not only on the percentage of ash in the fuel as fired, but also on the nature of the fuel and the fusion temperature of the ashes. The bituminous English coal is, generally speaking, much easier to burn out than most of the Continental coal, and the contractors will probably be able to reduce the content of unburnt fuel in the ashes to 10 per cent. This depends on the construction of the grates and the quantity of fuel which has to be burnt per sq. ft. of grate area. For Continental fuels the percentage of unburnt coal varies for chain grates between 20 and 30 per cent., and the highest guarantees I ever heard of for this type of grates was 20 per cent.

To show the great influence on the efficiency of the plant I have calculated the losses in the ash pit in percentage of the heat units, supplied to the grates, for fuels containing 5, 10, 15 and 20 per cent. of ash, and for a percentage of unburnt coal left in clinker of 5, 10, 15 and 20 per cent., and give these in the following table:—

LOSSES BY UNBURNT COAL IN ASHES AND CLINKER IN PER CENT.

Percentage of ash in fuel.	Percentage of unburnt coal in ashes and clinker.					
	5	10	15	20	25	30
5	0·3	0·6	0·9	1·3	1·75	2·25
10	0·6	1·23	1·95	2·99	3·7	4·76
15	0·95	2·0	3·0	4·4	6·0	7·6
20	1·3	2·8	4·4	6·25	8·33	10·7
25	1·8	3·7	5·9	8·3	11·1	14·3

Now suppose that the fuel which is described in the contract contains 15 per cent. ash, then the losses in the ash pit with 10 per cent. unburnt coal are 2 per cent. If the fuel during the tests contains 20 per cent. of ash, these losses will be 2·8 per cent., and the efficiency goes down by 0·8 per cent. Therefore I should like to add to Mr. Brownlie's question what is to be done if the heating value is higher than 10 800 B.Th.U., what is to be done in case the ash percentage of the fuel is higher, or lower, than the ash percentage fixed in the contract, supposing always that this percentage is really fixed?

There are many other questions arising not only from this special contract but also from boiler plant testing in general, but these cannot be dealt with without taking too much space. In my opinion the whole problem for the contractors is to reduce the losses in the ash pit. If they succeed to burn the ashes out to 5 per cent. at the guaranteed load, it might be possible to obtain the guaranteed performance during the tests, but as far as I can see it will never be possible to obtain this efficiency under normal running condition.—I am, etc.,

J. EDWIN O'BREEN.

London, W.2. March 26th.

To the Editor of THE ELECTRICIAN.

SIR,—I have read with great interest Mr. David Brownlie's article in your issue dated March 16th. The many points raised therein appear to affect the whole problem of boiler testing and the improvement of boiler house efficiency. Indeed, we have apparently reached the stage at which—until we have a well-defined and standardised system of testing—we cannot be certain whether or not a particular boiler installation is really an advance upon its forerunners.

The extent to which the gases are cooled in the equipment described by Mr. Brownlie is remarkable. Theoretically, the lower the temperature of the gases at the final outlet, the higher the overall efficiency of the plant, but there is certainly a commercial limit to the extent to which it is profitable to cool the gases and probably there is also a thermal limit. Apart from the capital and maintenance costs of plant for cooling gases which are already at a relatively low temperature (so that further heat must be extracted under a very small "temperature gradient"), is there not a point beyond which supplementary radiation and additional losses in auxiliaries offset the extra heat units nominally "recovered"? An associated problem is the proportion in which the total extraction of heat is divided between the boiler, superheater, economiser, and air heater. Can Mr. Brownlie give us average figures representative of the latest practice, and will he express an opinion as to whether we are taking up as much heat as we ought to do in the boiler itself?

In the vexed problem of lower *versus* gross heating value, to what extent does each value approximate to the real conditions in the boiler? Mr. Brownlie states that under the "Civils" Code the final exit flue gas temperature is taken as 212° F. and the assumption is made that all the steam escapes from the plant. From his diagram in the article the assumption that the gases escape at 212° F. is within measurable distance of the truth and, if all the steam does not escape from the plant, does any part of it condense where it can give heat to the boiler system? With a steady stream of gases escaping at 236° F. or so it is not apparent how any useful amount of heat can be derived from the steam in the products of combustion.

From the practical standpoint every engineer will surely agree with Mr. Brownlie that the power consumption of *every*

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auxiliary essential to the working of the boiler should be deducted in calculating the net efficiency. To what extent is this done where pulverised fuel is used (*vide* the 86 per cent. claimed for the Milwaukee plant)? It would appear that the only figure of real value is the overall efficiency from coal dump to main stop valve. Ought not the power consumption for crushing, drying and transporting the coal to be taken into account. It is certainly an inevitable (and more or less costly) factor where pulverised coal is used and if it is taken into consideration there it must also be allowed for where non-pulverised fuel is used. Analysis of the efficiency of individual parts of the plant is valuable, and indeed essential for maintenance purposes, but it is the overall efficiency *under normal running conditions* which affects the profit or loss of the undertaking. What, in a modern installation, are the main causes and the magnitudes of "efficiency decay" in service?

These and other questions which will doubtless be raised by other correspondents, deserve to be discussed in detail and Mr. Brownlie has rendered a service to manufacturers and users alike by expressing the problems in concrete form. It would be particularly helpful if users would give their views, especially as they are mainly responsible for the "service efficiency" as distinct (very distinct sometimes!) from the "guaranteed efficiency."—I am, etc.,

R. E. NEALE.

London, W.
March 28th, 1923.

To the Editor of THE ELECTRICIAN.

SIR,—I read with the greatest interest, in your issue of March 16th, Mr. David Brownlie's fascinating outline of the arrangements made to reach the Mount Everest highest peaks of steam practice, and I was disappointed, on looking through my ELECTRICIAN on Saturday morning, that no one from the large number of capable men at our various power stations had made any comment on the subject, bristling as it does with huge possibilities.

I am not an electrician, but have spent well over 30 years in the search for cheaper steam, and, having some imagination, have often in fancy climbed above the 81 per cent. efficiency peak, but soon everyday practice has sent me after the two historical characters, Jack and Jill. I therefore sincerely trust, with Mr. Brownlie and other of your readers, that the guarantees will be fulfilled.

I will not attempt to analyse in details the figures given by Mr. Brownlie, but it will interest many of your readers to find what a large share of the work is credited to the superheater and economiser and the small percentage of heat losses with the gases passing up the chimney.

I am inclined to doubt the practicability of working a boiler with an excess air supply of only 37 per cent. above the theoretical requirements, especially when such air is increased in temperature approximately 200°; furnace troubles appear almost certain, especially with such low grade coal as specified.

I would suggest to those of your readers who are especially interested to consider from the data to hand that 1 lb. of coal, with a calorific value of 10 800 B.Th.U., must raise 7·6 lb. of water from 180° to steam at 677°, i.e., 285° superheat, the gases passing up the chimney at about 240°, and I am sure they will find the results very interesting.

Personally, I think but little of a boiler test covering a period of only a few hours, with boilers and flues all perfectly clean and additional help supplied. That the very best results may be secured, test the same boiler over a four weeks' period and note the difference in duty and efficiency of each week, and the effect of dust on the tubes and water impurities will show a marked falling off in efficiency when comparing the last week's results with those of the first week.

To judge the capacity of any boiler by the orthodox methods of testing for eight hours is practically the same thing as saying that an athlete who can run 100 yds. in 10 seconds can run a mile in 176 seconds—there is just as much reason in one as the other. I am satisfied that the most economical proportion of air to coal of, say, 12 500 B.Th.U. cal. value is 18 to 1, the temperature secured, 2 700°, is also sufficiently high for good practical work, and is such that black smoke cannot be produced, and if these rules were in daily use 16 cwt. of coal would do the same work as is now done by 20 cwt., in other words, 20 per cent. saving in coal could be effected if we maintained 13 per cent. CO_2 instead of 7 per cent.—I am, etc.,

W. H. CASMEY.

Wakefield,
March 26th.

To the Editor of THE ELECTRICIAN.

SIR,—I have read with much interest the article by Mr. David Brownlie on "Boiler House Practice" in connection with the extraordinary guarantee of 85 per cent. efficiency. I am not going to express any opinion at all as to whether such figures can be obtained, but in the first place I am very glad to note that a modern plant of this description is being fitted with superheaters, economisers, and air heaters, and that the economisers are of the cast iron type. There has been some tendency of late, especially in the United States, to do away with the economiser entirely on large boiler plants and to substitute for it the air heater. I contend that whilst, of course, the amount of saving to be obtained by the economiser is not so great in the case of a large water-tube boiler plant as with cylindrical boilers, yet to do away with the economiser entirely is a fundamental mistake, not only from the point of view of economy, but also because of the equalisation of the temperature. The proper arrangement is superheaters, economisers, and air heaters, and I am certain that power-house designers will be unanimous in this respect again before long.

Writing from about 35 years' personal experience in the manufacture of economisers, I think also that the steel tube economiser is a mistake, as steel will not withstand corrosion to anything like the same extent, and the extra space and reduced weight give really trifling advantages over the cast iron economiser.

With regard to the question of a boiler testing code, I must admit that the whole question is so very intricate and complicated that one hesitates to write about it, but it is quite obvious to every engineer that some standard method is necessary, especially with regard to deducting the steam or power used. As Mr. Brownlie has pointed out on various occasions, there are boiler plants in this country which are taking anything from 0·5 to 21½ per cent. of the steam production of the plant on the nozzles alone, and yet in expressing the result these figures are not taken into account at all, which is, of course, ridiculous.

I note also that Mr. Brownlie states very definitely that high figures, such as 85 per cent. efficiency, can be obtained with pulverised fuels, and I am sure that engineers like myself would be glad of further enlightenment on this subject.—I am, etc.,

DAVID RUSHWORTH.

Nottingham.
March 26th.

To the Editor of THE ELECTRICIAN.

SIR,—In your issue of March 16th you published an article by Mr. David Brownlie entitled "Modern Boiler House Practice," in which some remarkable efficiency figures are given, and Mr. Brownlie makes use of these figures to urge the need for an international code.

I cannot imagine any power engineer disagreeing with Mr. Brownlie's deduction in principle, and doubtless this important matter will be discussed at the coming World Power Conference next year.

My purpose in writing, however, is to deal only with one point raised by Mr. Brownlie, namely, the deducting of all auxiliary power in calculating the real net working efficiency. The particular plant under consideration refers to large generating stations, but the same principles are involved in industrial plants, and under present conditions it is almost impossible for the average factory owner to arrive at a common basis of comparison when steam power plant is under consideration.

This point was brought home to me in a very emphatic manner in pre-war days, when it was my privilege to fight the case for the large gas engine. Incidentally, the gas engine sometimes won, but with some half dozen well-known British steam firms ranged against you, the gas engine man naturally asked some awkward questions, and the poor factory owner was at his wits end to get at the truth.

There is nothing to be gained by leaving this matter where it now stands, and, as Mr. Brownlie points out, efficiency in the modern boiler plant has become such a very fine art that it is bordering on the ridiculous not to have a more scientific basis for determining such efficiency.—I am, etc.,

JOHN D. TROUP.

Southampton.
March 26th.

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To the Editor of THE ELECTRICIAN.

SIR,—The article on "Modern Boiler House Practice," by Mr. David Brownlie, in your issue of March 16th, discusses matters of great moment to all engineers interested in the economical generation of steam; in it he describes, in considerable detail, an undertaking which promises to secure a greater transmission of the heat units available in fuel into steam than has hitherto been obtained.

Mr. Brownlie seems to be dubious of the successful issue of the undertaking, partly on account of the high efficiency to be obtained and partly because the methods and conditions for conducting boiler trials are insufficiently exact to warrant any engineer in predicting efficiencies as determined by trials. It seems clear from the tenor of the article that Mr. Brownlie is so impressed by the magnitude of the undertaking that, while wishing to be encouragingly hopeful, he is apparently afraid to approach the subject closely and by careful analysis test the justification for his doubts.

Had he boldly applied his knowledge of the factors governing steam generation plant efficiencies he could scarcely fail to see that the undertaking can be successfully accomplished.

When set out the heat balance is a perfectly normal one, taking the figures given in Mr. Brownlie's article, and he may be safely challenged to point to any item which is not a justifiable anticipation. The approximate heat balance may, from the data given by Mr. Brownlie, be written as follows:—

	B.Th.U.	B.Th.U.	Per cent.
Heat units per lb. of coal as fired	10 800	—	—
Heat units absorbed by boiler	—	7 377	65·4
Heat units absorbed by superheater ..	—	1 204	10·67
Heat units absorbed by economiser ..	—	807	7·15
Heat units in dry gases to chimney ..	—	579	5·13
Heat units in steam in chimney gases due to combustion of hydrogen and moisture in coal	—	483	4 28
Heat units in ashes (1 per cent. of the heat units in coal)	—	108	·96
Heat units lost by radiation (1 per cent. total heat supplied to furnace)	—	114	1·00
Heat units absorbed by air heater	487	487	4·28
Balance	—	128	1·13
Total heat units supplied to furnace ..	11 287	11 287	100·00

	Per cent.	Per cent.
Percentage of heat contained in 1 lb. of coal imparted to steam	86	
Less power for forced and induced draught, fan and stoker	1	
	—	Net 85
Percentage of heat supplied to furnace and absorbed by boiler, economiser and superheater	83	
Less power for forced and induced draught, fan and stoker	1	
	—	Net 82

Now, considering these various items, the boiler heating surface is only asked to yield a gross efficiency of 65·4 per cent. This is not an extravagant demand, and Mr. Brownlie, who has conducted hundreds of boiler trials, could not hesitate to agree that a modern watertube boiler is readily capable of yielding so modest an efficiency. The further absorption of heat by the superheater, the economiser and the air heater is merely a question of the provision of the necessary heating surface so that the rate of heat transmission per hour per square foot per degree difference in temperature is within the rates which have been definitely established in practice. The temperature gradient throughout the unit, as indicated by Mr. Brownlie, would enable any engineer by calculation to determine what heating surface has to be provided definitely to secure the necessary transference of heat. It certainly should be possible for the contracting manufacturers named, viz., Babcock and Wilcox, Ltd., the Underfeed Stoker Co., and E. Green respectively to determine from actual experience what heating surface will secure the required heat transmission.

Mr. Brownlie says that the low grade nature of the coal makes the guarantees more difficult of attainment, but he overlooks that the return of heat units from the air heater is another source of heat to the furnace which may be considered as adding to the heat units in the coal. The effect, as seen from the heat balance, is to increase the heat units available in the furnace per lb. of coal supplied from 10 800 B.Th.U. to 11 287 B.Th.U.

Further, it may be taken that the heat units returned in the heated air from the air heater furnish another source of heat added to that which is in the coal, so that the efficiency of plant should be calculated on this total supply of heat, and not only on the heating value of the coal. Calculating the efficiency from the total heat supplied to the furnace and the heat imparted to the steam, the efficiency of the boiler, superheater and economiser, is 83 per cent. only—a figure closely approximating the 82½ per cent. which Mr. Brownlie implies is possible of attainment.

The remaining items of the heat balance, namely, radiation and loss by combustible in ashes, are frequently classed under a vague item of "heat unaccounted for," but surely it should be possible with modern instruments and methods of precision to dispense with this indefinite grouping and allocate this loss. As Mr. Brownlie points out, the allowance of 5 per cent. for radiation is surely wrong for modern plants. Mr. Henry Kreisinger, late of the United States Bureau of Mines, has conducted most careful investigation on modern boiler plants and has determined definitely that in some particular cases the loss by radiation was 0·6 per cent., and may be safely taken as less than 1 per cent.

A coal having 10 800 B.Th.U. as fired, will probably have 15 per cent. ash, and a loss of 1 per cent. of the coal would mean that the ashes would contain 7 per cent. of combustible; for the loss to be 2 per cent. the ashes would contain 11 per cent. combustible. At many stations with free burning coals such results are readily obtained.

There remains the error of determination and whether the various factors governing the efficiency can be recorded with sufficient accuracy to warrant an efficiency being guaranteed which does not provide for a substantial figure to cover "heat not accounted for."

Certainly coal weighing machines, measuring tanks, thermometers, etc., can be carefully calibrated and checked, and, in experienced hands, the errors are negligible. It says much for the advance in methods for testing when the losses can be located, specified and predicted and the balance of heat accredited to the steam and guaranteed.—I am, etc.,

VIVAT VERITAS.

ADVERTISING IN THE ENGINEERING PRESS.

To the Editor of THE ELECTRICIAN.

SIR,—The opinions of Mr. E. H. Reeves expressed in his letter in THE ELECTRICIAN of the 16th inst., do not appear to differ vitally from my own. An advertisement in the technical press is addressed by one engineer to another. Success in writing such an advertisement demands, obviously, two things—a knowledge of engineering and a knowledge of advertising (including salesmanship). The present level of engineering publicity proves the difficulty of obtaining these two sets of qualifications in the person of one man, however ideal that arrangement may be. I suggest therefore that the best results will be obtained not by the engineer rushing blindly into advertising nor by the advertising man committing technical blunders, but rather by a close co-operation between the two. If the advertising agent supplies the advertising experience *and* the salesmanship, it does not seem as "vital" as Mr. Reeves suggests that the engineer should possess the latter quality.

I quite agree, however, that the more the engineer makes himself acquainted with the science of advertising and selling the more effective will be his co-operation with the advertising agent. Indeed, these articles have been written solely in the hope that in some small measure they may increase the engineer's knowledge of and sympathy with modern methods of selling.

I will not quarrel with Mr. Reeves as to the exact definition of a service agent as the point is immaterial and the type of agent which I described is that with which the engineer is most likely to come into contact. In the sentence "the value of such services to the engineer is not necessarily quite the same as to other fields," I refer, of course, not to salesmanship but to certain services into which salesmanship may enter to a greater or less degree or (in the case of despatching "copy" and blocks and checking of accounts) to no degree at all.

The penultimate paragraph of Mr. Reeves's letter is so close a paraphrase of the last phrases of my own article that it calls for no reply but complete agreement. In conclusion, I believe the editor of THE ELECTRICIAN would welcome correspondence on this subject from electrical engineers who, like myself, feel that engineering publicity should attain by any means its maximum level of efficiency.—I am, etc.,

YOUR CORRESPONDENT.

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Works Production.

At a recent meeting of the NORTH-WESTERN CENTRE of the INSTITUTION OF ELECTRICAL ENGINEERS, Mr. G. H. Nelson read his paper upon "Works Production," an abstract of which appeared in our issue of January 26th. The discussion emphasised the essential fact that efficient production, the organisation of manufacture so as to obtain the maximum result with the minimum of effort, depends most of all upon the human and personal element.

Two Essential Elements.

Mr. G. E. BAILEY pointed out that many systems of successful operation were possible but all depended in the last issue upon these elements and Mr. W. J. MEDLYN quoted that "the engineer can have no greater asset than aptitude to handle staff and labour." Intelligence and full co-operation were most important between those who carried on the various parts of a manufacturing organisation. Most of all sympathetic relations and good feeling were necessary between those whom Mr. A. B. MALLINSON called "the man in the shop and the man with the collar on." As means for encouraging team work Mr. BAILEY stated he had found of great value periodical meetings of foremen and others interested to discuss troubles and difficulties to suggest improvements and to deal with anything that in any way affected efficiency of manufacture.

Training the Worker.

The benefits of works schools for apprentices had already been noted in the paper and Mr. MEDLYN gave some details of vocational training which had been carried on in the South Lancashire District by the Post Office in co-operation with the education authorities. Classes were held on two evenings per week, the students' fees and other necessary expenses being paid by the Post Office. This system had worked successfully in Manchester and Liverpool, 600 of the 1 500 students having obtained first-class certificates. The cost of the training had been 23s. per head. In cases of special difficulty tuition had been given in the department's time and in one case quoted, on the work of cable-jointing, pamphlets of instructions had been issued which corresponded closely with the technical process specifications described and illustrated in the paper.

Consideration for Labour.

The probable efficacy of the bonus scheme suggested by the author for the encouragement of labour efforts was doubted by some of the speakers. Mr. BAILEY recommended instead some arrangement for unemployment insurance by the industry and hoped for some concrete scheme which would enable a man to maintain his efficiency whilst unemployed yet which would have provision to guard against malingering. As a help toward maintaining the willing co-operation of labour it was urged that work on which delivery had been pressed should not be delayed afterwards. It was most discouraging for a workman to see a job upon which he had perhaps unwillingly worked overtime, stand for days afterwards awaiting its further progress. Departments should co-operate on this and customers too should be consistent in accepting delivery on the date arranged for.

Mr. T. E. HERBERT believed that nothing that was essentially wrong could permanently exist and that therefore waste must go. Advocating encouragement of effort by payment by results, he suggested that the principle of buying in the cheapest market and selling in the dearest could be greatly improved upon in the organisation of labour. Giving as little as possible for as much as one could exact was not the way to efficiency. More was to be gained by human consideration and the healthy co-operation which was the goal of the much maligned idealist.

Production in Small Works.

Though the term "scientific management" had been avoided by the author on account of the prejudice it had aroused in some discussions, it was agreed that the principles were the same for efficient production. Mr. L. H. A. CARR raised the problem of production systems for small works where special departments for such work as inspection, processing and rate fixing could be provided. "Without questioning whether such works should be allowed to exist" he suggested that even in such cases the principles could be applied and that there would be the compensating advantages of closer contact and control by fewer personnel. Perhaps the chief difficulty in all cases was the problem of shop lay-out so that the work would come in to suit the machines. The ideal works manager would therefore have to possess, in addition to other accomplishments, the ability to foretell orders for at least twelve months ahead.

The Author's Reply.

Mr. NELSON, replying to the discussion said that the bonus scheme he proposed was suggested to operate in addition to the Government scheme recommended by Mr. Bailey. He agreed with those who felt that co-operation was the secret of efficiency and pointed out the advantages that would result in extending this through the industry. In the works where the system described in the paper was used the costs of the special departments for processing, inspection and production were only 0·9 per cent, 0·87 per cent. and 0·95 per cent. respectively of the factory cost of manufacture. His recent experiences in the United States had shown him that American methods were not always efficient. In one works he had visited an 80 ton boiler was taken up four floors in the course of its manufacture. In another case where American costs of manufacture were only 25 per cent. of British he had found that the labour and material costs were similar to ours and the saving was on factory expense.

Hot Water Supply for an "All-Electric" House.

Conditions for the Second "Electrician" Competition.

We give below the conditions for the second ELECTRICIAN competition. The plans of the house for which a hot water supply is to be provided appear overleaf.

1. Competitors are required to submit suggestions for an electric hot water supply scheme and the cold water supply service necessary in connection with it for the house illustrated on pp. 372 and 373 of this issue. Provision should be made for hot water service to an electric hot water boiler and/or washing machine not shown on the plan. The house is assumed to be in Hackney. The plans and elevations should be re-drawn on ¼ in. = 1 ft. scale on tracing cloth in black ink.

2. Competitors must give the following information:—

(*a*) A specification of the materials to be used and the method of fixing.

(*b*) A schedule of all hot water "draw offs," controls, fittings and apparatus to be erected.

(*c*) A priced bill of quantities.

(*d*) Plans showing the runs and sizes of all conductors and pipes and the position of all materials installed.

(*e*) Wiring diagrams (if necessary) of any work or connections that cannot be clearly indicated on the wiring plans.

(*f*) A brief description, not exceeding 1 500 words, of the methods proposed to be employed, with reasons.

(*g*) A letter to a prospective client, quoting for the job and describing concisely what is offered in non-technical language.

3. While technical correctness will be the first essential, the judges will take into account literary and artistic presentation in the competitors' work. Financial soundness will also be a very important consideration.

4. Drawings, specifications and typescripts must bear in the top right-hand corner a pseudonym by which the competitor wishes to be known, and must be accompanied by a sealed envelope bearing on the outside the pseudonym and on the inside the full name and address of the competitor, and a certificate (see paragraph 10).

5. The typescripts, drawings and pseudonym envelope must be sent by registered post to the Editor, THE ELECTRICIAN, 8, Bouverie Street, London, E.C.4, and must reach him not later than first post on Friday, June 29th, 1923.

6. Typescripts, etc., bearing the pseudonyms will be sent to the judges, but the names and addresses of competitors will not be disclosed to them until the awards have been made.

7. The names and addresses of the successful competitors will be published in THE ELECTRICIAN as soon as possible after the close of the competition.

8. The following prizes will be given: First, 25 guineas: second, 15 guineas; third, £5.

9 The Editor of THE ELECTRICIAN will act *ex officio* as judge, and his decisions on all matters relating to the competition is final. He can enter into no correspondence on the competitions.

10. Competitors will be required to submit with their typescripts, etc., a certificate agreeing to abide by the conditions of the competition.

11. The proprietors of THE ELECTRICIAN will not be responsible for the loss of or damage to any typescripts or drawings. Every care of the matter submitted will, however, be taken.

12. Competitors must take their own steps to protect any patentable suggestions in the plans or essays sent in. The Editor reserves the right to publish any matter he receives, and will not be responsible if protective steps have not been taken before publication occurs. Solutions other than those of the prize winners, if published, will be paid for at £2 2s. each.

13. The Editor will not be responsible for any opinions which may be expressed about apparatus, methods or systems by the competitors.

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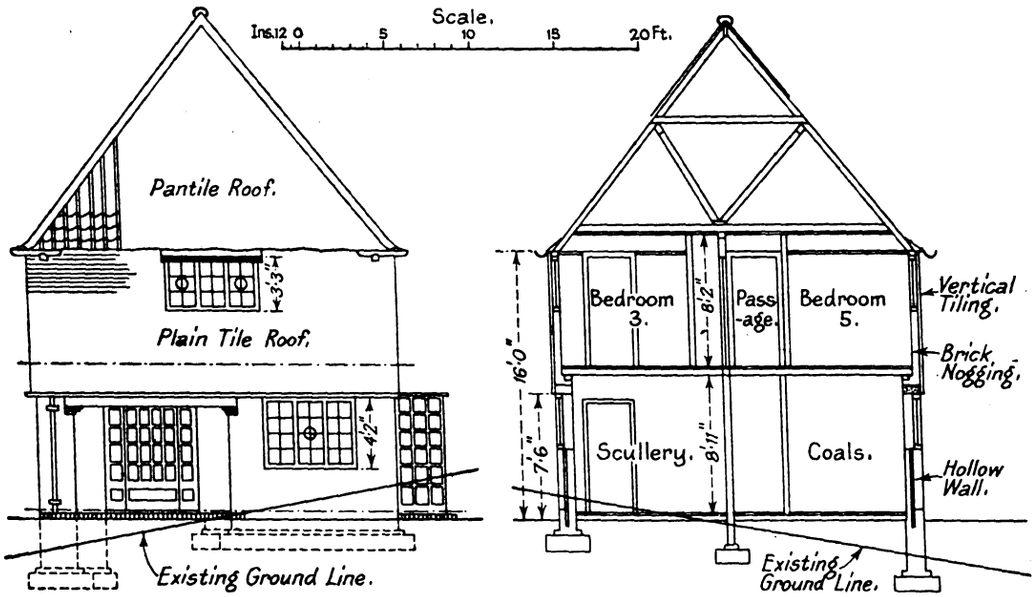
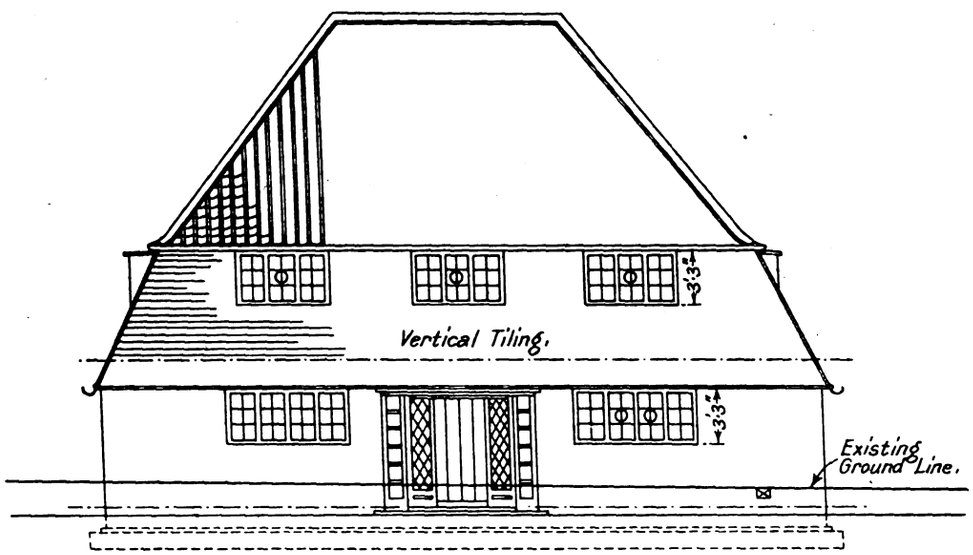
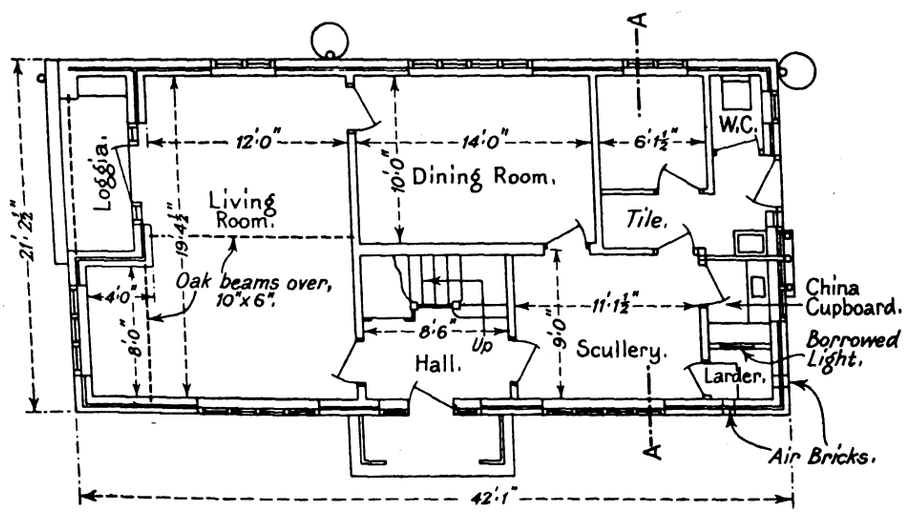


SOUTH ELEVATION. SECTION A-A.



EAST ELEVATION.



GROUND FLOOR.

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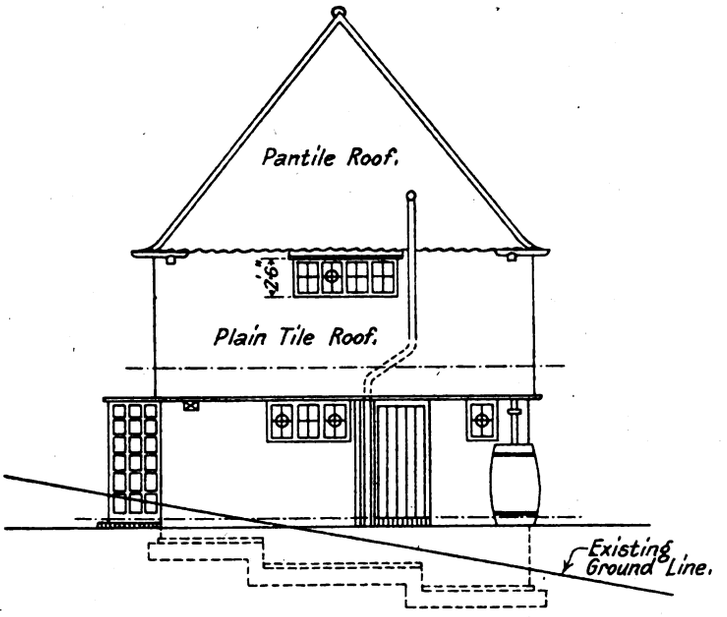
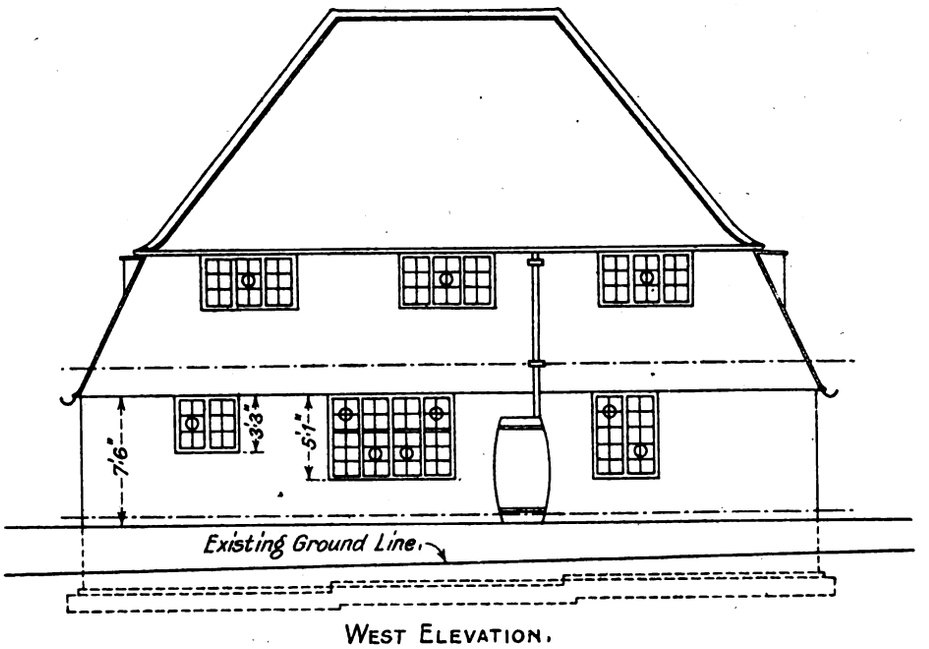
OUR ALL-ELECTRIC HOUSE.

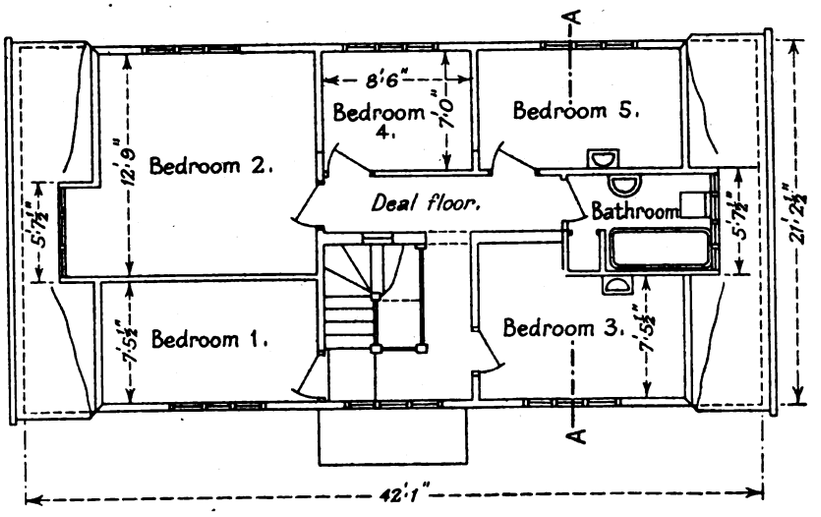
Complete Elevations and Plans for the Use of Competitors.



NORTH ELEVATION.



WEST ELEVATION.



FIRST FLOOR.

Architects:
Messrs. G. Blair Imrie & T. G. Angell

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Parliamentary Intelligence.

Telephones in Scottish Rural Areas.

In reply to Mr. DUNCAN MILLAR on March 29th, the POSTMASTER-GENERAL stated that there were 190 telephone exchanges and 746 party lines in operation in rural areas in Scotland.

Turbo-Electric Drive for Warships.

In reply to Lieut.-Commander KENWORTHY on March 28th, Commander EYRES-MONSELL said that the Admiralty was fully acquainted with all the developments of the turbo-electric drive in the United States of America. No trials had been carried out for warships in this country, and the turbo-electric drive was not being tried at the present time.

Land for Battersea Electrical Showroom.

Viscount CURZON on March 28th asked the Minister of Health whether he was aware that the Battersea Borough Council had decided to purchase a plot of land in the borough for the purpose of erecting a showroom for electrical appliances at a price of £4 000; whether he was aware that the land referred to was valued by the district valuer at £3 300; and whether he could take any steps to prevent such a transaction taking place?

The Parliamentary Secretary to the Ministry of Transport (Colonel ASHLEY): I have been asked to reply. The sanctioning authority for loans in connection with electricity supply is the Electricity Commissioners. In the event of the borough council applying to the Commissioners for sanction to borrow money for the acquisition of the land in question, the Commissioners, in accordance with their general practice, will consult the district valuer.

Viscount CURZON: Are we to understand from that answer that a borough council has power to go in for this expenditure and the Government has no power to prevent it?

Colonel ASHLEY: It depends whether the borough council is going to pay for it out of the rates or out of general powers, or is coming for a special loan.

Viscount CURZON: If it is out of the rates, has the Government power to deal with the matter?

Mr. SAKLATVALA: Is the hon. and gallant gentleman aware that the Battersea Borough Council, by running its own power station, is selling electric current at 4½d. as compared with 8d. in the neighbouring borough by a private company; and in view of this, and especially when the landlord will not part with the land cheaper, will the hon. and gallant gentleman consider this a reasonable demand?

Legal Intelligence.

Judge's Comments on Electrical Firm.

Before Judge RUEGG at Hanley County Court on March 22nd, Arthur Goodwin, of Stoke-on-Trent, electrician, claimed from the Stone Electrical Supply Co. a rescission of his partnership in the firm, the return of £50 paid into the concern, £1 arrears of salary, and an indemnification against all liabilities of the firm.

Mr. BURNE, for the plaintiff, said his client was engaged as an electrical foreman with a Liverpool firm, when he saw an advertisement for a partner in the defendant company. Upon inquiring, he was told that £50 capital was required and that he would be paid a working salary of £3 10s. per week. He was also told by letter that the firm was "well supported and backed by business men," and that they had every house in Barlaston to wire, power plant to fix, and to maintain the same. He invested his £50 and started work on January 1st this year. At the end of the first week he received £3 10s. salary, but the next week he only received £3. The same amount was paid the following week, and as he had heard that there was a shortage of money he became suspicious. On January 14th he attended a meeting of the partners at the firm's solicitor's office, and learned that there was a judgment debt against the firm for £20. The firm could not pay the instalment of £2 due and the solicitor paid it out of his own pocket. He also learned that the firm's liabilities were about £800.

Mr. BURNE added that he did not want to say anything that would embarrass the firm if they intended to carry on.

Judge RUEGG: If what you say is correct, the more you say the better, to prevent others putting their money in.

The plaintiff gave evidence, as also did two partners of the defendant firm. One of the partners said he believed now that the firm was solvent, and that they had plenty of work to do.

In giving judgment for the plaintiff, Judge RUEGG said there had been deliberate misrepresentation. He characterised the statement in the firm's letter that the firm was "well supported and backed by business men," as a "deliberate lie."

The Hon. RICHARD CLERE PARSONS, elder brother of Sir Charles Parsons, who died on January 26th, left £125 855 (net personalty £119 724).

The Spring List issued by SIR ISAAC PITMAN AND SONS contains particulars of a number of books on electrical engineering shorlty to be published by the firm.

The April issue of the official journal of the INSTITUTE OF COST AND WORKS ACCOUNTANTS will contain a verbatim report of the proceedings of the Institute's Annual Costing Conference, on the subject of "Standardisation in Cost Accountancy."

East Midlands Electricity District.

A Joint Advisory Committee Approved.

As the result of the inquiry held at Nottingham in January last, the Electricity Commissioners have published their conclusions and decisions upon the scheme for the EAST MIDLANDS ELECTRICITY DISTRICT.

The area provisionally determined is confirmed with certain minor adjustments and the development of the North Wilford station of the Nottingham Corporation, the new station of the Leicester Corporation, the stations of the Derby and Burton Corporations and the Spondon station of the Derbyshire and Nottinghamshire Electric Power Co. is approved, together with the gradual discarding of the other stations in the district. The original technical scheme provided for a new station at Newark, but this is not considered to be necessary and the possibility of providing for the future requirements of the town by means of bulk supply will, therefore, require investigation. The question as to whether the capacity of the Spondon station should be increased above 36 000 kW is also reserved.

The original proposals suggested that interconnecting cables should be laid between the municipal generating stations in the district, but the routes suggested offer little prospect of remunerative supplies being given at intermediate points and, it therefore appears to the Commissioners that development should proceed by extending the transmission systems through those portions of the district where the chief potential demands have been ascertained to exist and by providing at the same time for the interconnection of these systems, with the municipal stations.

Subsequent to the local inquiry an agreement was arrived at between the Nottingham Corporation and the Power Co., with regard to certain distribution areas immediately adjacent to the city of Nottingham, and this may involve a modification of the transmission proposals discussed at the inquiry. The principal parties are therefore to be asked to co-operate in the preparation of a detailed lay-out of transmission lines for the first stage of development so that this can be embodied in the technical scheme.

The Commissioners approve the establishment of an advisory committee similar in most respects to the advisory board in the South-East Lancashire Electricity District.

N.A.S.E. Prizes.

Silver Shield for Best Paper.

The Board of Control of the NATIONAL ASSOCIATION of SUPERVISING ELECTRICIANS has decided to encourage the educational work of the Association by the annual award of prizes for papers by members on subjects connected with the electrical industry and/or the Association. In addition to three prizes, a trophy for the annual competition, in the form of a valuable silver shield, has been presented by the president, Mr. W. E. Highfield, for the best paper of the year. Arrangements for the current year are as follows: Papers to be read at a members' meeting on Tuesday, May 8th; entries to be notified to the General Secretary by April 12th; papers to be of about 1 000 words and to be of ten minutes' duration; subject to be connected with the electrical industry or the N.A.S.E.; awards to be made upon a ballot of the members at the meeting.

The winner of the first prize will be entitled to hold the shield for one year and his name will be suitably inscribed thereon. Certain rules will be decided upon at a meeting of full members on April 12th. Provincial members are invited to compete and members of the Committee will be chosen to read the papers. Every effort will be made to ensure absolute impartiality in the judgment. The object is to encourage papers of a practical nature and original thought, and these will receive first consideration in judging. The literary excellence is of minor importance.

Ernest Benn, Ltd.

Fine Books and Industrial Technical Literature.

In order to promote efficient working, the business of Benn Brothers, Ltd., will in future be divided into two companies. The division is merely one of convenience, no change in proprietorship taking place and the directorate of the two companies being practically the same. The periodical part of the business will be conducted under the old name of Benn Brothers, Ltd., while the book publishing section will assume the title of Ernest Benn, Ltd.

The chairman of the new company will be Sir Ernest J. P. Benn, with whom will be associated Mr. H. P. Shapland, Mr. C. E. Hughes (directors of Benn Brothers, Ltd.) and Mr. Victor Gollancz, who has for the past two years occupied the position of manager of the books department of Benn Brothers, Ltd., with marked success.

The business of Ernest Benn, Ltd., will be the publication of books without any qualification or restriction, except that they shall be fine books. No attempt will be made to enter the popular market. The company will continue the policy of Benn Brothers, Ltd., in publishing scientific and technical books of the highest class. It will also publish works of art and will begin its career with "The Players' Shakespeare," a series of thirty volumes which bids fair to take its place as the finest ever issued by a British publisher.

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Taxation and Trade.

Experts View on the Situation.

Important pronouncements on the industrial outlook, with particular reference to the Chancellor of the Exchequer's forthcoming Budget statement, have recently been made by Sir Eric Geddes and Sir Robert Horne.

SIR ERIC GEDDES, speaking at Birmingham to members of the West Midlands branch of the Federation of British Industries, said :—

"The country, as I see it, is being taxed out of existence. It hardly appears that there will be any surplus of national income over national expenditure in 1922 to add to available capital for the employment of our additional and increasing population. Except from abroad, I do not see where the surplus is to come from which is necessary to carry the increased burdens in the way of population which are forced upon us. It is absolutely imperative that taxation should be reduced. In the last few days all the estimates for the incoming year have been published, and they do not make very encouraging reading. The Committee on National Expenditure, of which I was chairman, in reviewing the Estimates for the year now coming to a close, made recommendations for a reduction of £100 000 000 in 1922-23 ; indication was also given that reductions in subsequent years should, in our opinion, exceed that amount. The Government found, as might be expected, that everyone was in favour of economy in general, but each particular economy raised its own opposition, and few supported the would-be economists. Last year effect was given to about one-half of the recommendations of the Committee.

"From the estimates that have been published for the coming financial year, it looks as if a real saving of about £50 000 000 was contemplated, as compared with the current year, since almost one-half of the apparent £100 000 000 represents not economy, but mere cessation of war charges. It looks, therefore, roughly, as if this Government and the late Government had given effect in two years to what the Committee considered could have been done in the first year, with increased economies in the next year."

Debt Repayment or Tax Reduction ?

Sir ROBERT HORNE, addressing members of the Manchester branch of the F.B.I., said that a controversy had been started as to whether the Chancellor of the Exchequer could best use any available surplus to reduce debt or to reduce taxation. The chief argument for reducing debt was that such a proceeding meant handing money back to citizens of this country who would immediately put it into some form of trade or industry. The effect was, moreover, to save, so far as the taxpayer was concerned, the amount which would be required to be paid in interest if the debt had not been paid off.

"I entirely agree with that argument in normal conditions," said Sir Robert. "It is perfectly sound and logical ; but see where it carries you. If it is good to pay off debt rather than reduce taxation, it would also be good for increasing taxation in order to pay off debt. If I were to say that to the Chancellor of the Exchequer, he would probably reply that there is a limit to the amount of taxation which the country can stand. To which my reply would be that this country cannot afford to bear its present taxation."

Plea for Railway Rates Reduction.

Following Sir Robert Horne, Sir ERIC GEDDES dealt with the question of railway transport, and strongly urged a reduction in rates. "I feel sure," he said, "that the optimism of the industrial community would rise enormously if a reduction in railway rates and a reduction in taxation could be given by the railways and the Government respectively at the present time, and, just as in the case of taxation, where a reduction in the rate of income tax in the £ does not necessarily mean less revenue to the Government, because arrears of tax are paid off, and trade gives a fillip upwards, so in the case of the railways. A study of the increase of traffic in 1922 gives remarkable results.

"The reduction to 75 per cent. above pre-war took place as from August 1st last. The increase of traffic, which, so far as can be seen, still continues, began almost simultaneously. A study of the figures seems to point to the fact that the reduction of rates was very largely responsible for the increase. It is difficult to resist the inference that a really substantial reduction now would have correspondingly beneficial effects."

The "Met-Vick" Calendar.

THE METROPOLITAN-VICKERS ELECTRICAL CO. are believers in beauty—feminine beauty that is. For some time past they have gone in for "Girl" calendars, which have had the effect of lightening the gloom of at least one editorial office. This year the result, which we have just received, is, if we may enter into comparisons, better than ever. To obtain the necessary reproduction a very thorough search among the beauties of the stage, not omitting Daily Press Beauty Competitions, was made, and Miss Maime Watson has been selected to carry the "Met-Vick" message. We are asked to say that we approve the selection. Most certainly we do. We may also add that the work of searching must be very jolly.

The Bann Hydro-Electric Scheme.

Cheap Power for Ulster Industries.

The need for cheap electric power in the development of Ulster industries has been recognised by local industrialists for some time. An important point in this connection is the cost of coal at the various linen mill centres. This is distinctly high, and likely to remain so, owing to (*a*) the growing demand in Ireland for coal for railways, shipping and domestic purposes in comparison with the small output from Irish collieries ; (*b*) the strictly limited extent of the proved deposits of coal in Ireland ; (*c*) the high cost of mining Irish coal deposits, and (*d*) the high cost of delivering coal to industrial centres. The average yearly output from Irish coal mines for the past twelve years has only been 86 000 tons, as compared with a yearly import of 4 500 000 tons.

Under these circumstances attention has been drawn to the possibilities of developing cheap hydro-electric power on the River Bann, and of distributing the energy so generated to the various industrial towns within economic transmission distance. With this object in view, the Bann Syndicate, Ltd., was formed last September, and an examination of the water-power possibilities of the river was made. A detailed scheme has now been prepared, and is being embodied in a private Bill to be introduced by the Syndicate in the Northern Parliament.

It is proposed to erect the generating station on the Bann between the Movanagher and Carnroe weirs. The design of the scheme permits of development in stages to meet a growing power demand, beginning with a supply of 6 000 h.p., and increasing in steps until eventually upwards of 15 000 H.P. are developed. The total capital cost of the ultimate development will be something less than 1¼ million pounds, and it is estimated that power can be supplied even in the earlier stages of development in the proposed area of supply, where coal costs are considerably higher than in Belfast, at a rate well below that at which power is supplied to consumers in Belfast at present. The scheme provides incidentally for regulating the water of Lough Neagh and preventing the periodical flooding which now takes place.

The consulting engineers are J. F. Crowley and Partners, acting in conjunction with Meik and Buchanan.

Newport Electricity Undertaking.

Details of the Extensions.

As intimated in THE ELECTRICIAN of March 16th, Newport (Mon.), Borough Council has applied for sanction to a loan of over £150 000 for extensions in connection with the electricity undertaking. The extensions are detailed in a report by the electrical engineer, Mr. A. NICHOLS MOORE, and this report was unanimously approved by the last meeting of the Council.

The recommendations in Mr. Moore's report may be summarised as follows :—

(*a*) To extend the boiler annexe so as to accommodate two additional boiler units, and build a new electrical repair shop.

(*b*) To instal one additional boiler unit complete, having a normal evaporative capacity of 35 000 lb. per hour (working pressure 260 lb. per sq. in.)

(*c*) To instal an evaporative plant and confer with Kennedy & Donkin as to the most suitable type.

(*d*) To proceed with the ash-handling scheme.

(*e*) To make the necessary alteration to the 3 750 kW set so that it will be available for operation off the high-pressure steam range.

(*f*) To instal additional switchgear, control boards, etc., as required.

(*g*) To continue and complete the scheme for lowering the frequency of the single phase system.

(*h*) To re-lay, where required, and modernise the h.t., a.c., single phase feeder system.

(*i*) To re-lay, where required, and modernise the l.t. single phase distributing system.

(*j*) To re-lay, where necessary, and modernise the d.c. feeder distributing system.

(*k*) To apply for sanction to borrow a further sum of £3 000 for new electricity meters.

(*l*) To apply for sanction to borrow a sum of £2 000 for the provision of domestic heating and cooking apparatus.

Electricity in the City and Home.

The BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION'S two latest publications deal respectively with electricity in the city and in the home. On the first subject a poster has been issued whose slogan is "Use Electricity ; bring back sunlight to the city ; banish smoke, dirt and noise." After all, could anything be more desirable. For the rest the poster is more a useful suggestion than a fixed idea and any letterpress matter desired can be reproduced.

On the second subject the publication is called "The Home of 1923," and a very jolly place that home is. The pamphlet tells those interested (and all electrical people ought to be), how lighting, heating, cooking, washing and ironing can be carried out electrically and how when this is done flexibility and control can be obtained. Altogether a very useful production of which larger numbers should be secured for distribution among salesmen and consumers.

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Imperial Notes.

AUSTRALASIA.

Electricity Supply Items.

SYDNEY (N.S.W.) electricity department connected up 15 679 new consumers during 1922.

Permission has been granted by the Local Government Department to the BATHURST (N.S.W.) Council to borrow £40 000 for providing an electric supply service.

TARANAKI (N.Z.) Electric Power Board's proposal to carry out an electric power scheme at Tariki, estimated to produce 2 000 H.P., has received the approval of the Cabinet.

BYRON Shire Council has decided to grant authority to Mr. J. B. Grant to supply electricity for lighting and domestic purposes in BANGALOW (N.S.W.) subject to the Governor's approval.

CAMBELLTOWN (N.S.W.) Municipal Council have been notified by the Local Government Department that the Governor has approved of the council borrowing £10 000 for the purpose of installing an electricity supply plant in the town.

Melbourne Tramway Finance.

The chairman of the MELBOURNE (VICTORIA) TRAMWAYS BOARD recently submitted to the Railways Standing Committee a statement showing that during the year ended June last the gross profit on the cable and electric tramways under the Board's control was £452 911, but after providing for sinking funds, payments to consolidated revenue, etc., the net surplus was only £10 111. On the electric lines alone there was a net deficit of £50 908. Mr. Cameron said it was probable that the statute relating to contributions to the State revenue would be altered, at least to the extent of basing such contributions on surplus instead of on receipts.

The Newcastle Tramway System.

Mr. E. J. Doran, traffic manager, announces that about £500 000 has been spent by the Railway Commissioners on the electrification of the NEWCASTLE (N.S.W.) TRAMWAY SYSTEM. The power house is practically completed. The rolling stock will be of the same type as in use in Sydney, and each car will seat 70 passengers. The Mayfield line will be the first to be electrified, and the first cars are expected to be running some time this year.

Harvesting by Electric Light.

An Australian farmer, Mr. H. E. Bradtke, of Burrumbuttock, near Albury, New South Wales, has demonstrated the practicability of carrying on farming operations by night as well as by day. At an outlay of £75, Mr. Bradtke fitted a pair of ELECTRIC LAMPS TO THE HEADER, for the purpose of taking off his wheat crop after dark. Another lamp was placed over the bag filler. The electric light was found to be thoroughly satisfactory. The first trial consisted of day and night operations for 5½ days. In this time the header went through 120 acres. Without night work eight days would have been required. Farmers of the Riverina are turning their attention to electricity, and are hoping that eventually ample hydro-electric supplies will be forthcoming from the Hume reservoir on the Murray River.

The Standards Question.

Prof. R. W. CHAPMAN, president of the Institution of Engineers, Australia, delivered an address on January 18 to the members of that institution and representatives of allied professions. He said a Federal Engineering Council had been formed, on which their Institution and the Mining and Metallurgy and Chemical Institutes were represented. A Bill had been prepared by the Council of the Institution for the registration of professional engineers, which would apply to the engineers employed by Governments, municipalities and companies, as well as consulting engineers. Standardisation was regarded by the Council as a matter of vital importance to the young industries of Australia, because State Government departments were making many different specifications for the same articles. The Commonwealth Government had now gazetted the main committee of the Commonwealth Engineering Standards Association, and it was hoped that standards would be evolved which would cheapen cost of production and enable articles to be manufactured for stock when orders were short.

Mr. W. J. NEWBIGIN (a Past President) said he was interested in a small concern that had been striving to establish certain industries. One of these was the manufacture of electric irons. They found there was 31 combinations of voltage and periodicity in use for electric irons in Australia. He also referred to the unnecessary multiplicity of patterns of water taps, and other members complained of the diversity of specifications for railway axles and tyres and cement.

Mr. HOWIE said those who drew up the standards should be acquainted with general commercial practice.

Mr. CHAPMAN visited all the States of the Commonwealth, and addressed each Division of the Institution.

CANADA.

Bell Telephone Dividend.

The Bell Telephone Co. of Canada has declared a QUARTERLY DIVIDEND OF 2 PER CENT. on the capital stock, payable on April 14.

Ontario Railway Electrification.

The scheme for electrifying the Temiskaming and Northern Ontario Railway involves the DEVELOPMENT OF THREE WATER FALLS having a total capacity of 25 000 H.P., and with heads ranging from 50 ft. to 130 ft., at a cost of, roughly, 3 000 000 dollars. Power will be transmitted at 66 000 V and distributed by 3 000 V d.c.

SOUTH AFRICA.

Durban Power Station.

A reply has been received from the Union Government to the Durban Town Council's application for permission to construct a NEW POWER STATION AT CONGELLA. Under the new Electricity Act this permission is a necessary condition precedent to any new erection of the kind. The reply expresses the view that there should be no difficulty about the Government granting the application, but suggests the desirability of a conference between representatives of the Durban Municipality, the Electricity Supply Commission (a body yet to be appointed), and the S.A.R. Administration.

Foreign Notes.

EUROPE.

Railway Electrification in Czecho-Slovakia.

Immediately after the establishment of the Czecho-Slovak Republic in 1918, the Ministry of Railways began to study the question of the ELECTRIFICATION OF THE STATE LINES, and it has now been decided to start operations from Prague to Pilsen. The electrification of the line will not be completed before 1926. Should it prove successful, work will at once proceed on further branches of the State lines.

Swiss Hydro-Electric Power Resources.

Lecturing at the City of London College last week on commercial developments in Central Europe, Dr. Pierre de Wolff, secretary-general of the Swiss Bank Corporation, said that Switzerland had enormous water-power resources, estimated at about 2.7 million H.P., of which, perhaps, 700 000 H.P. were developed. Its full development would occupy Swiss industry for at least the next 50 years and would provide the SWISS MACHINERY INDUSTRY with a very dependent home market, which was totally lacking in regard to many other industries.

The Italian Telephone System.

The Italian Government has decided to CEDE TO PRIVATE ENTERPRISE the country's telephone system, which is at present run on bureaucratic lines, instead of ordinary business methods, and shows an annual loss of about forty million lire. The State wishes to be relieved of this loss and to have the service modernised and extended to many regions not at present reached. An increase in the capacity of nearly all the big central exchanges is urgently needed, as thousands of demands for new telephones remain unsatisfied. Further, a great part of the present system is far behind modern technical progress, and many innovations are awaited, such as automatic exchanges.

Norwegian Electric Railways.

It is expected that tests will be carried out next month on the ELECTRIFIED PORTION OF THE OFOR RAILWAY between Narvik and Riksgraensen, connecting the North Baltic (Sweden), with the Polar Sea (Norway). Current at 80 000 V will be generated for the entire system at Porjus (Sweden), being transformed down on the Norwegian side at Hundalen and Narvik. The Drammen Railway will shortly be using the first electric locomotives constructed in Norway. These have been manufactured by mutual arrangement between the Thunes Mek. Verksted and the Norsk Elektrisk and Brown Boveri, at Skoien, near Christiania, the former works having constructed all the bogey and carriage work, while the latter has delivered all the electrical equipment.

THE FAR EAST.

Japanese Electrical Developments.

"Eastern Engineering" states that the Furukawa Co., of Tokyo, which has PURCHASED THE SIEMENS-SCHUCKERT PATENTS, is preparing to build large new factories near Tsurumi. These will be completed by December, 1924, and 1 000 men will be employed. The company has a capital of ten million yen.

The Shanghai-Chefoo Cable.

A report by the Chinese Ministry of Communications states that the Shanghai-Chefoo Cable, completed in May, 1922, has been EXAMINED AND FOUND SATISFACTORY. The cable will be entirely under the control of the Ministry of Communications as soon as it is taken over from the Japanese Kuho Electric Industrial Association, who were the contractors.

U.S.A.

Good Business Conditions Reported.

The "Bulletin of the National City Bank of New York," in a report on GENERAL BUSINESS CONDITIONS, says:—"There has been no slackening of industry or trade as the winter has passed, but rather increasing strength and confidence. Railroad traffic has been the heaviest ever experienced for the season. Unemployment practically has disappeared from the principal industries and in its place labour shortage is reported. In many lines the activity is greater than at any time since 1920, and in numerous cases close to capacity. This is true of the textiles, iron and steel and automobiles. The number of cotton spindles in use in January for the first time passed 35 000 000 and the consumption of cotton totalled 610 375 bales, which has been exceeded only in March, 1916, and May, 1917. The copper situation has been cleared up of overhanging stock, the foreign market is reported as more active, and the domestic price has touched 16½ cents. Lead is up to 8.10 cents per pound, New York; tin and zinc are both higher. Raw cotton is close to 30 cents per pound."

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Electricity Supply.

Extensions and Developments.

PORTRUSH (Ireland) Urban Council has decided to install additional plant at the electricity works at a cost of £3 500.

REIGATE Town Council has applied to the Electricity Commissioners for a loan of £26 000 for electricity purposes.

GUILDFORD Town Council has instructed the borough electrical engineer to do away with slot meters as the opportunity occurs.

HAMPSTEAD Lighting Committee recommends the laying of new h.t. feeders and l.t. distributors at an estimated cost of £7 678.

The Commissioners have sanctioned a loan of £40 000 at SOUTHEND for electricity works extensions. Diesel plant is to be installed.

An increasing demand for electric power for agricultural purposes is reported from YORK. Important extensions are contemplated to meet the demand.

The annual report of the FOLKESTONE Electricity Supply Co. states that the directors have now under consideration a scheme for further extensions which will be required in the near future.

A special committee of BARROW Corporation is considering the question of extending the electricity works. Failing the possibility of obtaining a bulk supply from Vickers, Ltd., extensions are proposed at a cost of £18 500.

CHESTER Electricity Committee has decided to make application to the Electricity Commissioners for sanction to the borrowing of £1 750 for new mains, and £2 400 for replacing with larger distributing mains the present district mains in certain parts of the town.

At PRESTON Town Council on March 29th, Alderman Astley-Bell (Chairman of the Electricity Committee) said the progress of the work of erecting the new Ribble power station was unsatisfactory. There were slight indications of improvement. The Committee were doing all they could. They were being fed by various contractors with an abundance of promises and assurances. There were more of those assurances than there was of actual progress.

Alterations in Charges, Proposed and Actual.

STOCKTON Corporation proposes to take off the 10 per cent. added to their scale of electricity charges, bringing the lighting rate down to 4½d. per kWh, which is the pre-war figure.

HUDDERSFIELD Electricity Committee recommends the following reductions in charges :—Lighting 6d. to 4½d. per kWh, power 4d. to 3d. per kWh, " under guarantee " 2d. to 1½d. per kWh.

LYTHAM ST. ANNE'S Council are recommended to introduce a system where electricity consumers who have both light and power meters shall have one minimum charge instead of two, as at present.

MAIDSTONE Town Council has reduced the charges for electricity as from April 1. The reductions roughly are, ½d. per kWh for lighting, ½d. for power to small users, and ¼d. for heating and cooking, street lighting, traction supplies, and sewage pumping.

COVENTRY Town Council has adopted the following new scale of charges for electricity :—Lighting, maximum demand rate, first hour per day 8d. per kWh, second hour 5½d., beyond, 1⅝d., ditto flat rate, 5½d., prepayment meters 6d. ; heating 1⅝d. ; power (low tension supply), 1⅝d.

Tapping New Areas.

BALLINAGH (Cavan) is to be lighted with electricity.

SELBY is now being supplied with electricity by Electrical Distribution of Yorkshire, Ltd.

Stoke-on-Trent Town Council has been asked to extend its electricity supply to SMALLTHORNE.

TIDESWELL Parish Council has abandoned the proposed electric lighting scheme on account of expense.

WICKLOW Urban Council has been empowered to raise £6 000 for plant to provide electric light and power in the urban area.

The chairman of CREDITON Urban Council has expressed the opinion that the time has come for the Council to exercise its powers to supply electric light.

DEVIZES Town Council has decided to consult an expert on an electric lighting scheme submitted by a local syndicate, who have applied for the consent of the Corporation to an order.

ROMSEY Gas and Coke Co. has obtained from the High Court an alteration in its articles of association enabling it to supply electricity in Romsey. It will now seek a Special Order for this purpose.

MARTON Parish Council has passed a resolution authorising their representatives to make the best terms possible for the supply of electricity from Blackpool, if possible on the same terms as Blackpool.

BANSTEAD Rural Council has decided to support the application of the South Metropolitan Electric Lighting Co. for an order to supply electricity in the district, and to press for the early issue of the order, so that the company may commence laying the mains.

THETFORD Town Council has engaged Mr. Richard H. E. Lee, of London, at a fee of twenty guineas, to advise on a proposal to generate electricity by water power. It is estimated that electricity for Thetford and Brandon could be generated by this means.

Inquiries and Orders.

Col. T. C. Ekin held an enquiry last week into the application of HEREFORD Town Council for a loan of £40 000 for the electricity undertaking. It was explained that £28 000 was needed for loans overspent, and £10 000 for the development of the rural electricity scheme.

The award of the arbitrator has been issued in connection with the proposed purchase by the NEWTON ABBOT Urban District Council of the undertaking of the Urban Electric Supply Co. The figure is fixed by the arbitrator at £59 275. The company's claim was for over £104 000, and witnesses at the arbitration proceedings estimated the total present value of the undertaking at £5 688, this figure, however, being afterwards advanced to £6 828.

CHORLEY Town Council is to make application to the Electricity Commissioners for representation on the committee, which, it is proposed, shall be set up for the Mid-Lancashire electricity district. A letter from the Town Clerk of Preston states that as the Chorley Corporation were not authorised undertakers, no provision was made for their representation in the scheme submitted. The Lancashire Electric Co., who had been approached to supply electricity in bulk to the Corporation for the latter's distribution, stated that they were convinced, as the result of their past experience, that it would be to the advantage of Chorley and the surrounding districts that the order should remain in the hands of the company.

Forty Years Ago.

"The Electrician," April 7th, 1883.

THE NEW ARMY TELEGRAPH CORPS.—It is stated that the commanding officer of the 24th Middlesex Rifle Volunteers (Post Office Corps) is asking for men who have had experience in artillery and cavalry regiments to act as drivers to the recently acquired telegraph van. This completes the equipment of the Postal Telegraph Corps, which now numbers more than 150 men.

ELECTRIC BELLS.—Mr. Gent, of Leicester, is exhibiting at the Building Exhibition now being held at the Agricultural Hall a new method of arranging the electro-magnets of electric bells, by means of which he obtains more power with a given current. Mr. Gent's plan consists in placing the electro-magnets horizontally and the armature above them, instead of at the side and at an angle, as is usually the case.

ELECTRIC LIGHTING IN PARIS.—On the occasion of the annual conversazione of the French Physical Society, the rooms of the Society of Arts, where it was held, were brilliantly illuminated by means of Edison and Swan lamps and accumulators. These latter were supplied by the French Electrical Power and Storage Company. M. Trouvé also exhibited some of his new bichromate of potash batteries at work.

Obituary.

Richard Ulbricht.

The death of Dr. RICHARD ULBRICHT is announced from Vienna. The deceased had a world-wide reputation as a worker in the fields of technical optics and illumination, and as the inventor of the spherical photometer which bears his name.

Sidney Herbert Wells.

Mr. SIDNEY HERBERT WELLS, who died on March 28th, will be remembered as the founder, in 1889, of what was then called the Institution of Junior Engineers. He won a Whitworth scholarship in 1885, and was first Principal of Battersea Polytechnic in 1893. He was an original member of the Faculty of Engineering of London University, and was a member of the City and Guilds Examination Board.

Personal Items.

Mr. J. P. CROWTHER, electrical engineer to Worksop Corporation, has tendered his resignation.

Mr. HARRY KAHN has joined the board of directors of the Hastings and District Electric Tramways Co.

Barnstaple Town Council has voted an honorarium of £70 to the electrical engineer, Mr. J. W. HADFIELD, for work done in connection with the installation of new plant.

Mr. R. H. KIBBEY, who recently retired from the post of superintendent of the Western Telegraph Co., at Montevideo, was presented by his colleagues with a silver service and canteen of cutlery.

Mr. A. A. TASKER has taken up an appointment as the South Wales manager for the Spearing Boiler Co., and Ferguson Superheaters, Ltd., his office address being 9, Connaught Road, Roath, Cardiff.

Faversham Town Council has decided to grant an honorarium of £150 to the Borough electrical engineer, Mr. G. SOMERVILLE, in respect of extra services rendered in connection with the extensions at the electricity works carried out since 1919.

Mr. A. C. CRAMB, engineer and manager of the Croydon electricity department, was entertained at dinner on March 29th, by the staff and employees of the department to celebrate his 21 years' service with the Croydon Corporation. Members of the Electricity Committee were among the guests. In proposing the health of Mr. Cramb, Mr. J. H. Parker stated that the reconstruction carried through by him in 1920/21 without any outside assistance had cost nearly £200 000, but it had reduced the coal bill from £81 000 to £27 000, in spite of a 16 per cent. increase in the number of units sold.

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Tenders Invited and Accepted.

UNITED KINGDOM.

MILNROW WESLEYAN CHAPEL AND SCHOOL.—Electric lighting. Particulars from Mr. Farrow, 3, Wesley Road, Milnrow.

BURRY PORT URBAN DISTRICT COUNCIL, April 7th.—Extension of overhead cables at the garden suburb, and at Pantyrhiw, Graig. Specifications can be seen at the Council Offices.

CROYDON CORPORATION, April 9th.—Construction of sub-stations at Craven Road, Beulah Park and Streatham Grove. Specifications from the Engineer, Electricity Works, Factory Lane, Croydon.

LEITH HOSPITAL, April 9th.—Electrical work in connection with addition to the Nurses' Home. Schedules, etc., from Mr. J. M. Johnston, 47, Charlotte Street, Leith.

TOTTENHAM URBAN DISTRICT COUNCIL, April 10th.—Clinker-crushing plant, with magnetic separator, etc. Particulars from the Council's Engineer.

MANCHESTER CORPORATION, April 11th.—Wiring and fitting, Osborne Street public washhouse. Specification from the City Architect, Town Hall, Manchester.

MANCHESTER CORPORATION, April 11th.—Low-tension d.c. switchgear for Dickinson Street sub-station. Specification from Mr. F. E. Hughes, Town Hall, Manchester.

BRIGHTON CORPORATION, April 12th.—Erection of electricity sub-station at Rottingdean Road. Plans can be seen at the Borough Surveyor's Office.

IRVINE CORPORATION, April 14th.—Wiring and fitting 18 additional houses comprised in the Bank House housing scheme. Specification from the Joint Town Clerks, Council Chambers, Irvine.

EDINBURGH CORPORATION, April 16th.—6 600 V and 33 000 V switchgear (specification 47), two induction motors for driving d.c. generators (48) and 33 000 V overhead main transmission line (49). Specifications from the Engineer and Manager of the Electricity Department.

CONWAY GUARDIANS, April 20th.—Wiring and fitting the Union Institution and Offices. Particulars from the Master of the Institution or the Clerk to the Guardians.

GLASGOW PARISH COUNCIL, April 20th.—Six months' supply of electric fittings, rubber goods, ironmongery, etc. Forms from Mr. M. A. Reynard, 266, George Street, Glasgow.

SOUTHPORT CORPORATION, April 24th.—Relaying with new rails portions of tramways in Mornington, Derby and Sussex Roads, also paving, etc. Specifications from the Borough Engineer.

AUSTRALIA.

COMMONWEALTH OF AUSTRALIA, April 17th.—Supply of timing clocks for telephone switchboards, with electrical connections (schedule V 97). Forms and particulars from the Supply Officer, Australia House, Strand, London, W.C.2.

MELBOURNE CORPORATION, May 21st.—Rotary converter, transformer, h.t. three-phase and d.c. switchgear. Specifications from the City Electrical Engineer.

The tender of G. H. Turner for electric fittings for new block at £169 has been accepted by DEWSBURY GUARDIANS.

YORK CORPORATION have accepted the tenders of Callender's Cable and Construction Co. for feeder cables, £4 661 9s.

BATTERSEA (LONDON) BOROUGH COUNCIL are recommended to accept the tender of the General Electric Co. for a rotary converter at £7 644 5s.

The English Electric Co.'s tender for switchgear, £952, and four transformers, £201 each, has been accepted by PORTSMOUTH CORPORATION.

The Bedford Engineering Co.'s tender for a coal suction conveyor for the electricity works, at £1 285, has been accepted by EASTBOURNE CORPORATION.

HAMMERSMITH (LONDON) BOROUGH COUNCIL have accepted the offer of the Underfeed Stoker Co. for the construction of a special type of boiler arch, at £290.

CLACTON URBAN DISTRICT COUNCIL have accepted the tender of the English Electric Co. for a Diesel engine, dynamo, cooling plant and switchboard apparatus, £6 271.

EAST HAM CORPORATION have accepted the tender of the Scholey Construction Co. for electric welding of 50 tramrail joints at 18s. each, plus 2s. an inch after the first six inches.

HULL TRAMWAYS COMMITTEE have decided to purchase an additional 1 000 tons of rails from the Anglo-Belgian Improvements Corporation at £11 1s. per ton, an increase of £2 2s. 6d. per ton on their present contract.

WOLVERHAMPTON CORPORATION have accepted the following tenders:—General Electric Co., 7 500 kW turbo-alternator, £17 848; W. H. Allen, Son and Co., condensing plant, £7 215; J. Thompson (Dudley), Carter feed tank, £405.

The tenders of Ferranti, Ltd., and Chamberlain and Hookham have been accepted by MIDDLESBROUGH CORPORATION for the supply of a.c. meters, both firms quoting at £2 2s. 6d. for 10A, £2 12s. 3d. for 20A, and £3 9s. for 50A.

GLASGOW TRAMWAYS COMMITTEE recommend the Town Council to accept the following offers for special track work:—United States Steel Products Co., £3 592; Titan Track Work Co., £4 066; Hadfields, Ltd., £4 118; Edgar Allen and Co., £4 145.

The following tenders have been accepted by GLASGOW TRAMWAY COMMITTEE:—Chloride Electrical Storage Co., battery for sub-station; Siemens Bros. and Co., signalling apparatus; Metropolitan-Vickers Electrical Co., magnetic brake equipment; Wardle Engineering Co., lighting fittings.

Tenders have been accepted by DUNDEE CORPORATION for supplies of cable by the following firms: W. T. Glover and Co., twin cable; Union Cable Co., and Western Electric Co., single l.t.; Enfield Ediswan Co., fireproof and 5-core; W. Geipel and Co., fireproof; Pirelli General Cable Works, 3-core and 6-core.

A. Higginbotham and Son submitted the lowest tenders for electric wiring and fitting of the Poor Law Institution for ROCHFORD GUARDIANS, their quotations being:—Main tender, £1 929; new building, £130. The main tender quotation was the lowest of 21 received, and the new building quotation the lowest of 19.

In connection with the new pumping plant which is being installed by the GREAT WESTERN RAILWAY COMPANY at Cardiff Docks, Electric Control have a contract for four equipments, each controlling a 650 H.P., 6 600 V slip-ring motor for the main high-pressure multi-stage turbine pumps, and two for the 105 H.P. 220 V motors of the auxiliary pumps, with accessories.

Cammell Laird and Co. have a contract for 41 motor coaches and 40 trailer coaches for the LONDON ELECTRIC RAILWAY COMPANY. The railway company have ordered 191 coaches in all, at an estimated cost of £710 000, the orders being distributed between Cammell Laird and Co., The Metropolitan Carriage, Wagon and Finance Co., and the Birmingham Railway Carriage and Wagon Co.

At the meeting of MARYLEBONE (LONDON) BOROUGH COUNCIL on 22nd ult. the Electric Supply Committee's recommendation that the tender of British Insulated and Helsby Cables, Ltd., be accepted for the supply of various kinds of cable during the ensuing year, was referred back, reference being made to the fact that the amount of the tender was considerably higher than those received from firms outside the Cable Makers' Association. Alderman Beaumont said he was informed that the B.I. and H. product was the best for the Council's purposes. (The amounts of the highest and lowest tenders for the various cables were given on p. 352 of our last issue.)

Institution Notes.

The Council of the INSTITUTION OF ELECTRICAL ENGINEERS has ordered the name of Mr. Walter Talbot Kerr to be removed from the register in pursuance of bye-law 41 (*a*).

At the next meeting of the DIESEL ENGINE USERS' ASSOCIATION on April 13th, Mr. J. G. Griffin will present some notes on "The Use of Cooling Waters for Diesel Engines."

On April 20th, Mr. C. H. Richardson will read a paper before the INSTITUTION OF ENGINEERING INSPECTION on "The Inspection of Ball Bearings." The meeting will be held at the Royal Society of Arts, Adelphi, London, W.C.

An address on "Postal and Telegraph Work in India" will be delivered by Mr. Geoffrey Rothe Clarke, director-general of Posts and Telegraphs in India, before the members of the Indian Section of the ROYAL SOCIETY OF ARTS this afternoon (Friday) at 4 p.m.

Mr. W. M. Selvey will lecture before the ELECTRICAL POWER ENGINEERS' ASSOCIATION (Southern Division) on "Power Plant Testing" at the Institution of Electrical Engineers, London, W.C.2, on April 13th. Mr. J. H. Parker will occupy the chair, and all engineers, whether members of the Association or not, are invited.

The sixth ordinary and annual general meeting of the Scottish Centre of the INSTITUTION OF ELECTRICAL ENGINEERS will be held at 207, Bath Street, Glasgow, on April 10th, at 7.30 p.m., when the late Dr. Gisbert Kapp's paper on "The Improvement of Power Factor" will be read by Mr. R. B. Mitchell. The seventh ordinary meeting will be held at Dundee Technical Institute on April 27th, when a paper by Messrs. L. Breach and H. Midgley, entitled "The Drive of Power Station Auxiliaries," will be read. A visit to Mason's Cove has been arranged for the afternoon prior to the meeting.

At the annual general meeting of the NATIONAL FEDERATION OF IRON AND STEEL MANUFACTURERS the thanks of the Federation were expressed to Mr. John Craig, the retiring president, for his services to the Federation during the past year. Mr. Arthur Dorman (Dorman Long and Co.,) was elected president for the ensuing year; Mr. C. E. Lloyd, M.P. (N. Hingley and Sons), and Mr. Albert Peech (chairman, United Steel Companies,) vice-presidents; and Mr. Edward Steer (chairman of Guest, Keen and Nettlefolds), was also elected a vice-president in place of Mr. Arthur Dorman.

At the ROYAL INSTITUTION on Thursday afternoons, commencing April 12th, Dr. A. O. Rankine will give two lectures on "Transmission of Speech by Light"; Prof. MacGregor-Morris will give three on "Modern Electric Lamps"; Dr. E. G. Coker two on "Engineering Problems solved by Photoelastic Methods," and Sir William M. Bayliss on the "Nature of Enzyme Action." The Friday evening meetings will be resumed on April 13th when the discourse will be delivered by Dr. W. H. Eccles on "Studies from a Wireless Laboratory." Succeeding discourses will probably be given by Mr. W. J. S. Lockyer, Mr. C. V. Boys, Prof. Soddy, Prof. W. A. Bone, Mr. W. M. Mordey, Sir Aston Webb, Prof. Lorentz and Miss Joan Evans.

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Electric Traction.

Tramway Extensions and Developments.

A new tramway route and extensions to existing routes are proposed by LIVERPOOL Tramways Committee.

HULL Tramways Committee recommends that the tramway on the Holderness Road should be extended to the city boundary.

The appeal of the DUBLIN United Tramways Co. to have its valuation, as assessed by the Commissioners of Valuation, reduced from £39 000 to £15 000 has been dismissed.

HULL Tramway Committee is recommending the City Council to allow advertisements to appear on the outside of 50 tramcars, of the non-vestibule type, at an annual rent to a contractor of £10 per car.

EDINBURGH Tramways Committee has approved a draft agreement which it is proposed to carry through with the Musselburgh Tramways Co. for the through running of cars from the centre of the city to Port Seton.

DUDLEY Chamber of Commerce has suggested a Joint Conference between representatives of the Chamber, the Town Council, and the Birmingham and Midland Tramways Joint Committee to discuss the whole question of the local tramway service.

The Electricity Commissioners are recommending the Ministry of Transport to revoke the powers granted some years ago to the CUMBERLAND Electric Tramways Co. The proposed works have not been carried through within the prescribed period.

A scheme for the substitution of trolley buses for the present trams is understood to be under consideration at WOLVERHAMPTON in respect of the Heath Town and Wednesfield route, and it is likely that a report will be presented by the Tramways Committee to the Town Council at the April meeting.

BURNLEY Tramways Committee has decided to ask the Lancashire and Cheshire Tramways Authorities Council to negotiate with the Engineering Union with a view to securing an agreement governing engineering employees in tramway undertakings throughout the Lancashire and Cheshire area.

Trials have now been undertaken with the new car designed for local use by Mr. R. L. Horsfield, general manager of the CARDIFF Corporation Tramways. The car has a covered top deck, but has been specially designed to pass under low bridges. It was built by the Brush Electrical Engineering Co. and is fitted with two special light 40 H.P. B.T.-H. motors.

Fares, Receipts and Passengers.

LIVERPOOL Tramways Committee is recommending the City Council that the penny fare stages should be lengthened.

Councillor John Stewart has given notice to the GLASGOW Tramways Committee that he will move that it be remitted to the Tramways Sub-Committee on Finance to consider and report on the advisability of revising fares.

BLACKBURN Tramways Committee has decided to recommend the revision of fares and stages. On the various sections inside the borough the fares will be reduced by a halfpenny and the stages will be extended. There will be no reduction on the Accrington route.

The adoption of penny fares was strongly advocated by members of ACCRINGTON Tramways Committee last week, but for the present it was decided there could be no alteration. It is pointed out that though the cost of material and wages represented an increase of 100 per cent. on pre-war rates, tram fares had only advanced 50 per cent.

BLACKPOOL tram receipts for the four weeks ending March 15th were £10 070 (decrease of £103); passengers 1 513 443 (against 1 355 449), and receipts per car mile 16·33d. (a decrease of 1·08d.). From April 1st, 1922, to March 15th, 1923, (349 days) the receipts were £261 919, against £246 121, an increase of £15 868.

Underground Rolling Stock.

Following practical tests of the sample cars submitted by various manufacturing firms for use on the LONDON "Underground" railways, it has been decided that the car constructed to the specification of the Underground is the most suitable for general service, but certain improvements in the other cars are to be embodied in what is hoped to be the ideal car.

Orders have now been placed for the construction of 191 cars at a cost of £710 000—and the manufacture of these will be spread over the following firms: Cammell Laird and Co., the Metropolitan Carriage, Wagon, and Finance Co., and the Birmingham Railway Carriage and Wagon Co. Delivery will be begun in September, and the new trains will be put into service on the new Moorgate and Hendon extensions of the Hampstead Tube when it is opened in the autumn.

Electric Railway Items.

New and improved rolling stock will shortly be brought into use on the MERSEY Railway.

The Southwark Borough Council has decided to transfer the Elephant and Castle subways to the LONDON ELECTRIC RAILWAYS Co., on the understanding that the company contributes £2 000 towards the unpaid balance of the cost of construction. The Borough Council will discharge the remainder of the cost.

Wireless News.

The Licensed Premises Problem.

An attempt by Lieut.-Col. SPENDER CLAY in Parliament last week to clear up the existing uncertainty with regard to wireless receiving sets on licensed premises was entirely unsuccessful. He asked the Home Secretary whether his attention had been called to the fact that divergent views had been expressed by licensing justices as to the necessity for obtaining a music licence when a wireless receiving set was installed on licensed premises; and what action he proposed to take to secure uniformity?

Mr. BRIDGEMAN replied: "There are no steps which I can take in this matter. The decisions depend on mixed questions of law and fact, as to which I have no jurisdiction. If any applicant for a licence thinks that he has been wrongly refused and desires the decision overruled, he must have recourse to the Courts of Law, which alone can determine the point authoritatively."

Meanwhile local licensing justices are ruling that a music licence is necessary, or not, as the fancy takes them. A definite pronouncement would certainly be to the advantage of manufacturers of receiving apparatus.

Imperial and Foreign Developments.

The SWEDISH TELEGRAPH BOARD has accepted the tender of a Malmö firm at 99 000 kronor (£5 500) for the erection of a wireless station near Varberg.

We understand the MARCONI Co. is to erect, in connection with the Imperial Wireless Scheme, a group of six stations in England with a minimum transmitting capacity of 35 000–40 000 words per hour.

A complete description of the recent Firpo-Brennan prize fight in New York was successfully transmitted from the LONG ISLAND station to the Argentine by wireless telegraphy. On being received the messages were broadcasted to listeners-in in the Argentine.

Arrangements have been concluded between Amalgamated Wireless (Australasia), Ltd., and the Union Steamship Co. of New Zealand for the establishment on the latter company's vessels of newspapers to be published at sea daily, CONTAINING NEWS SUPPLIED BY WIRELESS. Such papers are to be established on the four trans-Pacific liners conducting the services between Sydney and Vancouver and Sydney and San Francisco, and on steamers travelling between Sydney and New Zealand.

An Australian Manufacturers' Association.

Persons interested in wireless in Sydney are combining to oppose a monopoly of WIRELESS BROADCASTING IN AUSTRALIA. Mr. Geo. A. Taylor, who has been appointed president of the experts considering the matter, states that resolutions have been adopted at a meeting of the firms interested that an association be formed consisting of radio manufacturers and traders in radio equipment to further the development of radio science, to protect the interests of radio traders and manufacturers by arranging with the Government and other authorities regarding the earliest issue of regulations that will best assist the advancement of wireless, and to see that a fair field be allowed firms making or trading in radio apparatus, and that all contracts entered into by the Government and other public bodies be open to investigation in order to prevent any monopoly which would hamper competition and development.

Miscellaneous Wireless Items.

A Joint Committee of theatrical managers, music publishers, actors, authors and others has been appointed to consider their mutual attitude towards broadcasting.

The following have been appointed by the Postmaster-General as members of a committee to consider the future of TRANSATLANTIC WIRELESS TELEPHONY: Admiral Sir Henry Jackson (chairman), Maj.-Gen. Sir F. H. Sykes, Mr. R. A. Dalzell, Prof. W. H. Eccles, Mr. F. Gill, Mr. E. H. Shaughnessy and Major A. G. Lee (secretary).

The POSTMASTER-GENERAL states in Parliamentary papers that about 260 firms have become members of the British Broadcasting Co. The number of types of broadcasting receiving apparatus approved by the Post Office is 1 450. The number of wireless licences issued is approximately 115 000, of which about 80 000 are in respect of receiving sets bearing the trade mark of the British Broadcasting Co.

Telegraph and Telephone Notes.

BURNLEY Town Council has been informed that the present telephone system will be replaced by a new automatic exchange.

The first provincial TOLL TELEPHONE EXCHANGE has just been brought into use at Hull. The area extends to Scarborough, Cleethorpes, Doncaster, Lincoln, Selby and York.

The United River Plate Telephone Co.'s NEW AUTOMATIC EXCHANGES at Plaza, Retiro, Barracas and Corrales (Buenos Aires) were put into operation at 11 p.m. on Saturday, February 24th.

The Postmaster-General has appointed the following additional members of the POST OFFICE ADVISORY COUNCIL:—Lord Ashfield, Lord Daryngton (formerly Mr. Pike Pease) and Mr. John Walter.

The Postmaster-General draws the attention of architects and all engaged in the building industry to the importance of making ADEQUATE PROVISION FOR TELEPHONE SERVICE in the construction of large buildings, in order to eliminate the necessity of costly alterations later on.

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Companies' Meetings, Reports, etc.

AMERICAN TELEPHONE AND TELEGRAPH CO.—The stockholders have ratified the proposition to increase the capital from $750 000 000 to $1 000 000 000.

LONDON ELECTRIC WIRE CO. AND SMITHS.—Final dividend proposed of 6½ per cent., making 7½ per cent. for the year, less tax, carrying forward £30 671. The profit balance for 1922 was £64 431, plus £44 546 brought in, making £108 977.

SWANSEA IMPROVEMENTS AND TRAMWAYS CO.—Dividend recommended of 6 per cent., placing £3 137 to reserve (totalling £57 000), and carrying forward £4 078. The revenue for 1922 was £142 444 and the surplus (including £3 613 brought in) was £17 613.

The STOCK EXCHANGE COMMITTEE have granted official quotations to 500 000 £1, fully paid, 7 per cent. cumulative preference shares of the British Thomson-Houston Co., Ltd., and 10 000 $100 6 per cent. cumulative preference shares and £452 807 4½ per cent. first mortgage debenture stock (in lieu of preference shares and 1st mortgage debenture stock) of the British Columbia Telephone Co., Ltd.

BRUSH ELECTRICAL ENGINEERING CO.—Following the preliminary dividend announcement (10 per cent.), the report now issued shows that, after providing for general charges, debenture interest, etc., the profit for 1922 was £247 837, plus £120 368 brought in, making £368 205. Allocations include £15 000 to depreciation, £34 405 to general reserve (making £200 000) and £19 599 for writing down patents and goodwill to the nominal sum of £1. The sum of £251 301 is carried forward.

LANCASHIRE DYNAMO AND MOTOR CO.—Final dividend proposed of 3 per cent. actual, free of tax, making 6 per cent. for the year, carrying forward £487. The accounts for 1922, after providing for depreciation, debenture and other interest, show a loss of £15 153, from which is deducted £5 237 brought forward, while £23 530 is transferred from reserve. The company's liability for excess profits duty and income tax from 1917 to 1922 is not yet adjusted, but full provision has been made to cover this.

CAMMELL LAIRD AND CO.—The report for 1922 shows that the net profit was £145 906, compared with £170 487 for the previous year and £260 632 for 1920. In view of the large liquid resources of the company and the substantial sum standing to the credit of reserve account, the directors have felt justified in transferring a sum of £50 000 from that account. Including £36 237 brought in, the balance available is £232 143. A dividend of 5 per cent. is recommended on the ordinary shares, less tax, for the year, compared with 5 per cent. for 1921 and 7½ per cent. for 1920, leaving to be carried forward £31 223. The reserve account now stands at £700 000.

Supply and Lighting.

BROMLEY (KENT) ELECTRIC LIGHT AND POWER CO.—Dividend recommended of 6 per cent., free of tax, making 10 per cent., free of tax, for the year, placing £2 500 to general reserve, and carrying forward £706. The gross profit for 1922 was £24 637, as against £17 574 for 1921.

ARBROATH ELECTRIC LIGHT AND POWER CO.—Dividends declared of 8 per cent. on the ordinary shares and 6 per cent. on the preference shares, carrying forward £2 006, and placing £4 000 to reserve and renewals fund. Profit for the year amounted to £6 880.

FOLKESTONE ELECTRICITY SUPPLY CO.—The annual report for 1922 shows that the profit on the revenue account for the company's three undertakings at Folkestone, Sandgate and Hythe amounted to £32 381, to which is added £855 brought forward. Final dividend recommended of 6 per cent., free of tax, making 10 per cent., free of tax for the year, placing £11 502 to the depreciation fund, £6 000 to reserve, and carrying forward £1 498.

New Companies.

WOODWARD BROTHERS, LTD.—Private. Reg. March 23rd. Cap., £1 500 in £1 shares. Motor and mechanical engineers, founders, electrical engineers and contractors, suppliers of electricity, etc. Reg. office: 86, High Street, Stratford, London, E.15.

WILD, WINDSOR AND CO., LTD.—Private. Reg. March 22nd. Cap., £1 000 in £1 shares. General, mechanical and electrical engineers, metal stampers and forgers, machine and engineering tool makers, welders, etc. Reg. office: 26, Warwick Row, Coventry.

MARREC, LTD.—Private. Reg. March 15th. Cap. £6 000 in £1 shares. To acquire and turn to account certain inventions, patents and processes relating to wireless telegraphy and telephony, and to adopt an agreement with Y. Marrec and R. G. Guerquin. Solicitors: Waltons and Co., 101, Leadenhall Street, London, E.C.3.

A. FITCH AND SON (CLACTON), LTD.—Private. Reg. March 22nd. Cap., £5 000 in £1 shares. To acquire the business of automobile, electrical and general engineers carried on by Eveline S. Hilton and F. A. Fitch, at 6–10, Rosemary Road, Clacton-on-Sea, as "A. Fitch and Son." Reg. office: 6–10, Rosemary Road, Clacton-on-Sea.

SOUTHWARK ELECTRIC CO., LTD.—Private. Reg. March 23rd. Cap., £2 000 in £1 shares. Electricians, electrical engineers and manufacturers, suppliers of electricity, etc., and to adopt an agreement with E. J. Walker, S. L. Durell and R. Herrick, for the purchase of certain assets. Reg. office: 138, Southwark Street, London, S.E.1.

W. JEFFERY, LTD.—Private. Reg. March 21st. Cap., £1 100 in £1 shares. To take over the business of a builder, decorator and contractor, sanitary and electrical engineer, wireless installer, etc., carried on by W. G. Jeffery, at 94, Crawford Street, Bryanston Square, W., as "W. Jeffery." Reg. office: 94A, Crawford Street, Marylebone, London, N.W.

ADVANCE WIRELESS, LTD.—Private. Reg. March 23rd. Cap., £6 000 in 5 500 10 per cent. cumulative participating preference shares of £1 each and 5 000 ordinary shares of 2s. each. Manufacturers of wireless receiving and transmitting apparatus and appliances, etc. Solicitors: Harry Lewis and Co., 1, Great James Street, Bedford Row, London, W.C.1.

W. WARD AND SON, LTD.—Private. Reg. March 12th. Cap., £2 000 in £1 shares. To adopt an agreement with W. Ward (trading as W. Ward and Son) and to carry on the business of wireless and electrical engineers as formerly carried on by the said vendor at Hinckley, Leics. W. Ward, 8, Alma Road, Hinckley, Leics, electrical engineer, is a provisional director.

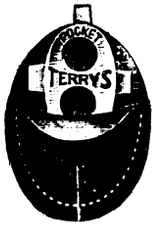
KELLY AND TARSHIS, LTD.—Private. Reg. March 12th. Cap. £1 000 in £1 shares. To adopt an agreement with T. Kelly and N. Tarshis for the acquisition of the business carried on by them in London as "Kelly and Tarshis," together with the leasehold messuages referred to therein, and to carry on the business of electrical engineers, etc. Reg. office: 5, High Street, Shoreditch, London, E.C.2.

BRITISH GENERAL RADIO CO., LTD.—Private. Reg. March 10th. Capital, £3 000 in 4 000 ordinary shares of 5s. each, and 2 000 preference shares of £1 each. To take over the business of a wireless apparatus manufacturer, carried on by G. D. Hinks, at Hardington, Yeovil, as the G. D. Hinks Wireless Department, together with the selling and manufacturing rights of various wireless components. Reg. office: 74, Hendford, Yeovil, Somerset.

GLEVUM MOTOR AND RADIO CO., LTD.—Private. Reg. March 23rd. Cap., £2 000 in £1 shares. To acquire the business carried on at Gloucester as the "Glevum Motor Co.," to adopt an agreement with M. J. Jones and A. R. Jones, and to carry on the business of motor car manufacturers, manufacturers of and dealers in instruments, appliances, accessories and materials capable of being used in connection with radio or wireless telegraphy and telephony, etc. Solicitors: Wellington and Clifford, 1, Berkeley Street, Gloucester.

A Pocket Screw-Driver.

The pocket knife is an established institution, but it has been left to the ingenuity of HERBERT TERRY AND SONS to produce a really practical pocket screw-driver. This useful little tool, as our illustration shows, is fitted into a leatherette case, and can thus be carried about without fear of damage to the pocket lining. It is unnecessary to enumerate the many occasions on which this tool is bound to prove of use to its possessor. As is the case with all really useful things, we can only wonder that it has not made its appearance before. The screw-driver may be had either bronzed or plated, and the cost is only a few pence in either case. The makers inform us that they are also casing their spanner sets in the same convenient manner.



Electrical Business.

READING RADIO INSTALLATIONS have opened showrooms at 17, King's Road, Reading.

The London office of the ELECTROLYTIC ZINC CO. OF AUSTRALIA has been moved to 27, Old Broad Street, E.C.2.

Mr. LEWIS NORMAN, electrical engineer, Newport, Isle of Wight, has removed his business from 33, Pyle Street to 22, High Street.

MR. ADOLPHE ARBENZ, Ludgate Hill, Birmingham, informs us that he has laid out an up-to-date plant for the production of moulded composition insulating parts.

ELECTRICAL INSTALLATIONS, LTD., are now associated with Wireless Service, Ltd., and the whole of the wireless department of the former company will be worked by the latter company at 2, Lower John Street, Piccadilly Circus, London, W.1.

HOLLINGS AND GUEST, LTD., inform us that they now have orders on hand for the supply of hydraulic presses for the British Thomson-Houston Co. and the Gutta Percha Co. They report an increased demand for their insulating presses.

A firm of manufacturers' sales agents in Montreal, who already represent British manufacturers of lead-in and filament wire for electric lamps and resistance wires for electrical heating and scientific instruments, desire to secure the representation, on a commission basis, for the whole of Canada, of British manufacturers of TINFOIL and INSULATING PAPER FOR ELECTRICAL PURPOSES, glass bulbs, rods and tubes for electric lamps, and also electric lamp bases, in brass, cemented, particularly the following types:—European numbers 732, 507 and 730, corresponding to Canadian numbers 102, 108 and 401.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

BERG, J. AND CO., 169, City Road, E.C., wholesale electric accessories. £39 18s. 2d. January 8th.

SHAW, A., 49, Lark Hill, Blackburn, electrical contractor. £34 12s. 2d. February 9th.

SPREADBOROUGH, Leonard, 539, High Road, Leytonstone, electrical engineer. £17 9s. February 5th.

WESTON, Edgar, 8, Southampton Row, W.C., electrical engineer, etc. £21 6s. 2d. February 8th.

Receivership.

MOODYS, LTD. W. A. J. Osborne, of Balfour House, 119, Finsbury Pavement, E.C., was appointed receiver on March 21st, 1923, under powers contained in mortgage or charge dated October 2nd, 1922.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

BROADBENT (T. W.), LTD., Huddersfield, electrical engineers. Registered March 15th, mortgage, to bank; charged on Victoria Electrical Works, East Parade, Huddersfield. *Nil. August 8th, 1922.

ELECTRIX, LTD., London, E.C., electricians. Registered March 15th, £1 500 debentures; general charge.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-up.

ECON MANUFACTURING CO., LTD. The petition (dated February 21st) for winding-up of the company by the High Court of Justice, postponed from March 13th, will be heard on Tuesday, April 10th, at the Royal Courts of Justice, Strand, London, when the Court will be asked by the petitioners for an Order continuing the voluntary winding-up of the company under the supervision of the Court.

Company Winding-Up Voluntarily.

SAUNDERS (J. B.) AND CO., LTD. S. G. Leech, 11, Dacre Street, Westminster, S.W.1, engineer, appointed liquidator. Meeting of creditors at liquidator's office on Wednesday, April 11th, at 3 p.m.

Notices of Dividends.

CHAMIER, Frederick William, 59, Fleet Street, London, E.C., electrical engineer. Second and final dividend of 3s. 6d. per £, payable April 17th, 4, Charterhouse Square, London, E.C 1.

TRUELOVE, Harold (trading as H. TRUELOVE AND CO.), 19, Shepley Street, Stalybridge, electrical engineer. First and final dividend of 1s. 3½d per £, payable April 5th, Official Receiver's Offices, Byrom Street, Manchester.

Edinburgh Gazette.

TAYSIDE ELECTRIC AND GAS LIGHT CO., LTD. P. R. Johnston, solicitor, 46, Reform Street, Dundee, appointed liquidator. Meeting of creditors within the Office of Stevenson and Johnston, solicitors, 46, Reform Street, Dundee, on Thursday, April 12th, at 12 noon.

Bankruptcy Proceedings.

MODERN ELECTRICAL SUPPLY CO., LTD., 7 and 9, Whitecross Street, Wilson Street, E.C. Under a Winding-up Order made against this company on January 16th last, upon the petition of the General Electric Co., Ltd., the statutory meetings of creditors and shareholders were held at the offices of the Board of Trade, Carey Street, W.C., on March 28th. The statement of affairs showed unsecured liabilities £4 319, preferential claims £106, and debentures £5 000. The assets valued at £4 975, consisted of cash £164; stock (cost £3 717), £3 000; fixtures and fittings, £50; good book debts, £1 465; bad and doubtful debts together amounting to £907, expected to realise £296. The deficiency in assets to meet liabilities was returned at £4 450, and the total loss to the shareholders was £7 383. Mr. E. T. A. Phillips (Official Receiver) reported that the company was incorporated as a private company on August 15th, 1921, with a capital of £1 500 in £1 ordinary shares, subsequently increased to £3 500 by the creation of 200 preference shares of £10 each. On March 20th, 1922, debentures for £5 000 were issued to Mr. A. T. Whittle as security for money advanced and on November 6th, 1922, Mr. F. S. Wilkes, 31, Lombard Street, E.C., was appointed receiver. On November 6th, 1922, at an extraordinary meeting of the shareholders, a resolution was passed for voluntary liquidation and Mr. Rodway Stephens, 31, Lombard Street, E.C., was appointed voluntary liquidator. The trading accounts which had been produced showed that up to July 31st, 1922, the company had made a gross profit of £2 295, but a net loss of £3 180. In the opinion of Mr. Stone the failure of the company was attributable to the fact that pending the licensing of broadcasting it purchased for cash, large quantities of wireless instruments which it was unable to dispose of owing to the prolonged negotiations for the issue of licenses, during which time the public were warned against making use of such instruments, until the licences had been granted. The Official Receiver had no reason to disagree with those views and he thought it probably had a great deal to do with the failure of the company. He would be pleased to receive communications from creditors who had supplied goods near the date of the winding-up order, and a full investigation would be made, and, if necessary, a full report sent to the proper authorities. The following are creditors:—Associated Electric Traders, Ltd., £81; Automatic Telephone Manufacturing Co., Ltd., £66; British Thomson-Houston Co., Ltd., £144; Billing and Co., £71; Bernard and Co., £47; Bapty, S. L., £795; Catchpole and Maurice, Ltd., £164; City Electrical Co., £37; Cable Accessories Co., Ltd., £212; Dawson, W., and Co., £167; Dwyer, P. L., and Co., £117; Ever-Ready Co. (Great Britain), Ltd., £79; Falk Stadelmann and Co., Ltd., £92; Graham, A., and Co., £37; General Electrical Co., Ltd., £332; Gupell, W., and Co., £75; Hart Accumulator Co., Ltd., £44; Henley's Telegraph Works, Ltd., £84; Higgs Bros., £47; M. and N.W. Railway, £35; Langham Electrical Supplies Co., £85; Leach, S. G., and Co., Ltd., £39; Maxim Lamp Works, £190; Mullard Radio Valve Co., Ltd., £87; Mickelwright, Ltd., £41; Petters, Ltd., £42; Rose Bros. Electrical Co., £50; Russ, J., £86; Smith, J. and W. B., £139; Wireless Instrument Manufacturing Co., £42; Wootton, H. A., and Co., £60.

WEEKS, William Edward, 59, Victoria Street, and 12, Filton Avenue, Horfield, Bristol, wholesale electric dealer. (See ELECTRICIAN, 30/3/23, p. 355). At their statutory first meeting the creditors decided to appoint Mr. J. P. Emett as trustee, while a committee of inspection was also nominated. The following are creditors:—Cable Accessories Co., Tipton, £54; Callender Cable Co., London, £75; Claremont Johnson and Co., Ltd., London, £35; Davis Kent and Stewart, London, £100; Edison and Swan Electric Co., Ponders End, £35; Guiterman and Co., Ltd., London, £45; Henley's Telegraph Co., London, £30; Jackson Electric Stove Co., London, £24; Leach, S. G., and Co., London, £210; Metropolitan Vickers, Ltd., Manchester, £45; Simpson Baker and Co., Bristol, £41; Sloan Electrical Co., London, £25; Simon Bros. and Co., Ltd., London, £79; Tudor Accumulator Co., London, £45; Veritys, Ltd., Birmingham, £40; Wholesale Fittings, Bristol, £25; "Z" Lamp and Supplies Co., Ltd., London, £193.

Prices of Metals, Chemicals, etc.

TUESDAY, April 3.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£77 10 0	£1 0 0	—
Electro Wirebars	,,	£83 0 0	10s. 0d.	—
H.C. Wire, basis	per lb.	11½d.	1/16d.	—
Sheet	,,	11⅝d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 3½d.	1/16d.	—
Brass 60/40—				
Rod, basis	,,	7½d	—	—
Sheet, basis	,,	10½d.	—	—
Wire, basis	,,	11d.	—	—
Pig Iron—				
Cleveland Warrants No. 3	per ton	£6 7 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 10 0	—	—
Lead Pig—				
English	,,	£29 5 0	5s. 0d.	—
Foreign or Colonial	,,	£28 5 0	10s. 0d.	—
Tin—				
Ingot	,,	£219 5 0	£2 5 0	—
Wire, basis	per lb.	2s. 10¼d.	¼d.	—
Aluminium Ingots	per ton	£110 0 0	—	—
Spelter	,,	£36 7 6	10s.	—
Mercury	per bottle	£11 15 0	—	10s. 0d.

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2¾d.
,, (Roll-Brimstone)—,, £7 15s. *Sulphuric Acid* (Pyrites, 168°) per ton, £7 10s.
Copper Sulphate.— ,, £26
Boric Acid (Crystals). ,, £55 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 3½d.; plantation 1st latex, 1s. 4⅛d. to 1s. 4⅜d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

190 655 E. W. PATTISON (DICTOGRAPH PRODUCTS CORPORATION). Telephone transmitters. (26/1/22.)
174 929 GENERAL ELECTRIC CO., LTD. Incandescent lamps. (4/2/21.)
190 736 EASTERN TELEGRAPH CO. and B. DAVIES. Electric signalling over submarine cables. (23/6/21.)
165 413 PLAUSON'S FORSCHUNGINSTITUT GES. Motors for operation with high-frequency currents. (23/6/20.)
165 450 SPERRY GYROSCOPE CO. Concentrated flaming arc-lamps for projectors. (26/6/20.)
190 739 J. NEALE and J. A. MANNERS-SMITH. Electro-magnets. (28/6/21.)
166 560 GES. FUR DRAHTLOSE TELEGRAPHIE. Production of electrical oscillations by means of choke coils or transformers with auxiliary magnetisation. (21/7/20.)
190 747 O. P. PETERSEN and A. E. WELLS. Electrically-driven gramophones. (29/9/21.)
190 750 NEALE MAGNET CONSTRUCTION CO., J. NEALE and L. H. WILMS. Suspension of electric lamps. (20/8/21.)
190 755 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Thermostatic controlling devices. (24/8/21.)
190 758 J. HALDEN AND CO. and J. B. HALDEN. Variable-speed gear for electric photographic printing machines, etc. (29/8/21.)
190 759 A. F. SYKES. Electric apparatus for recording sound. (29/8/21.) (Cognate Applications, 31 027/21 and 17 661/22.) (Addition to 160 223.)
190 761 METROPOLITAN-VICKERS ELECTRICAL CO. and A. B. FIELD. Devices for balancing currents in parallel-connected conductors for heavy alternating-currents. (30/8/21.)
190 762 A. C. GOOLDEN, V. E. PULLIN and A. R. GREATBATCH. Rectifiers for high potential a.c. (30/8/21.)
185 429 ALLMANNA TELEFONAKTIEBOLAGET L. M. ERICSSON. Devices for indicating and recording duration of trunk line calls. (20/5/21.)
190 765 W. H. EXLEY, G. H. HANDASYDE and L. C. RAWLENCE. Batteries or accumulators. (2/9/21.)
190 769 H. E. HADWEN and H. WILLIS. Coupling for electric cables, etc. (20/9/21.)
190 777 J. P. PRANGNELL. Thermionic valves. (21/9/21.)
190 778 G. F. MANSBRIDGE. Obtaining air-tight joint round leading-out wires and covers or casings. (22/9/21.)
190 783 J. E. EVANS-JACKSON (T. TAKEUCHI). Starting arrangements for squirrel cage induction motors. (23/9/21.)
190 790 F. WILSON and H. S. ROBERTSON. Electro-mechanical high-speed relay. (26/9/21.)
190 793 M. C. ELLISON. Telephonic systems for use in mines, etc. (27/9/21.)
182 750 PHILIPS' GLOEILAMPENFABRIEKEN. Rontgen-ray installations. (4/7/21.)
190 798 GENERAL ELECTRIC CO., LTD., and J. W. RYDE. Apparatus for electric discharge through gases. (28/9/21.)
190 809 BRITISH THOMSON-HOUSTON CO. and H. S. HOLBROOK. Electric reactors. (29/9/21.)
190 824 G. H. SCHOLES and E. A. CLAREMONT. Junction boxes for electric conductors. (3/10/21.)
170 571 SOC. LE FER. Production of electrolytic iron. (19/10/20.)
190 840 A. F. SYKES. Inter-valve electric transformers. (15/10/21.)

APPLICATIONS FOR PATENTS.

March 19th.

7 781 H. M. LORRAIN. Electric fire detector and alarm.
7 785 W. H. LOWTH. Terminals for wireless telegraphy.
7 790 E. CLARKE and W. TYERS. Burglar alarms.
7 801 C. E. SNELL. Electric condensers.
7 824 R. F. GORDON. Shade for electric light bulbs.
7 826 P. D. MORTON. Connecting several wires to one contact.
7 839, 7 840, 7 841 and 7 842. L. A. LEVY. Thermionic valves.
7 858 A. S. BEWLEY. Telephones, etc.
7 860 T. W. LOWDEN. Vacuum electric tubes.
7 866 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Starting a.c. motors.
7 873 W. M. TAYLOR. Electric table lamps, shades, etc.

March 20th.

7 892 A. C. R. ARROWSMITH. Wireless receiving apparatus.
7 897 W. A. EASTAWAY. Electric couplings.
7 911 W. E. CARLSON and G. W. CARPENTER. Telephone receiver circuits for radio telegraphy, etc.
7 921 J. F. BEASLEY. Electric soldering irons.
7 928 WESTERN ELECTRIC CO. and B. B. GRACE. Sockets for thermionic valves, etc.
7 943 F. W. HAMPSHIRE. Telephone receivers.
7 944 H. S. POCOCK. Winding inductance coils.
7 945 F. H. HAYNES. Signalling and amplifying systems employing electric oscillations.
7 961 L. W. WILD and E. P. BARFIELD. Electric furnaces.
7 963 C. C. PHILLIPS. Variable condensers, resistances, etc.
7 972 E. A. GRAHAM. Cabinets for wireless apparatus.
7 973 E. A. GRAHAM. Cabinets for sound reproducers.
7 981 R. M. DEELEY. Microphones, telephone receivers, etc.
7 993 E. R. BENEY. Facilitating inter-connection of radio apparatus.
8 001 BRITISH THOMSON-HOUSTON CO. (CIE FRANÇAISE THOMSON-HOUSTON). Induction motors.
8 002 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Renewable fuses.

March 21st.

8 016 A. M. TAYLOR. Electric transmission systems.
8 017 J. MCCREATH. Earthing running rails.
8 020 B. BRYAN. Wireless apparatus.
8 039 F. R. MACHIN. Locking device for crystal detectors.
8 048 E. R. GARDNER. Wireless detectors.
8 052 F. G. BROWN. Switch.
8 054 H. H. M. SHURLOCK. Ear cushions for telephone receivers.
8 063 C. W. HARTMANN. Discharging electrically charged rolls of paper. (21/3/22, Germany.)
8 075 H. S. MCCLENAGHAN. Crystal detectors.
8 081 P. VAN BOMMEL. Incandescent lamps.
8 106 W. E. BARBER. Thermionic valves, etc.
8 112 SOC. ANON. DES ATELIERS DE SECHERON. Electric vehicles. (28/3/22, Switzerland.)
8 113 BRITISH THOMSON-HOUSTON CO. and L. GRIFFITHS. Battery boxes.
8 114 BRITISH THOMSON-HOUSTON CO. Suspension device for battery boxes.
8 122 CREED AND CO. and F. G. CREED. Translating wireless messages.

March 22nd.

8 136 B. E. F. GREENAWAY. Overwinding gear for electric cranes.
8 154 I. H. PARSONS. Switches.
8 157 W. BURKE. Electric apparatus for indicating boiling of liquids.
8 161 W. M. W. THOMAS. Wired wireless telephone systems.
8 166 R. AMBERTON. Electric controllers.
8 170 R. H. BARBOUR and J. R. WALTON. Fittings for electric cables.
8 172 C. E. SNELL. Insulators.
8 173 C. E. SNELL. Electroscopes.
8 190 SIEMENS BROS. AND CO. and A. E. FOSTER. Insulation of electric conductors.
8 194 METROPOLITAN-VICKERS ELECTRICAL CO. Collector rings for electric machines. (13/4/22, U.S.)
8 198 R. C. LEVY. Detectors for wireless telegraphy.
8 210 G. A. H. WOOTTON. Accumulator charging boards.
8 225 ENGLISH ELECTRIC CO. and F. MORRIS. Electric control of mechanical movements.
8 228 C. H. WADSWORTH and A. E. CHAPMAN. Electric variable condensers.
8 229 C. H. WADSWORTH and A. E. CHAPMAN. Resistance capacity devices for wireless telegraphy.
8 235 M. P. LAUGHLIN. Electric telemotor apparatus.
8 239 W. DUBILIER. Variable electric condensers. (20/7/22, U.S.)
8 240 A. SEGUIN. Measurement of frequency. (8/4/22, France.)
8 245 A. L. DAVIS. Electric couplings.
8 246 V. RICHES. Electric fittings for wireless apparatus.
8 248 F. E. GUEST. Wireless receivers.
8 250 A. NIXON. Converting headphones into loud speakers.

March 23rd.

8 253 P. B. DOWN. Crystal detectors.
8 254 D. S. B. SHANNON. Wireless receiving apparatus.
8 263 E. DAVENPORT. Crystal detector.
8 266 E. B. WEDMORE. Switches and circuit breakers.
8 282 T. C. CAMERON. Storage battery. (8/3/22, Australia.)
8 283 T. A. VENABLES. Wireless telephone receivers.
8 293 T. GINSTI. Switch.
8 303 J. L. CROWN. Electro-magnetic power transmission mechanism.
8 308 SILUMINITE INSULATOR CO. and W. E. WINDSOR-RICHARDS. Insulators.
8 316 SIGNALISATION ELECTRIQUE SIMPLEX S.A. H. VIATOUR and N. THIRY. Mine signalling.
8 326 METROPOLITAN-VICKERS ELECTRICAL CO. Automatic electric control systems. (23/3/22, U.S.)
8 331 A. ALLEN. Headpieces for telephone receivers.
8 334 SOC. TALCO E GRAFITI VAL CHISONE and E. RIDONI. Natural graphite electrodes.
8 340 and 8 341 WESTERN ELECTRIC CO. and G. H. NASH. Wireless receiving apparatus.
8 341 WESTERN ELECTRIC CO. and B. B. GRACE. Wireless receiving apparatus.
8 342 WESTERN ELECTRIC CO. Coating filamentary materials, etc.
8 344 S. LEVEY. Reception apparatus for radio telephony.
8 345 H. E. DAVIS. Crystal detector.
8 348 S. S. WHEELER. Transformers for a.c. motor starting switches.
8 366 C. E. HORTON and C. C. SEYMOUR. Apparatus for direction finding by wireless telegraphy.

March 24th.

8 369 C. MILLS. Crystal detector.
8 389 W. E. and J. H. TAYLOR. Batteries, etc.
8 399 G. E. MALLETT. Device for varying resistance or tuning inductance of coils.
8 408 MIDLAND ELECTRIC DETONATOR FUSE CO. Means for blasting coal, etc.
8 426 F. W. RICHES. Crystal detectors, etc.
8 433 H. MCCLELLAND. Adaptors for utilising electric currents.
8 448 SIEMENS BROS. AND CO., C. L. PETERS and J. BERRY. Telephone systems.
8 463 T. P. GATH. Rectifiers for alternating current.

Arrangements for the Week.

FRIDAY, APRIL 6th. (To-day.)

ROYAL SOCIETY OF ARTS.

4 *p.m.* At John Street, Adelphi, London. Lecture on "Postal and Telegraph Work in India," by Mr. G. R. Clarke.

INSTITUTE OF TRANSPORT.

5.30 *p.m.* At the Institution of Electrical Engineers, Victoria Embankment, London. Paper on "The Influence of Trans-shipment on Railborne and Road Traffic, with special reference to the most economical methods of labour-saving appliances," by Mr. C. Bentham.

INSTITUTE OF METALS (SHEFFIELD LOCAL SECTION).

7.30 *p.m.* At the University, Sheffield. Annual General Meeting. Lecture on "The Heat Treatment of Non-Ferrous Alloys," by Professor F. C. Thompson.

EDINBURGH ELECTRICAL SOCIETY.

8 *p.m.* At Philosophical Institute, 4, Queen Street, Edinburgh. Apprentices' Night. Competition Papers for Society's Prize.

MONDAY, APRIL 9th.

INSTITUTION OF ELECTRICAL ENGINEERS (WESTERN CENTRE).

5 *p.m.* At the Guildhall, Gloucester. Lecture entitled "Notes on Railway Electrification," by Mr. Roger T. Smith.

TUESDAY, APRIL 10th.

INSTITUTION OF ELECTRICAL ENGINEERS (EAST MIDLAND SUB-CENTRE).

6.45 *p.m.* At Loughborough College, Loughborough. Paper on "Some Problems in High Speed Alternators and their Solution," by Mr. J. Rosen.

INSTITUTION OF ELECTRICAL ENGINEERS (NORTH-WESTERN CENTRE).

7 *p.m.* At the Engineers' Club, Albert Square, Manchester. Annual General Meeting.

INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH CENTRE).

7.30 *p.m.* At The Rooms, 207, Bath Street, Glasgow. Sixth Ordinary and Annual General Meeting.

THE RÖNTGEN SOCIETY.

8.15 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. General Meeting. Paper on "A New Method of Operating Induction Coils," by Mr. Mortimer A. Codd.

WEDNESDAY, APRIL 11th.

INSTITUTION OF CIVIL ENGINEERS.

(Afternoon.) Students' Visit to the Golders Green-Edgware Extension of the London Electric Railways.

INSTITUTION OF RAILWAY SIGNAL ENGINEERS.

6.30 *p.m.* At the Institution of Electrical Engineers, Victoria Embankment, London. Paper entitled "Some Notes on Railway Accidents," by Mr. G. Holt.

INSTITUTION OF ELECTRICAL ENGINEERS (WIRELESS SECTION).

6 *p.m.* At the Institution. Lecture on "The Application of a Revolving Magnetic Drum to Electric Relays, Siphon Recorders and Radio Transmitting Keys" (Experimental Demonstration), by Dr. N. W. McLachlan.

THURSDAY, APRIL 12th.

INSTITUTION OF ELECTRICAL ENGINEERS.

6 *p.m.* At the Institution. Lecture on "The X-Ray Examination of Materials," by Mr. A. G. Warren.

FRIDAY, APRIL 13th.

ELECTRICAL POWER ENGINEERS' ASSOCIATION.

7 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Lecture on "Power Plant Testing," by Mr. W. M. Selvey.

JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At 39, Victoria Street, London. Paper on "Instrument Equipment of Aeroplanes," by Mr. C. B. Clapham.

The Editorial, Advertisement and Publishing Offices of "THE ELECTRICIAN" are at 8, Bouverie Street, London, E.C.4. Telegrams: Benbrotric, Fleet, London. Telephone: City 9852 (6 lines). The subscription to "THE ELECTRICIAN" is £1 5 0 per annum in the United Kingdom and £1 10 0 per annum Abroad. Advertisement Rates can be obtained on application to the Manager. Advertisement copy and blocks should be received on the Friday preceding date of publication.

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THE ELECTRICIAN

ESTABLISHED 1861.

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CONTENTS.

Notes of the Week	383	Power Station Economy	402
Power Station Economy	385	National Trades Exhibition	402
Notes on Wireless Matters. By Prof. G. W. O. Howe. Illustrated	386	Long Distance Telephony	402
Electric Traction in Italy	386	Institution Notes	402
A Modern Swiss Electric Locomotive. Illustrated	387	Electricity Supply	403
The Control of the Speed and Power Factor of Induction Motors. Illustrated	391	Obituary	403
German Broadcasting Schemes	392	Personal Items	403
Broadcasting at Glasgow. Illustrated	393	Foreign Notes	404
Radio-Broadcasting	394	Imperial Notes	404
Development of Naval High-Power Valves. By H. Morris-Airey, C.B.E., M.Sc.	394	Wireless News	405
Correspondence	395	Wireless Experiment Difficulties	405
An Air Break Outdoor Switch. Illustrated	398	"The Wireless Monopoly"	405
Hydro-Electric Supply for Dublin	399	Books Received	405
I.E.E. North-Eastern Centre	399	Tenders Invited and Accepted	406
Post Office Estimates	399	Electric Traction	406
An Impossible Load (Cartoon)	399	Companies Meetings, Reports, etc.	407
S.-E. Lancs. Advisory Board	399	New Companies	407
Merchandise to Sell and Profit By. Illustrated	400	Business Items	407
The I.M.E.A. Convention	402	Reference Index to Wireless Publications	408
British Empire Exhibition	402	Commercial Intelligence	409
		Forty Years Ago	409
		Prices of Metals, Chemicals, etc.	409
		Patent Record	410
		Arrangements for the Week	410

Notes of the Week.

Are We Unfair?

In a letter which we publish in our correspondence columns this week Alderman Walker, chairman of the National Joint Board for the Electricity Supply Industry, addresses us more in anger than in sorrow. He complains that when we comment on the differences that arise between the E.P.E.A. and their employers we are never fair to the latter, and that we are guilty of *suppressio veri*. He remarks that our attitude on this important question is resented. This is a grave indictment, but all the same we do not propose to assume the penetential sheet. If our comments have been one-sided, and we have taken every care to prevent them being so described, the fault is not altogether ours. It is a convenient fiction that editors are omniscient; in practice they depend for what they publish on outside information. If information is withheld by one party to a dispute what is published must suffer in certain qualities in a greater or less proportion. What we have been able to publish about this unfortunate matter has suffered because of the reticence of the employers. They have been asked for information; they have withheld it. They have been asked to state their case; they have not done so. Even now we are not allowed to see the struggle from their point of view. Can it be wondered at if our information or our comment is one-sided? The Electrician, like other electrical journals, exists to serve the industry. The E.P.E.A. have, at least, partially, begun to recognise this. Is it our fault that the employers are still walking in darkness? In matters of this kind the Press can give very great help; that help should be utilised.

Some Complaints and Our Replies.

Alderman Walker complains that we have refrained from informing our readers of the effect of the agreements that the E.P.E.A. made with the manual workers' unions. In our issue of December 22nd, 1922, we said that these agreements were of a kind that should be encouraged in the interests of peace. That may have been a foolish opinion; but it was an opinion. The question of arbitration was hardly a subject for special comment in this case. Had it been we should have supported it and criticised the E.P.E.A. for not submitting to it. We have often protested (we really have not space to give the references) against the strike policy of the E.P.E.A. That being so we can hardly be expected to differentiate between different kinds of strikes. All strikes are bad, but it is not always the side that goes on strike that is the more to blame. We are glad to learn that amicable relations have been re-established, and we assure Alderman Walker that we are as anxious as he is that they should continue. At the same time this is a free country with a free Press; and we cannot be expected to refrain from criticising actions which we believe to be wrong just because that course is resented. We are glad to learn that the employers as a whole are making no attempt to reduce salaries. If Alderman Walker will refer to our issue of March 23rd, 1923, he will see that we made the statement of which he complains with due reservations. That we made it at all in that form is another argument for our view that the employers should take the electrical Press into their confidence.

Broadcasting Troubles.

At a certain meeting in August last when the British Broadcasting Co. was formed some sceptic asked what would happen if people used wireless receiving sets, not bearing the official mark, or did not take out a licence. The airy reply was that they must not do the one and they would have to do the other. Hard cases, it has been said, make bad law. But bad laws make criminals out of law-abiding citizens. In the case of broadcasting the imme-

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diate result of this neglect to deal with what everyone ought to have seen would be an important problem is that two hundred thousand unlicensed receiving sets are said to be in use; the same number of people are breaking the law and cannot cease to do so without admitting their misdemeanour, while revenue which they sorely require is being lost by the Broadcasting Co. The POSTMASTER-GENERAL is said to be studying the broadcasting agreement with a view to its revision. He has our sympathy. But the remedy is certainly not to be found in vilifying the Broadcasting Co. or by talking about a monopoly as one of the more hysterical of our daily contemporaries is doing. It is doubtful whether it is to be found by throwing the market open and increasing the licence fees. There are complaints, some of them justified, about the quality of the broadcasting programmes. But unless the Broadcasting Co. or, indeed, any other authority, except perhaps a newspaper anxious to make its readers forget about its insurance schemes, obtains revenue sufficient to pay its expenses, broadcasting of any sort will be impossible. That is the real problem; everything else is beside the mark.

Broadcasting Programmes—Some Criticisms.

AN article which we publish this week from a Glasgow correspondent shows that the technical defects in broadcasting to which we have more than once called attention are being satisfactorily overcome. The reproduction of speech and music from the studio is stated to be very good indeed, but it is not so good when stage performances are being given, because the artistes are playing to two audiences at once, and naturally concentrate on the visible one. Nevertheless the results are rather uneven, and our correspondent suggests certain remedies of which we hope due note will be taken, not only at Glasgow but elsewhere. The technical points raised the Radio Society of Great Britain in their memorandum are also worthy of the attention we hope they will receive. All this is constructive criticism and will be a real help. What is not so helpful is the criticism in the daily papers that the news is bad, that the weather reports are dull and that what is wanted is more of this or that—more or less definitely specified. As regards the news being bad we should have thought this was what our contemporaries wanted. As regards the other criticisms it is impossible to please everyone and the Broadcasting Co. will be well advised not to try.

The Planning of Daylight Illumination.

SEEING that our views as to what constitutes effective artificial lighting are so largely dependent on our impressions of daylight, the discussion on natural lighting at the last meeting of the Illuminating Engineering Society is of general interest. The introductory paper read by Messrs. P. J. and J. M. WALDRAM contained an elaborate explanation of the methods of calculating the "daylight factor" for buildings and of ascertaining beforehand what the ultimate conditions of natural lighting are going to be. At present, it must be owned, the methods seem intricate, but the subject is comparatively new and no doubt in course of time they will be simplified. The chief thing that strikes the observer is the extreme variability of daylight. A mere measurement of the illumination at any instant is usually of little value. In judging the effectiveness of entry of daylight we must adopt relative methods, comparing the illumination at a specified point within the room with the sky-brightness or total unrestricted daylight out of doors. Work on parallel lines with that of Messrs. WALDRAM has been proceeding at the National Physical Laboratory for some time, and Mr. J. W. T. WALSH paid a tribute to the useful information contained in the paper. A special invitation was conveyed to members of the R.I.B.A. and the Surveyors' Institution to take part in the discussion, which was of obvious interest to the members of these professions. But no one who calls himself a lighting expert can afford to neglect the study of daylight, which often furnishes useful hints to the illuminating engineer. It may also bring to him the consoling reflection that even natural lighting has its drawbacks and disadvantages and that it is a relatively simpler problem to deal with the more constant and controllable artificial light.

The Budget.

ON Monday next Mr. STANLEY BALDWIN will introduce his first Budget, and everyone is hoping for the abolition of the corporation profits tax and a reduction in the super and income taxes. If relief can also be given for certain other forms of taxation so much the better. Mr. BALDWIN has no reason to thank his predecessor as Chancellor. For the surplus of about £50 or £60 millions which it is estimated will be obtained, as against the margin of less than one million anticipated by Sir ROBERT HORNE, has been due to a decrease in actual over estimated expenditure of some £97 millions. Incidentally, the chaos in the Treasury is well shown by the fact that though the revenue was within £4 millions of the estimate this was due to a series of bad shots cancelling each other out. From Mr. BALDWIN'S point of view the worst result of this state of affairs is that everyone is convinced they are overtaxed and is demanding relief. The question is, can he give that relief without endangering our financial stability?

Two Possible Financial Policies.

HIS two possible policies may be labelled debt reduction and tax reduction. Thanks to Sir ROBERT and the Treasury the former has had a windfall. Even if the corporation and super taxes are retained and the income tax is kept at its present level it is doubtful for more than one reason whether the yield would be so high as during the past twelve months, so that a large surplus for debt reduction cannot safely be anticipated. On the other hand, if these taxes, which act in restraint of trade, were mitigated, the yield owing to increased business might well be higher than it otherwise would be, and some surplus, though not so large as the present one, might be obtained. In addition there is the psychological effect of tax reduction. There is no doubt that Sir ROBERT HORNE did the right thing last year, and Mr. BALDWIN would do the right thing this year, by relieving the income taxpayer. Bad, therefore, as the corporation tax is we think the income tax has the first claim to reduction, and we hope that this line will be taken by the Chancellor. At the same time we hope that a sound financial policy will be followed and that no attempt will be made to obtain temporary relief by further inflation.

Our Competitions—Some Reflections.

THOUGH it is early days to make any definite statement it is easy to see that as great an interest is being taken in our "Hot Water" competition as in that for the "All Electric" House. It is right that this should be so; indeed we would even go so far as to say that more interest ought to be taken. The first problem was mainly economic; or where it was not economic it was mainly a question of clearing away a number of weeds and finding out the best method of using existing means for the end in view. The second problem is much more technical. There is no generally accepted design of electric hot water heater on the market, and those who are most interested are not in agreement as to the fundamentals of the problem. Competitors have, therefore, to tackle a subject in which hardly even the preliminaries have been determined. It is a case for thought, for ingenuity and for vision. We have no doubt that all these will be applied with interesting and valuable results.

The "Stay-at-Home" Convention.

LAST year we described the annual convention of the Incorporated Municipal Electrical Association as the charabanc convention. Those who attended it will not easily forget the constant succession of journeys made in those uncomfortable vehicles nor the relief they felt when the last day came and they found they were still whole, though bruised. There is a lot to be said for motion, but

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the general opinion at the end of that feverish week was that there was more to be said for rest. The twenty-eighth annual convention of the Association, which is to be held this year at Scarborough, will be, if the preliminary programme be anything to go by, a vastly different affair. It will be, we should say, a bathing, golfing and talking convention. We have often sung the praises of "shop." At Scarborough there will be chances for "shop" *in excelsis*. There are the usual meetings in the mornings and one informal meeting in the afternoon. The rest of the afternoons are free, and the evenings are devoted to entertainment. We congratulate those responsible on these arrangements.

Power Station Economy.

We have often said, and we make no apology for reiterating it, that one of the greatest needs of the electrical industry at the moment is that more and more attention should be paid to the problems of fuel economy. Ways and means must be found for ensuring that the coal, oil and gas consumed in generating electricity is employed in the most efficient manner possible; and it is further essential that all concerned should realise how important this question is. In the first place it is axiomatic that the less fuel used per horse power generated the more there will be to use, while the more the fuel costs are reduced the easier will it be to bring down the selling price and the more quickly will it be possible to approach the all-electric age.

Useful Statistics.

From both these points of view the analysis and summaries of the returns of fuel consumption and units generated in this country which are issued annually by the Electricity Commissioners under the provisions of the Section 27 of the Electricity (Supply) Act of 1919 are worthy of study. They show both in the aggregate and in the discrepancies that exist between the results that have been obtained in similar stations what is being done; and to those who read between the lines, they also indicate what remains to be done.

Alterations Make Comparisons Difficult.

The analyses and summaries for the year ended March 31st, 1922, which have just come to hand though interesting enough make comparisons with previous years rather difficult. In the first place the return is now based upon the areas of the Electricity Districts which have been provisionally determined, or, where there are so far no such districts, on appropriate areas which have been employed for this purpose only. These "compilation" areas will continue to be used until proper Electricity Districts have been determined, but they do not necessarily bear any relation to these ultimate districts. In former years the returns have been based on the "Coal Transport Reorganisation Scheme" of areas and, except for purposes of comparison, the change is therefore a distinct advantage.

Arrangement of the Returns Analysed.

Last year generating stations were divided into four groups depending upon the number of units generated. In the present year the number of groups has been increased to thirteen, the largest of which contains stations that generate over 200 000 000 kWh per annum and the smallest those that generate less than 50 000 kWh. The stations are also divided into four sub-groups which deal respectively with steam stations, gas producer stations, oil engine stations and stations which cannot be classified on a thermal basis. In general, thermal efficiency is taken as the basis of comparison, the principal exceptions being "composite" stations, where the efficiency is calculated on that type of prime mover by which the majority of the kilowatt hours are generated, the fuel consumption being determined by conversion, where necessary, into the equivalent value of the class of fuel consumed by the principal prime mover. The statistics of sixteen stations, which are only in operation for a portion of the year, of twenty-four stations, where the fuel is mainly waste heat, destructor, town gas or water power, and of twenty-eight stations, where electricity is generated entirely by these means, have been entirely omitted. In certain other cases where the proportion generated by these means is very small that proportion has been neglected. It would be interesting to know what ratio these "freak" kilowatt hours bear to the total number generated so as to determine the accuracy of the figures as a whole. In the case of water power, even in this country, that proportion cannot be inconsiderable, though, of course, it has no bearing on thermal values, with which these returns are mainly concerned.

Thermal Efficiency Figures.

Turning to the figures themselves we note that among the steam stations the highest thermal efficiency is obtained at one of the two stations in the country that generate more than 200 000 000 kWh per annum. This is obviously Carville, where the thermal efficiency is 17·2 per cent. and the fuel consumption per kWh generated is 1·74 lb. There is only one other station in this group and as it is in the London area we presume it is Lot's Road, where the thermal efficiency stands at the relatively low figure of 11·7 per cent. and the fuel consumption per kWh generated being 2·48 lb. The conditions existing in these two stations are pretty well known and an interesting essay could be written and useful morals drawn by comparing the results at length. At the moment we shall only suggest that an endeavour should be made to raise the figures of the latter somewhere near the level of the former. It is interesting to note that 459 153 708 kWh were generated in these two stations during the period under review, or rather less than 10 per cent. of the total units generated in the 396 steam stations analysed.

Good Results from Medium Sized Stations.

While the highest thermal efficiency is obtained in the largest station and a veil is mercifully drawn over which station has the lowest, it is interesting to find that one station in the group generating between 10 000 000 and 25 000 000 kWh has a thermal efficiency of 15·2 per cent. and that this station is also in the London area. Its coal consumption is 2·04 lb. per kWh, and though this is not a guessing competition the presumption is that it is Poplar. This is sufficient to show that size is not necessarily a concomitant to efficiency and should be an encouragement to others to go and do likewise. Incidentally, it shows that on the thermal side we can get on quite well without superstations. All these figures for steam engines, however, pale before the results obtained with oil engine stations, where the high figure of 29·15 per cent. is obtained for thermal efficiency in a station generating between 500 000 and 1 000 000 kWh per annum. This station is area No. 18, the Eastern Counties of England, a district which is not generally looked upon as being highly electrified in any sense of the word. In general, the figures for both the oil and the gas producer stations are higher than for those in the same class of steam stations.

Total Kilowatt Hours Generated.

Of the total kilowatt hours generated in the country 4 732 824 434 are generated in steam stations, 14 952 709 in producer gas stations 31 551 075 by oil driven plant, 54 628 405 by waste heat, 17 728 350 in refuse destructors, 3 874 029 by town gas and 29 107 036 by water power. There are 60 gas producer stations, 52 oil engine stations, 17 waste heat stations, 30 destructor stations, 10 town gas stations and 22 water power stations. Curiously enough the number of steam stations has fallen from 463 in the last return to 396. This may be due to some alteration in the classification, or can it be explained by the paragraph which complains of the inadequacy of the returns made, an inadequacy which is also the cause of the delay in the publication of these interesting statistics. We hope, at least, that this sin of omission will be taken due note of by those concerned during next year.

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Notes on Wireless Matters.

The Radiation of Wireless Waves.

By Prof. G. W. O. HOWE.

It is well known to all who have studied the subject that electromagnetic waves have not the same characteristics in the immediate neighbourhood of the aerial as they have at a considerable distance, and it is often stated that the formulæ and diagrams given for the waves are only applicable at distances exceeding a quarter of a wave-length from the transmitter. There appears to be some haziness as to what happens at this critical distance from the aerial and why it is that the electromagnetic waves undergo a change.

Sir Oliver Lodge's Opinion.

The subject is referred to by Sir Oliver Lodge in a recent article in "Modern Wireless" which concludes thus:—"The oscillator is stationary, true, but then the two

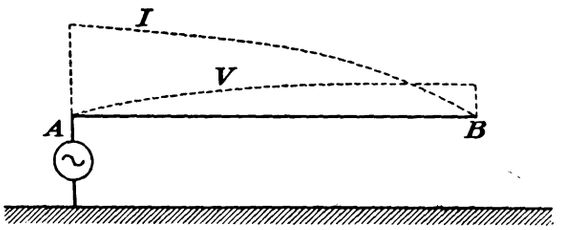

FIG. 1.

disturbances there are not in phase. One is a quarter period behind the other as one would expect: then the energy mainly pulsates, first out, then in, and is not all lost by radiation. The only part lost by radiation is that which has got a quarter wave-length away, where the one disturbance has caught up the other, and where the energy—that which is used in wireless telegraphy—is flicked off into space." This flicking off into space is an attempt on the part of Sir Oliver to make a complicated phenomenon clear to the non-mathematical reader. One cannot but wonder, however, why the one disturbance should ever catch up the other, and further, why, having done so, the energy should be flicked off into space. Let us consider a horizontal antenna as shown in Fig. 1 maintained in oscillation at its fundamental frequency by the alternator A. If there is no dissipation of energy either by radiation or resistance the terminal potential difference of the alternator

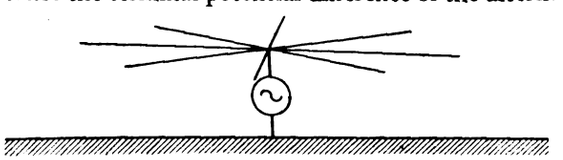

FIG. 2.

will be zero, no further supply of power being necessary once the oscillation is set up. The energy is at one moment all stored in the electric field, a quarter of a cycle later it is entirely magnetic, the two fields being a quarter period out of phase and extending little beyond the end of the wire.

A Sudden Cessation.

The unsymmetrical arrangement shown in Fig. 1 can be made symmetrical by adding a number of similar horizontal wires radiating in various directions as shown in Fig. 2. Except for fringing from the ends of the aerials, the electric and magnetic fields are confined to the space between the aerials and earth, that is, they cease more or less suddenly at a distance from the alternator equal to the length of the horizontal wires, whilst the wave-length will be a little greater than four times this length. As the wires are raised the fringing will become more extensive and the natural wave-length will be somewhat increased. On our ideal assumptions the output of the alternator is zero not only on the average as in a perfectly inductive load but at every moment, since its terminal p.d. is always zero.

Overcoming Losses.

If now the oscillation is accompanied by loss due to dissipation or radiation of energy, the alternator must have an average output equal to this loss; this will constitute a non-inductive load on the alternator, the current and p.d. of which will be in phase. This means that the magnetic field produced in the immediate neighbourhood of the alternator will be in phase with the electric field at the same point. The energy is given out from the alternator in pulses—two pulses per period—as in any single-phase alternator on a non-inductive load, but there is no returning of energy to the alternator. It will be noticed that the phase relation between the magnetic and electric fields of the energy given out by the alternator is the same as in the progressive wave at a great distance from the transmitting aerial, and that the radiated energy is "flicked off" in pulses from the alternator and together with the aerial losses constitutes the only load on the alternator.

Returning to the electric and magnetic fields of the oscillation it will be seen that their phase relation is quite different. At the moment of maximum current, the energy is all magnetic and is concentrated towards the inner end of the aerial, whereas a quarter cycle later it is all electric and is concentrated towards the open end of the aerial.

Although we have considered the oscillation and radiation fields separately they are, of course, superposed and immediately under the aerial the former are much the stronger with the result that the magnetic and electric fields are nearly 90° out of phase, but the oscillation fields fall off very rapidly as the distance from the aerial increases leaving the radiation fields to pursue their way.

Electric Traction in Italy.

Extended Trials with Three-Phase Systems this Summer.

According to "The Brown Boveri Review," extended trials with electric traction are to be undertaken on the Italian State Railways at 10 000 V, 45 cycles. The use of such a high pressure is rendered possible by taking account of the high inductive pressure drop occurring.

These trials will be begun in the summer of 1923 on the Rome-Tivoli section, which has a total length of 40 km. Curves abound on this line, and there are seven intermediate stations. The first twenty kilometres are about level, only a few gradients of 1·5 per cent. have to be climbed, whereas there is a practically uninterrupted gradient of 1·5 per cent. for the remainder. If this electrification comes up to expectations, the conversion of the level section between Rome and Anzio (60 km.), and of other lines in central Italy, will be proceeded with.

Interchange Arrangements.

The existing three-phase supply, 3 300 V, 16·7 cycles, is to be retained for extensions of the electrification of the upper Italian system. It follows that interchange stations will have to be able to accommodate locomotives belonging to both systems. The induction motors employed can use low-pressure current, inasmuch as they are able to develop their full torque when the normal pressure and frequency are lowered by two-thirds, their speed, however, in such cases is only one-third of the normal. Consequently, when the necessity of having interchange stations arises, these will be supplied with low-frequency three-phase current.

For working the traffic on the first-mentioned section four express passenger locomotives and four freight locomotives are to be supplied to the Italian State Railways by the Tecnomasio Italiano Brown Boveri.

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A Modern Swiss Electric Locomotive.

Details of Latest Single Phase Rolling Stock on the Rhaetian Railway.

An interesting example of single phase traction is to be found on the Rhaetian Railway in Switzerland. This line was opened for electrical working before the war on the Schulz-St. Moritz and Samaden-Pontresina sections, a total length of 62 km., and on the Bevers Filisur section, a distance of 31 km., in 1919. Since then the electrification programme has been actively pursued and electric traction is now in use throughout the entire system, a length of 277 km., of which much is heavily graded.

In 1913 a traffic of 240 000 000 ton km. was handled by fourteen electric and fifty-seven steam locomotives. It is estimated that in the present year, when the traffic will be about 75 per cent. of that before the war, that twenty-five electric locomotives will be sufficient. In 1919 fifteen locomotives were in use, seven of 300 H.P., four of 600 H.P., and four of 800 H.P., the larger ones being the most modern. To work the further extensions noted above it was decided to order ten more locomotives with an output of 1 200 H.P., and the design and construction of these was entrusted to BROWN BOVERI AND CO.

FIG. 1.—C-C TYPE LOCOMOTIVE USED ON THE RHAETIAN RAILWAY.

Locomotive Requirements.

The specification required that one locomotive should be capable of hauling the loads tabulated below, 20 min. layover being allowed at terminals, and one minute for stops at intermediate stations.

(*a*) Chur-Thusis-St. Moritz section. Two consecutive round trips, hauling the following loads :—
250 metric tons from Chur to Thusis.
200 metric tons from Thusis to St. Moritz.
200 metric tons from St. Mortiz to Thusis.
250 metric tons from Thusis to Chur.

(*b*) Landquart-Kublis-Davos section. Two consecutive round trips, hauling the following loads :—
200 metric tons from Landquart to Kublis.
150 metric tons from Kublis to Davos Platz.
200 metric tons from Davos Platz to Landquart.

The following speeds had to be attained when going uphill :—

Gradient. per cent.	Load hauled in metric tons.	Speed in km. per hr.
4·5	150	30
3·5	200	30
2·5	200	31
2·0	250	31
1·5	250	33
1·0	250	36
0	250	45

On going downhill electric braking was called for, the electric braking power having to be sufficient to hold half the weight of the train on the steepest inclines.

The locomotive had to be capable of climbing 4·5 per cent. and 3·5 per cent. gradients with loads 15 per cent. greater than the values given above for 10 minutes with the contact-wire pressure lowered to 9 000 V. Trains of 150 and 200 metric tons had to be started without difficulty up the maximum gradients, and the prescribed speed of 30 km. per hr. attained within 2½ min.—the state of the rails being normal and the contact-wire pressure lowered to 9 000 V.

Motors having a total continuous rating of 1 000 B.H.P., which corresponds to a tractive effort of 8 100 kg. at the tread of the wheels, were required to fulfil these conditions. The motors have been further designed for a total one hour rating of 1 200 H.P., giving the locomotive a tractive effort of 9 700 kg. The gauge of the railway is one metre and the maximum axle load 11 metric tons ; the weight of the locomotive had not to exceed 5·16 metric tons per metre and the length over buffers 13·3 m. The locomotives are designed for a maximum speed of 45 km. per hour, and have to be capable of negotiating curves of 100 m. radius in the open and 80 m. at points.

Alternative Designs.

Two designs were prepared to fulfill these requirements. The first was for a B-B-B type locomotive, comprising three four-wheel bogies having one motor per truck. The motors were designed for a continuous rating of 330 H.P. each. The second was for a C-C type locomotive, comprising two six-wheel articulated trucks ; one motor being mounted on each truck. The continuous rating of each motor was 500 H.P., and the one hour rating 600 H.P. The second design was chosen by the Railway Company on account of its greater simplicity.

The chief particulars of the C-C locomotives are as follows :—

Length over buffers	13 300 mm.
Total wheelbase of the locomotive	10 350 mm.
Truck wheelbase	3 275 mm.
Distance between truck centre pins	5 700 mm.
Diameter of coupled wheels	1 070 mm.
Diameter of crank circle	540 mm.
Gear ratio	1 : 4·134
Maximum height of locomotive body above rails	3 275 mm.
Maximum width of locomotive body	2 670 mm.
Weight of mechanical part (inc. vacuum brake)	38 100 kg.
Weight of electrical part (inc. electric brake)	27 900 kg.
Weight of locomotive in working order	66 000 kg.
Contact wire pressure	7 500–11 000 V, single phase
Frequency	16⅔ cycles
Height of contact wire above rails	minimum 4·1 m. maximum 6·4 m.

Rating	Tractive effort measured at the tread of the wheels.	Speed	Total output of the motors measured at the tread of the wheels.
Continuous	8 100 kg.	30 km. per h.	950 h.p.
One hour	9 700 kg.	30 km. per h.	1 140 h.p.

Maximum tractive effort .. .. .. 13 000 kg. at starting.
Maximum speed .. .. 45 km. per hour.

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Mechanical Details.

The mechanical part of the locomotive comprises two articulated trucks, the underframe and the body.

The Articulated Trucks.

The three axles of each truck are coupled, and the central axle has 20 mm. side play in either direction so as to secure the necessary lateral flexibility for going round curves. The trucks have outside frames in order to obtain sufficient space to allow of standard-gauge traction motors being utilised. The jackshaft is located between the outer and middle driving axles, somewhat above their centre line. The traction motors, which are situated immediately above the jackshaft, are carried by means of special supports fixed to the frames. Elastic pinions, situated at either side of the motor, transmit the torque to the gear wheels mounted on the jackshaft.

One pair of brake blocks is fitted per driving axle, the brake gear being operated either by hand or by vacuum. A braking effort equal to 50 per cent. of the weight of the locomotive can be obtained with the hand brake, and 75 per cent with the vacuum brake.

Locomotive Body.

The locomotive body is rigidly attached to the underframe. The space between the two driver's cabs is divided into compartments containing the transformer, apparatus and auxiliary machines. The roof, which protects the central portion of the body, is removable. A fixed roof, covering either end of the body and extending in front of the driver's cabs, carries the pantograph collectors, the roof being specially stiffened for this purpose.

A motor-driven compressor having an output of 370 litres per minute, supplies the compressed air for operating the pneumatic apparatus (current collectors, sanding gear and whistles). An air reservoir of 300 litres capacity is also provided for storing air.

Each locomotive is equipped with two speed indicators, of which one is recording.

Vacuum for the brakes is maintained by means of a rotary vacuum pump. On going down long inclines the brakes are applied first of all to the wheels of the train and finally to the wheels of the locomotive. The amount of dust under the latter produced by braking is thus diminished, and the wear of the locomotive tyres is considerably lessened. When stopping in stations the brakes are applied simultaneously to the wheels of the locomotive and the train.

Electrical Equipment: Traction Motors.

One of the principal reasons why the C.C. type locomotive with external frames was chosen, was that the same type of traction motors could be employed as with the 1 B-B 1 locomotives for the Swiss Federal Railways and the Bernese Cantonal Railways. These motors, which have twelve poles, are of the compensated series type with resistance connections between the rotor windings and commutator, and with the field of the commutating poles having a phase displacement with regard to the main current.

The employment of resistance connections, which was subjected to much adverse criticism when introduced, has proved to be of considerable advantage, as it enables the pressure at the motor terminals to be raised—with the motors in question this pressure is 520V—thus allowing the copper to be reduced. The width of the commutator is also less—in the present instance it is 130 mm. The number of commutator brushes is lower and their size larger—24 brushes of 18 by 60 mm. being required for the motors under consideration. These commutators last on the average 60 000 to 80 000 km. The efficiency of a motor with resistances is rather better than that of one without, as the losses in the resistances are more than compensated by the smaller commutation losses.

The one hour rating of one of these motors is 600 H.P. and and the continuous rating amounts to 500 H.P., the speed in both cases being 640 revs. per min.

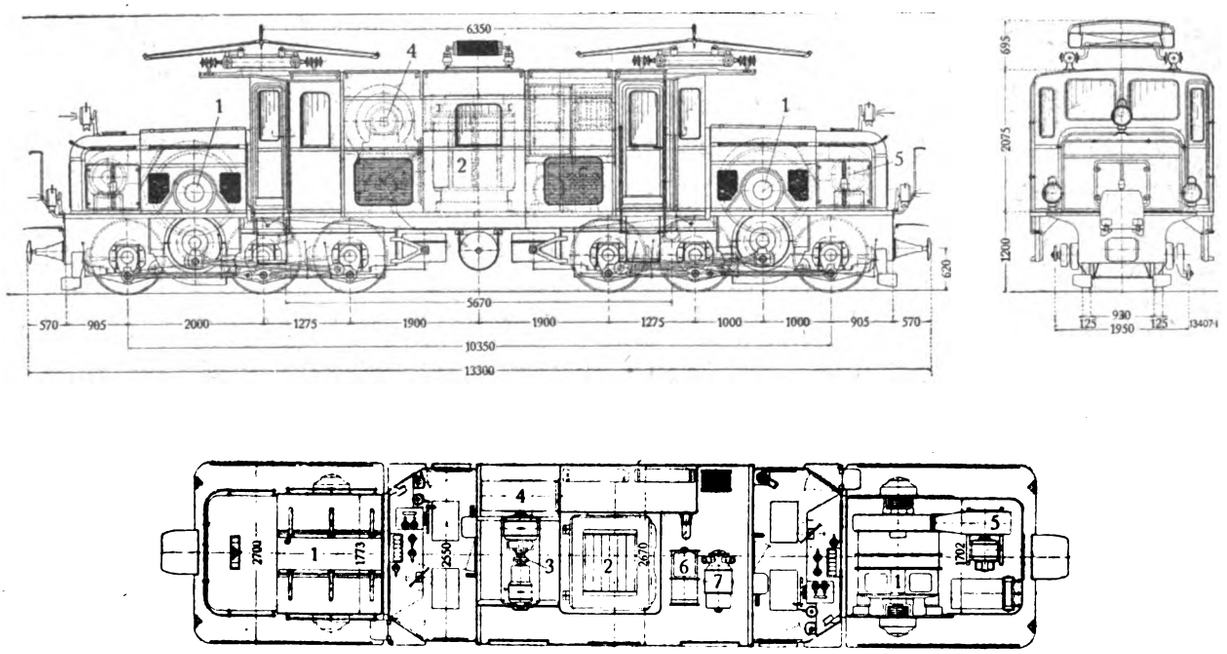

FIG. 2.—GENERAL ARRANGEMENT OF THE C-C TYPE LOCOMOTIVE.

1. Motor.
2. Transformer.
3. Blower and exciter.
4. Transformer blower.
5. Blower for a traction motor.
6. Motor generator set.
7. Motor-driven compressor.

Cooling Arrangements.

Forced draught is employed for cooling the motors, special blowers capable of delivering 120 cub. m. of air per minute at 100 mm. of water column being provided for each motor. The air, which enters at the side opposite to the commutators, goes through the motors, cooling chiefly the exterior periphery of the stator and the interior periphery of the rotor iron, the end connections and the resistances. The rotor has a series-parallel drum winding; the number of circuits in parallel being equal to the number of poles, so that, even with an unequal air gap, a complete symmetry in the distribution of the rotor current is obtained. The stator and rotor windings are taped with silk and mica ribbon, impregnated with varnish, and dried in an oven. The radial air gap is 2 mm.; it can be checked at four points from the outside. The brushrocker ring can be rotated, thus enabling the lower brushes to be brought up for inspection.

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The motors are able to withstand a speed 25 per cent. above that corresponding to the maximum travelling speed of 45 km. per hour, in case the coupled wheels slip.

The Transformer.

A clause in the agreement laid down that a certain portion of the order should be given to the Maschinenfabrik Oerlikon, who therefore supplied the transformer, the auxiliary motors, the exciter dynamo, the motor-generator set for lighting and certain auxiliary apparatus. The chief particulars and characteristics of these are given below.

The transformer is of the air-cooled type with forced draught and built for the following outputs :—

Continuous output : 940 kVA with a primary pressure of 10 000 V.
One hour output : 1 140 kVA with a primary pressure of 10 000 V.

It can also supply continuously an additional 30 kVA at 220 V for auxiliary services, and 125 kW at 300 V continuously for train heating purposes, or, later on, 240 kW for two hours at 1 200 V.

The transformer consists of two cores, with separate primary and secondary windings. It has 18 tappings on the secondary side giving pressures from 104 to 610 V, with a primary pressure of 10 000 V on load. Three tappings are for maintaining the output if the contact wire pressure drops below normal.

Auxiliary Apparatus.

The high-tension main oil-switch, which is designed for mounting in the roof, is provided with protective resistances and an earthing switch. The oil tank can only be lowered when the latter is closed. The earthing switch is operated by a key, which is interlocked in such a way that it can only be employed when the pantographs are lowered. The oil-switch is closed pneumatically, or, in the case of emergency, by hand ; it can be tripped either by hand or electrically. The electric trip has over-load and no-volt relays with damping device, but without time adjustment. The over-load relays are fed from a current transformer in the tank of the oil-switch, which serves to protect the main transformer, or by means of current transformers in the traction-motor circuit, which protect the latter. The no-volt release is connected to the 220 V tapping of the main transformer.

A standard Brown Boveri tapping switch—operated by hand from either cab by means of a chain, wheel and shaft mechanism—controls the traction motors. Hand control has given every satisfaction for a number of years on the older electric locomotives of the Rhaetian Railway equipped with Deri motors. For reversing, pneumatically operated air-break switches are employed, which cannot be thrown over while under tension.

Another compartment contains a group comprising a single phase motor of 12½ H.P. continuous rating, at 220 V, and 1 500 revs. per min., directly coupled to the blower for cooling the transformer and braking resistances, and to an exciter of 0 to 3·5 V and 300 A, with separate excitation, the current of the field circuit varying between 7 and 10 A at 18 V d.c. The motor-driven vacuum pump is placed directly below this set.

The Driver's Cabs.

The driver's cabs are provided with the usual equipment. Two Brown Boveri pantograph collectors pick up the current from the overhead wires. Attention may also be drawn to the fact that the three motors for the blowers are put in circuit by means of the same switch, which has a preliminary step. Lubricating lamps in each cab show whether these motors are running or not.

A warning device is provided for the blowers by means of which a bell is rung should the driver pass the fourth step without having switched in the blower—the first four steps being generally used when shunting. The bell can only then be silenced by switching in the blower set.

Electric Braking Arrangements.

Electric braking was called for in the specification, the retarding effect having to be sufficient to hold half the weight of the train on descending inclines. Only a portion of the total retarding power had to be furnished by electric braking, as it was not deemed advisable for the comparatively long trains to be held exclusively by the locomotive, on account of the numerous curves in certain sections. Regenerative braking could not be employed, as the weight of the machines and apparatus required for this purpose would have rendered the locomotive too heavy. For this reason, braking resistances had to be employed on to which the motors work as generators. From the technical point of view, the most satisfactory system of braking by means of resistances is that which is independent of the contact wires, i.e., where descents can be accomplished with the current collectors lowered, but in that case an exciter has to be provided. Another reason which rendered this system of braking unsuitable in the present case is that the rolling stock is equipped with vacuum brakes, which have to be applied when going downhill, and current from the overhead wires is required for operating the motor driving the vacuum pump whenever the vacuum brakes are released.

A system of braking was therefore chosen which, while enabling the weight of the apparatus to be reduced as far as possible, afforded a maximum of reliability and a perfectly smooth control of the train, but required a constant supply of current from the contact wires (see Fig. 3.)

Details of the System.

In this system the traction motors run as d.c. generators for braking purposes. The excitation current is supplied from

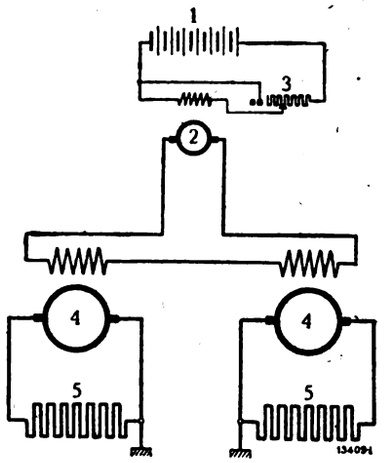

FIG. 3.—DIAGRAM OF BRAKE CONNECTIONS.

1. Lighting battery.
2. Exciter.
3. Field resistance.
4. Traction motor (connected as generator).
5. Braking resistances.

a special dynamo mounted on the same shaft as the motor-driven ventilator for cooling the transformer and braking resistances, as by this means the cooling system is automatically combined with the electric brake. The field circuit of this dynamo comprises a field resistance with 47 steps, and is fed by a small lighting battery. Fig. 4 shows the braking characteristics, the fineness of graduation and the stability of this method will be noticed. The resistances are dimensioned for dissipating 400 kW continuously—which corresponds approximately to the energy liberated by retarding half a train of the maximum weight. The total weight of the braking equipment is about 1 000 kg., that is to say, 2·5 kg. per kW of brake power ; whereas, the equipment for regenerative braking, as now fitted to the older electric locomotives of the Rhaetian Railway, weighs 2 500 kg., although the power of this equipment amounts to only 80 per cent. of the former. Each motor is connected to a braking resistance, one pole of which is earthed.

The quantity for air available for cooling amounts to 0·75 cub. m for every kW per minute of braking energy, the average temperature rise of the air being about 60° C. The common drive of the exciter and blower for transformer and resistances was chosen in order to obtain an automatic adjustment between the load of the braking resistances and their cooling.

The reversers are provided with a braking position, by means of which the traction motors are connected to run as d.c. generators. The rotor and compensating winding as well as windings of the interpoles are then in circuit with the braking resistances, and the field windings of the two motors are in series with the exciter. The windings of the interpoles are provided with tappings which are used in order to ensure satisfactory commutation when the motors run as d.c. generators.

A notable improvement as regards the older locomotives is realised in the weight per unit of power, the one hour ating having increased from 8·2 to 17·5 H.P. per metric ton.

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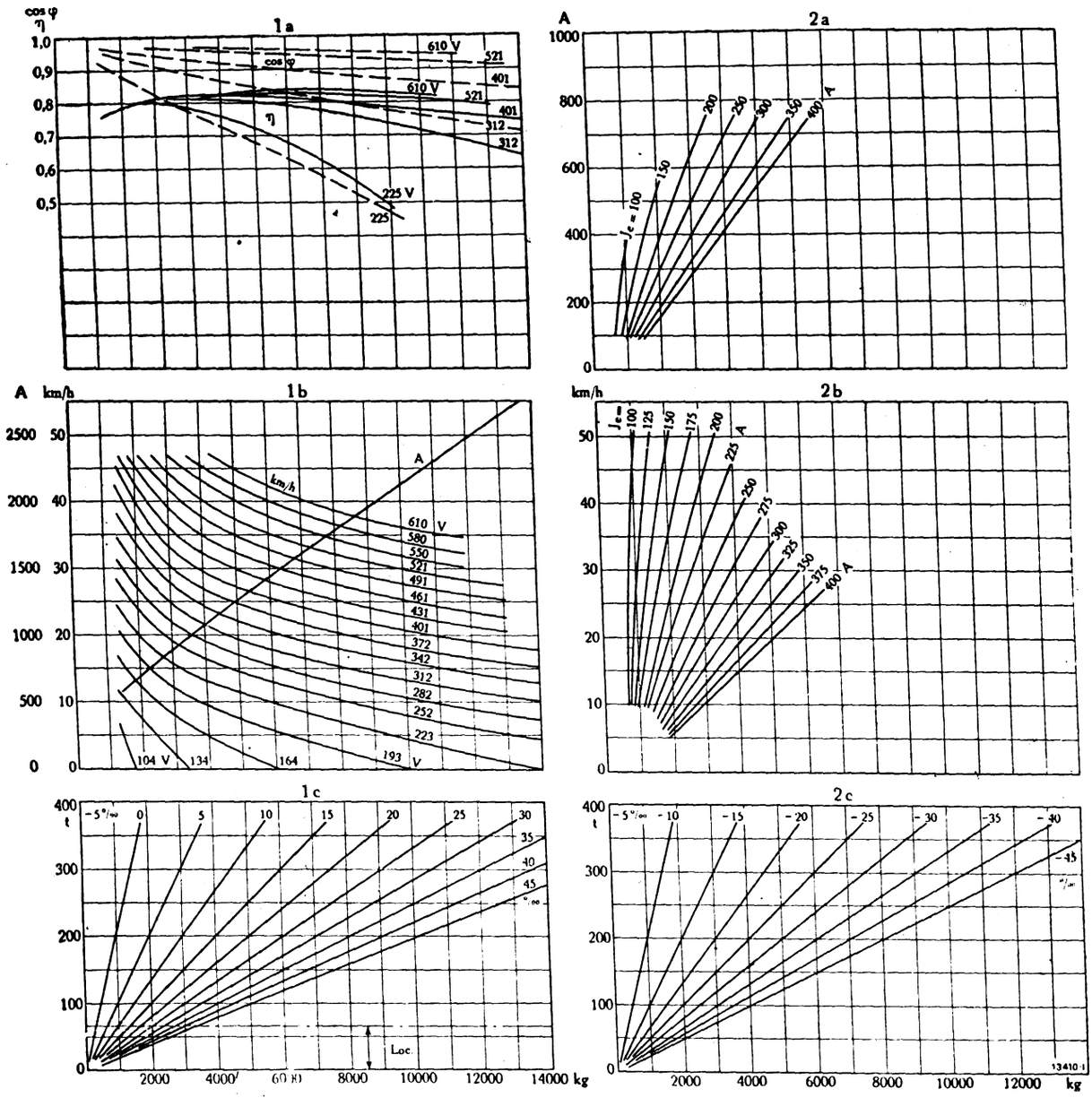

FIG. 4.—RHAETIAN RAILWAY. RUNNING AND BRAKING CHARACTERISTICS OF THE C-C TYPE LOCOMOTIVE.

Abscissæ of diagrams 1a to 1c: Tractive effort at the tread of the wheels.

Diagram 1a: The power factor ($\cos \phi$) and efficiency (η) are given for different pressures.

The effect of the mechanical losses of the locomotive on the efficiency has been taken into account, but not the losses in the transformer and auxiliary plant.

Full lines: efficiencies. Dotted lines: power factor.

Diagram 1b: Current consumption of the motors and speeds for different pressures at the terminals.

Diagram 1c: Weights of trains including locomotive in metric tons on different gradients (per thousand).

Abscissæ of diagrams 2a to 2c: Braking effort at the tread of the wheels.

Diagram 2a: Braking current in amperes generated by one motor for different values of the exciter current.

Diagram 2b: Speeds for different values of the exciter current.

Diagram 2c: Weights of trains including locomotive in metric tons on different gradients (per thousand).

Greater Capacity of Electric Locomotives.

The greater capability of the new locomotives will be rendered still more apparent by the following particulars.

Type.	Weight of locomotive metric tons.	One hour rating at the tread of the wheels h.p.	Weight of train hauled metric tons.	Speed when mounting a 3·5 per cent. gradient km/h	Ratio of weight hauled to weight of loco.
G 4/5 ..	63*	—	110	27	1·76
1D1 ..	56·27	800	112	30	1·99
1D1 ..	57·86	800	112	30	1·95
C-C ..	66·00	1 140	200	30	3·03

* Steam locomotive. The weight is for locomotive and tender with half the maximum supply of coal and water.

The largest type of steam locomotive on the Rhaetian Railway could only haul 1·76 times its own weight, and the 1-D-1 electric locomotives about twice their own weight, up a 3·5 per cent. gradient, whereas the new C-C locomotives are able to climb this gradient with a train weighing over three times their own weight attached, at a speed 10 per cent. higher than that of the steam locomotives. Moreover, these locomotives are the largest single phase metre-gauge locomotives yet built.

The specified tests were undertaken by a trial train weighing 250 metric tons, which was hauled from Chur to Thusis, the weight being reduced to 200 tons from Thusis to St. Moritz. The prescribed temperature rises, speeds and times taken to accelerate the train were easily kept, so that the design of these locomotives, the makers claim, may be considered satisfactory in every respect.

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The Control of the Speed and Power Factor of Induction Motors.

Lecture III.

In the second part of the third lecture of the course which Professor Miles Walker recently delivered before the University of London he dealt from the theoretical point of view with various types of induction motors which have been designed to give speed variation. We give below a short account of his remarks.

V. Motors in Cascade.

We will consider in the first place the effect of connecting two motors in cascade while leaving both rotors to revolve at their own speeds.

Electrical Differential Gear.

If the slip rings of the rotor of one induction motor be connected to the stator of another having the same number of poles whose rotor is short-circuited and free to run at its own speed, the combination of motors in its behaviour is analogous to the ordinary differential gear on the rear wheels of a motor car. If one of the rotors is locked the other will run at full speed (minus the slip); if both motors are loaded with loads whose torques increase with speed—*e.g.*, centrifugal pumps or ships propellers—the motors will share the loads fairly evenly and run at half speed. The combination can be used as an electrical differential gear. To be perfectly symmetrical it is well to have two pairs of motors, one primary and one auxiliary motor being connected to each load. If the loads are denoted by A and B the rotor of the primary motor of the load A is connected to the stator of the auxiliary motor of load B, and the rotor of the primary motor of load B is connected to the stator of the auxiliary motor of load A, both loads then receive constant torque. It is, of course, assumed that the ratio of the transformation of the winding is 1 : 1.

Speed Reduction by Cascade Connection.

If two motors have their rotors mounted on the same shaft and are connected in cascade so that the slip rings of the primary motor are connected to the stator of the auxiliary motor and the rotor of the auxiliary motor is short-circuited, the direction of rotation in the magnetic fields of both motors being the same, the combination will have a no-load speed equal to that of an induction motor having a number of poles equal to the sum of the poles in the two cascade motors.

Let s denote the slip of the primary rotor with respect to the primary rotating field and f_1 the frequency of supply, then the frequency of the voltage at the terminals of the auxiliary stator is sf_1. Let p_1 and p_2 be the number of pairs of poles in the primary and secondary motors respectively. Then the revolutions per second at no load are:

$$R_{ps}=\frac{f_1}{p_1}(1-s)=\frac{sf_1}{p_2}$$

$$sp_1=p_2(1-s)$$

$$p_2=s(p_1+p_2)$$

Therefore

$$s=\frac{p_2}{p_1+p_2}$$

$$R_{ps}=\frac{f}{p_1+p_2}$$

If we make $p_1=p_2$ the motors run at half speed when connected in cascade, and at full speed when both stators are connected to the line and the rings are short-circuited. If we only want a small change in speed we can make p_2 small as compared with p_1 and run the big p_1 motor either by itself or with the auxiliary motor in cascade. If the stator of the auxiliary motor is connected so that its magnetic field revolves in a direction opposite to that of primary stator the speed becomes

$$R_{ps}=\frac{f_1}{p_1-p_2}$$

that is to say it runs at a higher speed in cascade than when running with the primary rotor short-circuited. Instead of changing the number of poles on an induction motor driving the propeller of a ship one may obtain the cruising and fighting speeds by employing motors in cascade. Or alternatively we may use generators in cascade to vary the frequency of supply while the prime mover runs at a constant speed. Fig. 32 gives the various combinations.

Instead of connecting the rings of the primary rotor to the terminals of the auxiliary stator, we may connect the two rotor windings directly in series and then the stator of the auxiliary motor becomes a secondary which may be short-circuited or connected to a rheostat just as the rotor of a slip-ring motor. In order to do this the phases of the auxiliary

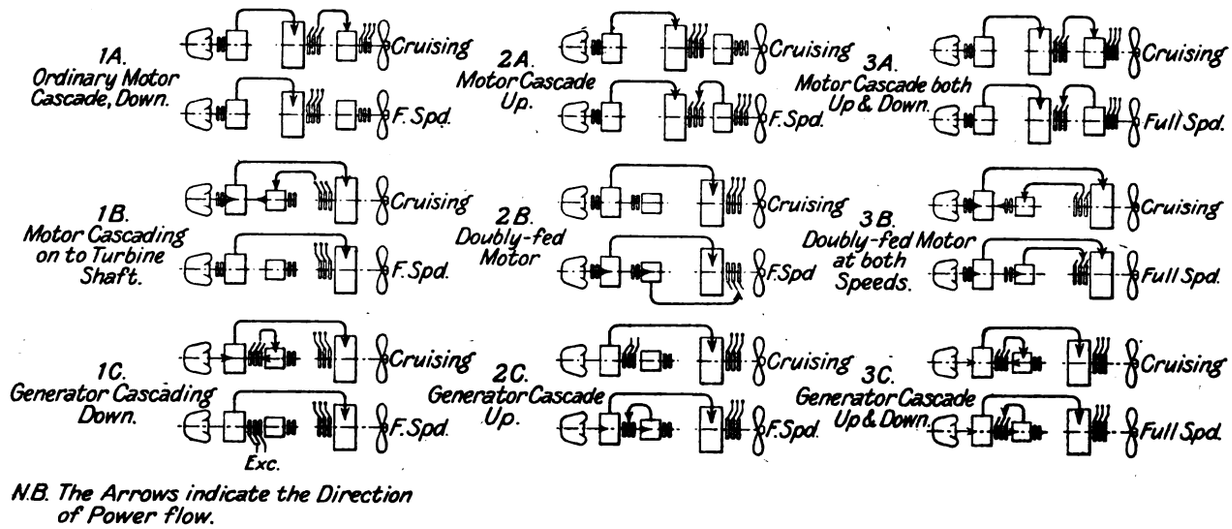

FIG. 32.—ALTERNATIVE ARRANGEMENTS PROPOSED OR CONSIDERED BY A. B. FIELD FOR OBTAINING A SPEED RATIO 2 TO 3 IN THE ELECTRIC PROPULSION OF SHIPS.

In 1*A* a steam turbine on the left drives a generator which feeds a motor, and the motor is connected to another in cascade. In 1*B* there are two generators, one a small geared one to run at a lower speed and connected in cascade with the motor. In 1*C* the auxiliary generator is connected in cascade with the main generator, and so on. In 2*C* (cruising) the rings of the main generator are connected to a d.c. exciter.

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rotor must be connected so as to make the magnetic field revolve (relatively to it) in a direction opposite to the direction of rotation of the stator field of the primary motor. When the motor is running near synchronous speed the magnetic field of the auxiliary motor is nearly stationary relatively to the stator and cuts the stationary conductors at the frequency of the slip. In order to run at the higher speed it is necessary to short circuit the rotor windings, and, if desired, arrangements can be made for switching power on to the stator of auxiliary motor.

VI. The Hunt Cascade Motor and Creedy's Modifications.

Several inventors have attempted to combine the primary and auxiliary cascaded motors into one frame so as to use a single core and a single rotor, but to Mr. L. J. Hunt falls the credit of having made practical commercial motors on this principle. The solutions of the problems involved are exceedingly ingenious and result in a motor of desirable characteristics and high efficiency.

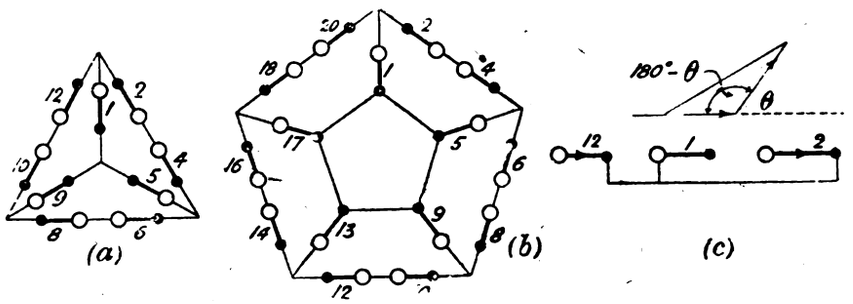

FIG. 33.

Mr. Hunt's Papers * read before the technical societies give a very lucid description of the design and method of working. Anyone who wishes to master this interesting subject cannot do better than make a close study of these Papers.

Motors of this type have quite good efficieneies at both speeds. The power factor at eight pole speed is 0·9, and at twelve pole speed 0·83. Mr. Hunt in his Paper describes the method of winding motors with a speed ratio of 3 to 1, and pole changing motors capable of running at three efficient speeds.

Mr. Creedy's Multispeed Motors.

Creedy has made a very extensive investigation † into the possibilities of pole-changing over a wider range than contemplated by Hunt, and has achieved some remarkable results. Starting from the root principle of the gramme ring, which is capable of having as many poles as there are taps per phase, he has devised a phase transformer which will give a large number of phases capable of being applied in various combinations for the stator of an induction motor whose winding is built up of elements capable of being grouped and regrouped according to the number of poles required. One element of the winding may consist of a simple coil lying in a two-layer winding. He uses a simple symbol to indicate one element of a winding. The polarity is indicated by the circle and dot. Creedy shows that by taking fifteen elements lying on a twenty-slot rotor (five coils being left out) it is possible to make a combination of the elements represented by the diagram shown at (*b*) Fig. 33. With this winding Creedy proposes either a two and eight pole motor or a four and six pole motor according to the phase difference between adjacent circuits. With a drum-wound armature however there must always be the difficulty that a coil of a given span cannot serve well for two sets of poles whose numbers have a greater ratio than 2 to 1. This subject of cascaded windings offers many possibilities and leads to complex combinations. The reader is referred to the papers already quoted for further information.

Prof. Miles Walker then proceeds to deal with Mr. Hunt's ideas at some length by taking the case of an 8+4 pole motor having a speed of a twelve pole motor in cascade and of an eight pole motor with the rotor short circuited. In the Hunt motor the necessary conditions are obtained by using one winding on the rotor and one on the stator, and so avoiding increased space, magnetic leakage, and copper loss.

* "Journal I.E.E.," vol. 39, p. 648 (1907); *ibid.*, vol. 52, p. 400 (1914). "Proceedings of the South Wales Institute of Engineers," vol. 35, p. 309 (1919).

† "Some Developments in Multispeed Cascade Induction Motors," "Journal I.E.E.," vol. 59, p. 511 (1921); *see also* lecture by Mr. Creedy before the Institution 1923.

German Broadcasting Schemes.

In a recent issue of the "Elektrotechnische Zeitschrift" is an article on the wireless telephony service in Germany which contains not only an outline of the German plans but a criticism of the broadcasting arrangements in England and the States.

In view of the financial conditions of the German Government the broadcasting was entrusted to private enterprise. The Eildienst (Express Service) Co. collects information and broadcasts it from Königswusterhausen by means of a private line from Berlin. There are 150 receiving stations distributed over Germany which take part in the scheme. On September 2nd Dr. Bredow invited representatives of the Press to the Ministry and explained the arrangements to them. In Germany broadcasting is regarded as a matter of the greatest economic importance and not, as in the United States, as a matter of entertainment (Spielerei). In the U.S. the enormous growth of private wireless stations has seriously endangered the wireless communications of the Government and business concerns. In Germany such general freedom to use wireless apparatus would instantly ruin the whole scheme of wireless communication which must be absolutely protected against unauthorised reception of messages. Broadcasting is to be so developed in Germany that it shall be available to all classes of the community and not only to the well-to-do, who can afford to buy private receiving apparatus. The receiving apparatus with loud speaker is to be installed in such places as school-halls. The supply of receiving sets to private persons will be considered as a further step. Preliminary experiments are to be made in ten towns by a Development Company entitled "Deutsche Stunde für drahtlose Belehrung und Unterhaltung," with a view to finding out whether such a scheme will find the necessary public support.

Undertakings a Public Service.

The undertaking is regarded as a public service and, after allowing for a suitable profit, all surplus is to be expended for "cultural" purposes. The provisional weekly programme is as follows:—(1) Orchestral. (2) Scientific lecture. (3) Humorous evening. (4) Social lecture. (5) Vocal. (6) Political addresses. (7) Educational for young people. It is also intended to introduce receivers and loud speakers into factories where the work is silent and monotonous.

It is the intention of the authorities to avoid the chaos which has arisen in the United States and in this way provide entertainment and instruction to the individual at small cost. The Post Ministry has appointed a committee to control and regulate the activities of the Broadcasting Company.

A sudden wild development of amateur activity is not to be expected in Germany because of the economic conditions and because of the more limited technical interests among large classes of the community.

Dr. Nesper is quoted as giving as the three necessary stipulations for a successful broadcasting scheme: (1) Only leading established firms to be allowed to take part in it, and not mushroom concerns hoping to take advantage of the scheme; (2) receiving apparatus to be suitable for a limited wavelength range and to be sealed and licensed; (3) all amateur transmission to be forbidden.

Broadcasting and Copyright.

Representatives of the Executive Committee of the SOCIETY OF AUTHORS, PLAYWRIGHTS, AND COMPOSERS met last week representatives of the British Broadcasting Co. and laid before them their contentions with regard to the broadcasting of works written or composed by their members. A long discussion took place in private, and tentative plans were drawn up by mutual agreement which, it is understood, place authors, playwrights, and composers in a more favourable position in regard to broadcasting than they are at present. These are to be circulated among all the members of the Society of Authors, Playwrights, and Composers, and their opinions on them are to be obtained. This is likely to take some considerable time, and it is not probable that any definite decision on the matters under discussion will be come to for some months.

It may be noted that the Society of Authors, Composers, and Publishers of America have decided to demand royalty payments in respect of musical, dramatic, and literary material broadcast by the wireless broadcasting stations.

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Broadcasting at Glasgow.

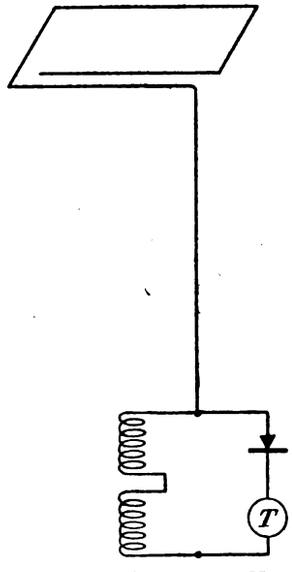
Some Personal Impressions.

FROM A CORRESPONDENT.

The Glasgow station of the British Broadcasting Co. was opened by the Lord Provost of the City on March 6th. The installation of the transmitting plant at the Port Dundas Power Station of the Corporation Electricity Department and of the microphone and amplifying apparatus at the Studio in the City had been carried out at short notice and was barely ready for the opening ceremony. Although successful in Glasgow and neighbourhood, complaints were immediately received from more distant listeners that the station was weak; this defect, due presumably to insufficient modulation, was speedily rectified.

An Opera Programme.

On March 19th, the British National Opera Co. commenced a three-weeks run at the Coliseum Theatre on the south side of the river, and with commendable courage the Broadcasting Co. fitted a microphone in the middle of the footlights, installed an amplifier under the stage, and on the opening night, less than a fortnight after the opening of the broadcasting station, broadcast with considerable success a portion of the "Rheingold." As the writer of these notes lives about two miles from the transmitting station he felt sure that his personal observations on the merits and demerits of the broadcasting would be of interest to the readers of THE ELECTRICIAN. First as to the receiving apparatus required at this distance; with an aerial consisting of a rubber-covered wire (Elwell's Esifix) looped round an upper room, then dropped from the window into the window of a room on the ground floor, no earth connection is required, in fact, it is advisable to avoid an earth connection and thus obviate the noises liable to be introduced *via* the earth, especially where there is an electric power supply. The tuning condenser has also been eliminated; the coil is made in two parts, one sliding within the other for the purpose of tuning. A carborundum-steel detector and an 8 000 O head telephone receiver completes the set.



RECEIVING APPARATUS USED AT GLASGOW. — NOTE THE ABSENCE OF CONDENSER, BATTERY, ETC

Speech and Loudness Correct.

The speech and music are almost exactly of the loudness that one would desire. There is no condenser, no battery, not even a dry cell, no earth lead, no switch, no rheostat, and no trace of any sound in the telephone except that due to the local broadcasting station.

Transmission Characteristics.

Turning now to the characteristics of the transmission, whatever is being transmitted there is always a background of noise, hardly noticeable when the music is loud, but very irritating when it is pianissimo. This noise, which was recently described as the "frying bacon" noise, is undoubtedly due in the main to the microphone which is of the type specially designed for broadcasting. When the studio operator switches off the microphone circuit, however, there is still a sound which can be used for tuning purposes; it is the musical hum due to incomplete smoothing of the rectified anode current. This is not loud enough to be noticeable when the microphone is switched into circuit, and could easily be reduced, if necessary, by additional smoothing elements. The reproduction of speech and music from the studio is very good indeed and were it not for the constant microphone noise, it would be very difficult to point to any imperfection in it. The same cannot be said of the opera, where the conditions are altogether more difficult. At the studio the microphone is the only thing which concerns the players and singers, who are carefully placed and instructed. At the opera, on the other hand, the performers are no more concerned with the microphone than they are with the footlights, and they are sometimes close up to it and at others far removed at the back of the stage. In view of these conditions the quality of the broadcasting is in most cases marvellously good. The opera "Phoebus and Pan" was listened to with delight from beginning to end, and the broadcasting of this opera must be regarded as the greatest triumph yet scored by the British Broadcasting Co.

Mixed Results.

In other cases, however, the result has been very mixed, beautiful reproduction suddenly going off into a horrible noise and always due, so far as the writer can judge, to the same cause, namely, impressing too large an amplitude on the microphone diaphragm. This only occurred when the performer sang very loudly and close up to the microphone; it was especially noticeable with high soprano notes and with duets and trios. After a time one felt the catastrophe coming as the soprano voice grew higher and louder, the microphone first giving warning by an exaggerated tremolo which developed into a rattle. A peculiar phenomenon which is difficult to explain is the entire cut-off which sometimes occurred for a second or so at a particularly high note, the peak being entirely wiped out and the sound coming on again as suddenly as it ceased. This was noticed by other observers who have mentioned it to the writer.

Defects that Should be Remedied.

These presumably microphone defects are so serious that every effort should be made to remedy them at once. The writer would suggest that the microphone should be placed in such a position or so screened that under no circumstances can the amplitude reach this breakdown point. The quality suffers so much even if the amplitude approaches this point that it would probably be a great improvement to err in the other direction and counteract the decreased sensitivity by adding another stage of amplification. Another possible method of avoiding the trouble is to adjust the amplifiers to give maximum amplification and then control mechanically or electrically a screen in front of the microphone. It may be asked whether the defect may not be due to over-modulation—that is, causing such excessive fluctuations of the potential of the grid of the valves in the transmitting station, that the aerial current is not merely altered in amplitude, but periodically wiped out. Were the defect due to this cause it could easily be remedied by the operator controlling the amplification between the microphone and the modulating valves; the persistence of the defect night after night points to some other cause beyond the control of the operator.

A Great Triumph.

Apart from these occasional lapses the reproduction of the opera was of such a standard that one cannot but regard it as one of the greatest triumphs of applied science, and it is therefore the more imperative that every effort be made to remove the defects. Although the microphone employed is a great advance on any previous type and represents the results of much careful research, it still appears to be the weakest link in the chain. We know that further research is being carried out in this direction and we look forward with confidence to great strides being made in the immediate future.

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Radio-Broadcasting.

Some Technical Points Discussed.

In the course of a lecture on "Radio-Broadcasting," which he recently delivered at Birmingham, Dr. N. W. McLachlan said it was a difficult matter to find a single microphone which would reproduce all types of musical instruments and different voices, and in order to secure good reproduction from solo instruments, and proper blending in orchestras, it was advisable to use a number of microphones of different characteristics.

Reproduction of Piano Sounds Difficult.

Probably the most difficult instrument to reproduce was the piano. The reason for this was the percussive or impulsive action which caused the microphone system to vibrate in two ways instead of only one. The fundamental frequencies on a piano varied from about 20 to 2 000, but the harmonics went much beyond the latter figure.

Speech frequencies varied from 100 to 5 000, most of the energy being carried below 1 000 periods per second, but the essential characteristics determining interpretation were carried by frequencies greater than 1 000. Microphonic systems could be severely tested when reproducing the high audio-frequency hiss in the sibilants, the jingling of coins, the top notes on a violin or piano, drums and the clapping of hands. Good test words begin with or end with "s," "f," "th," and "v," *e.g.*, "sink," "five," "thrive," "invaluable."

Distortion Problems.

Distortion was introduced in a degree by iron cored transformers, and to obviate this as much as possible, special amplifiers, in which the valves were coupled by resistances and condensers, were used.

By pushing reaction too far it was possible to spoil a transmission which was otherwise good. This was due to the selectivity of the circuit being too high, and at the same time variable. Thus to get the best from broadcasting there should not be a paucity of valves. A source of distortion which became readily evident was over-modulation of the transmitter. Since a rectifying valve was employed in the receiver it created, in virtue of the curvature of its characteristic curve, two frequencies from an outgoing single frequency from the transmitter. In a complex musical sound there were many different frequencies, and when these were all doubled and the combination tones resulting from the interaction of the carrier wave and side bands were superposed, the result was aurally offensive. When the modulation at the transmitter was not too deep the alien frequency was negligible.

Distortion due to improper adjustment of the valves at the receiver and the use of unsuitable valves was a common occurrence. An amplifying valve should not approach its rectification or saturation points. Thus for load signals it was necessary to use large valves at the output to the loud speakers. Grid current should be avoided in both the high frequency and low frequency valves, since this introduces unpleasant effects. To secure this necessary condition the voltage of the anode battery should be augmented and a negative potential put on the grid.

Moderate Intensity Best for Loud Speaking.

With almost all varieties of loud speaker the best quality was obtained when the intensity was moderate. When the sounds were very loud the effect was to introduce in the loud speaker, due to the large movement of the vibrating system, tones which were not present in the incoming radiation. Moreover, as in the case of over-modulation, there were produced rather distressing combination tones. It was possible that a similar phenomenon was experienced by the ears when the sounds were of large amplitude.

At the beginning and the end of a musical sound, especially from percussive instruments, the natural frequency of the loud speaker and its family of overtones were superposed in varying degree upon the main vibration. Thus, owing to the variable transforming action of the mechanism on the wave form of the incoming acoustic vibration, the output was distorted. Moreover, to secure satisfactory reproduction of speech and musical sounds with the loud speaker of the moment, it was essential to distort the input in such a manner that the inherent distortion of the loud speaker applies the requisite amount of correction to produce pleasing quality.

Development of Naval High-power Valves.*

By H. MORRIS-AIREY, C.B.E., M.Sc.

The first demand for transmitting valves arose early in 1916. In this year a valve of the oscillation type was obtained and was embodied in an experimental valve transmitter designed for use in seaplanes. Only a few experimental transmitters were constructed. One experimental result was that about 4 A could be produced in a ship's aerial.

Details of methods of designing valves have already been dealt with by Stead† and Gossling‡.

The anode is rated by a number expressing the average power which it is capable of dissipating under normal working conditions. This dissipation takes place almost entirely by radiation. The power that can be safely dissipated per square centimetre varies from 35 to 45 W according to the material of the anode.

Filament Characteristics.

An estimate is made of the effective mean anode voltage during the part of an oscillation when the anode current is flowing. Knowing the total energy to be given up to the anode per oscillation, a value for the emission, or electron current required from the filament can then be arrived at. Filament temperature is usually taken between 2 400° and 2 500° (abs).

Grid Design.

Upon the proper choice of grid depends the whole working success of the valve. This is expressed by reference to the constant, m, of the valve. This is a function of the anode and grid diameters, the grid spacing and the diameter of the wire from which the grid is made. Its numerical value in naval valves may lie between 20 and 30, but it is possible to use a valve in which the value of m is as high as 250.

First Glass Valve.

In 1917 a glass valve safely dissipating 800 W was constructed and used experimentally. Another valve designed for a rating of 3 000 W was constructed, but was a complete failure. At that time valves with an anode dissipation of the order of 3 or 4 kW were contemplated. The problem was to get rid of heat generated at the anode at this rate. One method, relying on radiation as a means for cooling the anode, involved the use of a more diathermanous and also greater heat resisting material, e.g., silica, instead of glass for the envelope.

Silica Valves.

The outstanding features of the silica valve are its very high melting point and its low coefficient of thermal expansion.

No simple method of sealing electrical leads directly through silica is known, but a seal provided by the Silica Syndicate has up to the present proved satisfactory. It consists of a molybdenum wire sealed into a silica tube by means of lead.

At the beginning of 1919 a silica bulb of the required dimensions had been obtained and fitted with the appropriate anode, grid and filament for a rating of 2 kW.

After trials and experiments extending over several months, the valve was sealed off at the Osram Robertson Lamp Works in November, 1919. It was not successful owing to the vacuum not being good when the valve heated up.

The results of this first effort were, however, encouraging, and it was decided to make in the Signal School laboratories a serious study of the manufacturing difficulties of silica valves.

First Successful Silica Valve.

The result was that a good 2½ kW valve was successfully sealed off early in 1920. By collaboration with the Mullard Co. in 1921, this firm was enabled to deliver valves exhausted and ready for use.

A 10 kW valve was attempted on the same lines, and towards the end of 1921 one was successfully exhausted and sealed off capable of dissipating 9½ kW under working conditions.

The work of bombarding a large valve of this power involved continuous attention for about 30 hours. After careful study it was found possible to produce a 24 kW valve with a bombardment period of less than one hour.

The life of the silica valve is in general determined by the filament. Some of the valves in the experimental transmitters at Horsea wireless station have been in use now for well over 1 000 hours and show no indication of deterioration.

* Abstract of a Paper read before the Wireless Section of the Institution of Electrical Engineers.

† O. Stead: "The Short Tungsten Filament as a Source of Light and Electrons." Journal I.E.E., 1920, vol. 58, p. 107.

‡ B. S. Gossling: "The Development of Thermionic Valves for Naval Uses." *Ibid.*, p. 670.

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Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

THE E.P.E.A. AND THE EMPLOYERS—A PROTEST FROM ALD. WALKER.

To the Editor of THE ELECTRICIAN.

SIR,—The employers have ceased to expect you to be fair to them in any comments you make on the differences which they may have from time to time with the E.P.E.A. Your remarks in this week's issue regarding the settlement reached on the questions of the agreements between the E.P.E.A. and other trade unions, and the functioning of the National Joint Board, condemn the employers as usual and praise the E.P.E.A.

You carefully refrain, however, from informing your readers of the actual effect of the agreements which the E.P.E.A. made. It is true that the representatives of the E.P.E.A. stated that when they were making the agreements they did not intend to bind themselves in the way the employers contended they had done, and the employers accepted their disclaimer. The employers, however, pointed out that the agreements must be discussed in the form in which they were signed and not "as intended," and the E.P.E.A. admitted that the employers' interpretation was correct.

You also withheld the information that for months the employers have been urging the E.P.E.A. to agree to submit to arbitration matters which the National Joint Board failed to settle, and that it was only at the last hour that the E.P.E.A. could be got to accept this reasonable proposal.

You also omit to report that the E.P.E.A. sought to establish the policy of striking against electricity undertakers who were observing every condition of the National Joint Board. The employers believed that it was necessary in the interests of the whole industry to refuse to recognise such a condition, and from the first they made it known that unless the E.P.E.A. were prepared to abandon this policy the employers would not continue to meet them, but would deal with the matter in their own way. At the official meeting the E.P.E.A. agreed to the employer's views.

There are other points, but I think I have given enough to show that the employers have been struggling to establish the principle of arbitration and freedom from national strikes. No crisis would have arisen if the E.P.E.A. had not abandoned the path of friendly negotiations in order to make drastic offensive and defensive alliances with bodies not represented on the National Board, and the effects of which they misunderstood.

As a result of the meeting at the Ministry of Labour, these points have now been settled in such a way that amicable working should ensue. Your persistent attempts to prove the employers to be always in the wrong are resented, and it is difficult to understand what object you can have in view.

The employers' representatives on the National Board consulted their constituent members through local and national conferences called for that purpose, and at all these conferences they received the most cordial support.

No meetings of employers have either been held or summoned to discuss the making of reductions of salaries or altering the conditions of the schedule. The E.P.E.A. officials have promised to correct this misstatement in the next issue of their journal. Whether you do so or not is immaterial. I am, etc.,

W. WALKER,
Employers' Chairman.

Manchester.
April 3rd, 1923.

[We comment upon this letter in our Editorial Notes.—ED. E.]

MODERN BOILER HOUSE PRACTICE.

To the Editor of THE ELECTRICIAN.

SIR,—My attention has been drawn to Mr. Brownlie's article of March 16th and the interesting correspondence which has ensued in your issue of April 6th. As I have written so frequently on the subject in question, and that recently, I am not able to offer any novel comments on the subject.

In an article in the "Electrical Review," November 17th, 1922, I ventured the opinion that a "boiler efficiency" of 85 per cent. was possible with steady working, and that the whole of the units used for auxiliary plant both in engine and boiler houses need not exceed 15 per cent. The system set out in Mr. Brownlie's article was indicated. In a paper given on December 8th, 1922, before the Manchester Association of Engineers the subject was argued in more detail and a higher limit of practical efficiency foreshadowed.

The case of Gennevilliers was quoted as an example of economisers plus air heaters with a possible efficiency of 87 per cent. The letter of your correspondent "Virat Veritas" deals with the subject in a similar manner.

Three questions seem to emerge from the correspondence, namely, (*a*) the standard of performance, (*b*) the possible efficiencies, and (*c*) the working efficiency. The first question easily provokes discussion. The Report of the "Civil Engineers" is, of course, open to revision from time to time. The setting out of the results in a standard form will remove any doubt as to whether "higher or lower" calorific value has been used and whether auxiliary power has been included.

Generally speaking, the "higher" value with the exclusion of auxiliaries has been the usual basis. As auxiliaries are included, and needed, for other aspects than "full load efficiency," it is generally best to give them separately, and not entangle them with the heat balance. This is equivalent to separating "boiler efficiency" and "boiler house efficiency." It is quite usual to do this in the case of the engine room plant and such practice gives rise to no misunderstanding whatever. To complain, therefore, that "boiler efficiency" is greater than "boiler house efficiency" is rather beside the mark. As regards "possible efficiencies," the calculable values of these and their radical dependence on heat losses in the escaping gases is now generally appreciated. Too much in the past has been made of the unknown losses in radiation and unburnt fuel. Radiation is a small loss on a well constructed installation, and offers practically no margin for improvement.

Unburnt fuel is also a small loss with skilled stoking, and can easily be over emphasised. Much heat loss occurs in every day working, by endeavouring to burn the last trace of carbon. This is because the unburnt carbon in the ashes appeals to the so-called practical man—as he can see it "with his own eyes" (what does this mean?), whereas the extent of heat losses in the flue gases can only be apprehended by a mental process based on calculation.

The value 8 per cent. to 10 per cent. should easily be obtained even with "ash" over 20 per cent. With "ash" as low as 10 per cent., 5 per cent. can well be looked for. Thus with skilled stoking there is also in this direction not a great margin for improvement.

Almost any good travelling stoker with suitable brickwork can maintain 10 per cent. to 12 per cent. CO_2 at the back of the boiler without distress, and hence the only remaining variable is the final exit temperature. This is appreciated in a specification recently issued which calls for a guaranteed efficiency and a guaranteed final temperature consistent with it.

As regards day-to-day efficiency, too much need not be made of the sooting problem. With modern furnace arrangements the so-called soot which is really dust and grit contains no carbon, and conditions must be very bad to attribute any loss to such a cause except what occurs at the few minutes of starting up, or a very sudden checking of demand. I am thinking, of course, of new plant such as was the subject of Mr. Brownlie's article. Again the rise of final temperature of the gases, with a proper stage heating scheme is extraordinarily slow when due only to such sublimation on the front tubes as is not readily removable by soot blowers. Thus the only remaining cause of inefficiency at lighter loads is the usage (which I am afraid is very general) of far too much air through the grate. In many cases both of forced and induced draught nearly full load air is always being passed through the boiler, and the practical regulation of output is done by means of the length of the fuel bed. This, of course, is quite unnecessary and avoidable. I doubt, however, whether it will ever be overcome except by breaking away drastically from the present system of employing a workman in a "technically responsible" position, that of controlling grate speed and draught.

Given good control, the efficiency of a boiler from half load to 25 per cent. overload is a very flat curve, although due to overhead losses the "boiler house efficiency" is a somewhat more drooping curve. Recent experiments on a complete power station properly operated, appear to show that the no-load losses usually assumed or expected for a Parsons' curve, are excessively high compared with those which are really unavoidable.

Banking losses are worthy of attention, and are often

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considered unavoidable. The actual heat loss unavoidable is really very small, but the heat in the coal burnt to keep up steam is many times the real radiation loss.

As regards, therefore, the difference between full load efficiency and general working efficiency, it is necessary to distinguish between those losses which are due to less efficient combustion and heat transfer, and those which are of an overhead nature and hence simply bulk more largely as the load factor decreases.

If one takes a case of a high "boiler efficiency" and compares it with realised "boiler house efficiency" on a poor load factor, there may be a very solemn but uninstructed "wagging of pows" over a so-called want of attention in the boiler house. On the other hand, there may be cases with a good load factor where "preening" occurs when a comparison is made with less fortunate cases, and this may be equally uninstructed.

In conclusion, there is surely no need to doubt the possibility of a "boiler efficiency" of 85 per cent. or a day-to-day "boiler house efficiency" of 75 per cent. to 78 per cent. as realised at Dalmarnock. What there is real reason to doubt is whether isolated boiler plants of small dimensions can ever hope to realise anything approaching such results in every day use.—I am, etc.,

W. M. Selvey.

London,
April 7th

To the Editor of THE ELECTRICIAN.

Sir,—The correspondence which has followed Mr. David Brownlie's article on "Modern Boiler House Practice," in your issue of March 16th, should prove of considerable value to all those engaged in submitting or receiving guarantees covering the performance of boilers and accessory equipment.

The reference to the manner in which the work done by the air heater should be considered with relation to the performance of the boiler, in the letter by "Vivat Veritas," is of particular interest as it suggests an entirely new way of considering the results to be obtained from the application of heated air for combustion.

Hitherto there have existed doubts in the minds of many engineers as to the efficacy of an air heater as applied for the recovery of heat units which would otherwise pass to the chimney. In their minds there has been the suspicion that such heat units extracted in the waste gases in large part pass through the equipment and these heat units might be described as "passengers," the heat units making a complete circuit through the furnace, boiler, economiser, air heater, and back to the furnace.

That this view is fallacious, has, of course, been clearly established, but by regarding the heat units recovered from the waste gases by the air heater as additional heat supplied to the furnace, and by realising that these additional heat units add directly to the furnace temperature, it can be seen that the boiler heating surface is at once made capable of absorbing a greater amount of heat per sq. ft. of surface for the reason that the temperature gradient is increased and the efficiency of the boiler thereby increased.

The real measure, of course, of the efficacy of the air heater is the measure of the heat units lost in the waste gases escaping to the chimney, and as by means of an air heater the temperature of the gas can be reduced to the figure of 236° F., as mentioned by Mr. Brownlie, as compared with the temperature of 396° F.; without the air heater the heat units actually recovered and usefully employed can be readily determined, and the value of the heat units will determine to what extent the capital expenditure involved is justified.—I am, etc.,

S. McEwen,
Underfeed Stoker Company, Limited.

London,
April 7th.

To the Editor of THE ELECTRICIAN.

Sir,—From Mr. Brownlie's article in your issue of March 16th on "Modern Boiler House Practice," it appears that a very high boiler efficiency is to be obtained. Few, though important facts are given in this interesting article. The boiler is to be large, 60 000 lbs. evaporation per hour, and is designed to maintain losses at a minimum. The coal is to be 10 800 B.Th.U. per lb. as burnt, and the working conditions are quite normal, 210 lbs. pressure with 677° F. temperature for the steam.

It may be estimated that a coal of 10 800 B.Th.U. would contain moisture of 10 per cent. and ash of 13·5 per cent., quite a good average central station coal, which could be very efficiently used on a travelling grate. By examining the losses, which the design of the plant renders the lowest possible, the remainder which is a high steaming efficiency may be obtained.

The greatest heat loss will be at the chimney, and from the data and design may be 9 per cent. There is then left 91 per cent. for steam raising, radiation loss, and ash pit loss, the last of these can be expected to be less than 1 per cent. A clear 90 per cent. would remain for steam raising and radiation loss, and indicates a high figure for the steam raising, most likely well above the guarantee. Power used on fans would be covered by 1 per cent., still leaving the makers concerned, Babcock and Wilcox, Underfeed Stokers, and Greens, a guaranteed result that could probably be produced without much difficulty.—Yours, etc.,

T. Halls.

Hackney,
April 9th, 1923.

To the Editor of THE ELECTRICIAN.

Sir,—Mr. Brownlie's article in your issue of March 16th appears to refer to one only of four test guarantees required for a recent specification.

The plant had to be designed and guaranteed to give the normal load of 60 000 lbs. of steam on a test limited to 8 hours, and 75 000 lbs. steam hourly on an overload test limited to 2 hours, when burning low-grade coal of not more than 9 500 B.Th.U. per lb., as fired. No information as to guarantees with this fuel is given.

But Mr. Brownlie merely refers to the normal load guarantee, limited to an 8-hour test, with a costly dust-free fuel, viz., double-screened nuts, ½ in. to 1½ in. cubes, having a gross calorific value of *not less* than 10 800 B.Th.U. per lb., as fired. With such nuts, burnt at low rates of combustion, the working cost would be abnormally low; and as the nuts are dust-free, the complication of an air heater having more heating surface than the boiler has, in order to add 4 per cent. efficiency on normal load test with nut coal, makes the 85 per cent. guarantee practicable on an expert 8-hour test with such nut coal.

With moving-grate multiple-retort stokers, requiring no furnace arches and using unheated air, direct combustion of run-of-mine or unscreened coal gives efficiencies equal to those obtainable with pulverized coal; as is shown by recent 24-hour tests of semi-bituminous unscreened coal on a large Riley Stoker.

I am showing at the E.P.E.A. meeting on April 11th, at Liverpool, the moving-picture known as the Riley stoker combustion film, showing all the processes of combustion in a large modern boiler at loads varying from banked fires to about 9 lbs. steam per sq. ft. of boiler heating surface; and I shall be glad to show this in London afterwards to engineers who will communicate with me at the undernoted address.—Yours, etc.,

Charles Erith.

Bridge Street, London, S.W.1.,
April 7th.

To the Editor of THE ELECTRICIAN.

Sir,—I note your correspondent "Vivat Veritas," in your issue of April 6th, gives in his ideal balance sheet the heat units absorbed by the economiser correspond to 7·15 per cent. efficiency, which is something like 9 per cent. saving in the coal bill. Personally, I think a fair figure for water-tube boiler plant work is 10 per cent. saving in the coal bill, but it seems to me in general most water-tube boilers are not equipped with sufficient economisers.

I would, however, emphasise in case of cylindrical boilers the saving due to the economiser, when worked under efficient conditions is much higher, amounting to something like 14 to 15 per cent. of the heat absorbed, which is very nearly 20 per cent. saving in the coal bill.

If we take the figure of your correspondent as 9 per cent. saving for a large water-tube boiler installation, I contend this is ample justification for the installation of an economiser, even if calculated on 15 years' life for the machine, a reasonable figure for water-tube boiler equipment, when taking the average feed water used as not over say 7-8 degs. hardness.

It would be interesting to know from your readers their experience with steel tube economisers and the life of same, as I recently inspected an outfit of this type which I was told had been in about five years, and was being taken out owing to the tubes having developed small pin holes, so to

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speak, due to corrosion. Also it would be of interest to learn whether the cost of repairs and replacements is included when calculating the performance of boiler equipment.—Yours, etc.,

Nottingham, April 7th. DAVID RUSHWORTH.

MR. BROWNLIE REPLIES.

To the Editor of THE ELECTRICIAN.

SIR,—Needless to say, I have read with great interest the correspondence on this subject in your issue of April 6th, and the contents of these six letters alone prove the urgent necessity of the adoption of a proper standard boiler plant test code. It is utterly impossible for me to reply in one letter of any reasonable length to all the many points raised, and accordingly, with your permission, I should like to discuss one or two, leaving the others for a future letter if you will permit me to trespass again upon your space.

With regard to Mr. O'Breen's comments on the codes in vogue on the continent, there are of course at least three so-called "official" boiler plant test codes in existence, the American Mechanical Engineers, the British "Civils," and what may be termed the "Continental," that of the Verein Deutscher Ingenieure of 1899. I have studied the latter code to some extent, and whilst it is open to criticism on a number of points, it would certainly appear to be more up to date than the British "Civils." Mr. O'Breen's opinion in this respect is of particular value, because he has had considerable practical experience with boiler tests conducted according to this code and the closely allied Belgian code of the Société Vincottes. All the more reason, therefore, why the good points of the Continental code should be embodied in a standard International code.

The question of the influence of the ash is, of course, a matter of the greatest practical importance—a fact which is not quite realised by the average power station engineer. In the first place, Mr. O'Breen is of course obviously correct in pointing out the mere size of the coal is an important factor in dealing with figures like 85 per cent. efficiency, and the results can easily alter to some extent with the same quality coal of uniform heating value according to the size of the coal particles. How this is to be guarded against is not very clear.

The amount of unburnt fuel in the ash is a very knotty point indeed, and the most serious losses in this connection are undoubtedly taking place in many power stations. I know of one case in my own personal experience where an unusually efficient and wide-awake works manager was being paid to take away fine ash from a generating station, ostensibly for use as road material, and was then actually using it as fuel under his "Lancashire" boilers and obtaining excellent results (!) One of the essential defects of the ordinary chain grate stoker is the amount of unburnt material in the large proportion of ash and riddlings that falls through the comparatively large air spaces rendered necessary by the size of the links. Mr. O'Breen mentions that the highest Continental guarantee as regards unburnt fuel in the ash is 20 per cent., that is to say, if the original coal contains 15 per cent. of ash, about 2 per cent. of the coal escapes unburnt in the ash, but in many cases the actual figures are much worse.

With regard to the special type of "Underfeed" travelling grate stoker in this particular installation having heavy transverse travelling bars containing a large number of very small fire bars, and the air spaces split up into correspondingly very small divisions together with "compartmented" air supply, I understand the ash guarantee is very much less than with the chain grate stoker—1 per cent. of the total heat in the coal—so that the loss here would not seem to be great.

It is interesting to note that one of the minor advantages of pulverised fuel is the more complete combustion of the fuel. Thus in the most elaborate tests carried out by Henry Kreisinger with the "Lopulco" installation at the Lakeside plant, Milwaukee, the figures were 0·40 to 0·70 per cent. of the original heat in the coal, the average being 0·45 per cent., about one quarter that of the ordinary chain grate stoker. I presume that the 85 per cent. efficiency guarantee includes the return of all the riddlings to the furnace in any the contractors think fit, but I have no information on the point. The existing codes contain no guidance as to whether a "flying" start and finish is to be made in this connection, and another point that has always puzzled me is how, with a multiple retort stoker, are we going to ensure that there is the same amount of coal in the stoker at the beginning and at the end of the trial?

It is very satisfactory to note that your correspondents are practically unanimous in agreeing that *all* auxiliary steam or power should be deducted in calculating the real net working efficiency of a boiler plant. I have never been able to understand how anyone, even of the most lofty, academic, and highbrow type, could worry himself about reading the barometer to one place of decimals in order to calculate for a difference of the final efficiency figures to some unknown *nth* degree, and regard as of no importance at all that actually 20 per cent. of the whole steam production of the plant may be wasted in steam nozzles and nine or ten other auxiliary methods, quite apart from the fact that boiler plant tests cannot in any case be relied upon as being accurate to more than, say, 0·5 to 1·0 per cent. In fact, the boiler-house in general seems to be a striking vindication of the old Lancashire saying, "there's nowt so queer as fowk."

In reply to one of the many interesting points raised by Mr. Neale, I understand that at the Lakeside plant the figures of 85–86 per cent. efficiency do not include the deduction of the auxiliary power used, which I believe is about 1·75 per cent. of the steam production of the plant inclusive. The later type of "Lopulco" plant is stated to have cut this figure to 1 per cent., equal to most modern mechanical stokers.

I wish I had the space to reply to all the points raised, but one last comment is in connection with the letter of "Vivat Veritas." I do not say that 85 per cent. efficiency cannot be obtained, but I certainly think it is a very much more difficult job than most people imagine, and it is the last 2 or 3 per cent. where the pull comes. The heat balance sheet given by your correspondent seems quite in order, except that I am not very clear about the air heater. In my book on "Boiler Plant Testing" I have given average figures almost identical with those of your correspondent for the performance of a high-class water-tube boiler plant, representing, however, only about 5 per cent. of the water-tube plants in the country, as 81·9 per cent. net efficiency with 1·5 per cent. total auxiliary steam or power deducted, corresponding to 83·1 per cent. without deduction, 65·8 per cent. of the heat being absorbed by the boiler, 7·6 per cent. by the economiser, and 9·7 per cent. by the superheater, the heating value of the coal being on the higher figure with medium quality coal. This does not include air heating, which is, of course, of very recent introduction in power-station work, and in endeavouring to obtain 85 per cent. net efficiency it seems to me a very great responsibility is being thrown on the air heater.—I am, etc.,

London, April 7th. DAVID BROWNLIE.

KEYS AND KEYWAYS.

To the Editor of THE ELECTRICIAN.

SIR,—The Sub-Committee of the British Engineering Standards Association, which is engaged in revising the standard specification No. 46 (keys and keyways) and enlarging it to cover other forms of keys, has found itself face to face with the fact that the key and keyway nomenclature appears to vary in different parts of the country. Consequently, they have been studying this question with the object of bringing about uniformity, so that, in dealing with different forms of keys and the dimensions of same, the names given to keys and their parts should be well understood.

We should be glad, therefore, if you would be good enough to publish the accompanying suggested nomenclature, and invite comments or criticisms in the columns of your valued journal for the assistance of the Sub-Committee.

As illustrations, we would point out that the well-known sunk key is in some parts called a "feather"; also that the recess formed in the shaft to receive the key is commonly called a keyway, but sometimes called a "key-seat." Further, that sometimes the expression "key-way" is used for the recess in the shaft, while the recess in the hub or boss is occasionally distinguished from that in the shaft by calling this a "key-seat."

This distinction appears to have been due to the introduction of what are commonly known as "key-seating" machines for cutting these recesses in the bosses of pulleys and flywheels, while, nevertheless the term "key-way" is generally used in England to represent the recess which is produced by the key-seating machine.

Further, when a number of keys are produced integral with the shaft, as in motor-car and machine tool practice, the finished shaft is sometimes called a "castellated" shaft, and sometimes a "splined" shaft.

These illustrations will serve to show to your readers the desirability of using standard expressions to define standardised objects.

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The Sub-Committee feel confident that the desire to arrive at standardised nomenclature will be approved by all engineers, and tney will await with much interest any comments or criticisms which may result from the publication of the proposed nomenclature in your valued columns and which should be sent to the Secretary, 28, Victoria Street, S.W.1.—I am, etc.,

W. REAVELL,

Chairman of Sub-Committee on Keys and Keyways.

London, S.W.

April 6th.

The following Key and Keyway definitions, etc., are submitted by the British Engineering Standards Association for comment :—

It is recommended that the term " castellated " be in no case applied to shafts.

Key.—A piece inserted in an axial direction between a shaft and a hub to prevent relative rotation.

Length of Key.—The overall dimension of the key, taken parallel with the axis of the shaft.

Width of Key.—The dimension of the key measured tangentially to the shaft.

Thickness of Key.—The dimension of the key measured radially to the shaft. In the case of taper keys the dimension is that measured at the large end.

Taper of Key.—The taper between the top and bottom surfaces in the direction of the length of the key. Taper is expressed as 1 in 100, etc., or as ⅛ in. per ft., etc.

Plain Parallel Key.—A parallel key with square ends.

Round-Ended Parallel Key.—A parallel key with round ends.

Gib Head Key.—A key provided with a head to facilitate withdrawal.

Plain Taper Key.—A taper key with square ends.

Round-Ended Taper Key.—A taper key with round ends.

Square Key.—A key having the thickness equal to the width.

Saddle Key.—A taper key fitted to a pair having a keyway in the hub only, the bottom of the key being curved to fit the shaft.

Flat Key.—A key fitted to a pair having a keyway in the hub and a flat on the shaft.

Sunk Key.—A key partly in the shaft and partly in the hub.

SPECIAL KEYS.

Feather.—A key attached to one member of a pair and permitting axial relative movement.

Spline.—A key machined integral with a shaft and adapted to pair with a corresponding recess in the hub.

Spline Shaft.—A shaft having one or more splines. Multi-spline shafts are usually referred to by the number of splines, *e.g.*, " 4-spline shaft " or " 6-spline shaft," etc., irrespective of the splines being projecting or sunk.

Peg Feather.—A feather with peg to prevent its axial movement in hub.

Single Head Feather.—A feather with a projection at one end to prevent axial movement (of feather) in hub.

Double Head Feather.—A feather with a projection at each end to prevent axial movement in hub.

Round Key.—A key fitted in a hole drilled partly in the shaft and partly in the hub.

Grooved Key.—A key having a groove, or grooves, lengthwise to facilitate fitting.

Tangent Keying.—The use of keys acting tangentially in opposite directions.

Stake Keying.—The use of taper keys for centralising the hub and for preventing relative movement. They may be fitted as flat keys, or saddle keys may be used.

Keyway.—A recess in a shaft or hub to accommodate a key or feather.

Woodruff Key.—A key segmental in form axially and parallel transversely.

Woodruff Keyway.—A segmental recess in a shaft to accommodate a Woodruff key.

Fitting.—" Top and Bottom fitting " when the key bears hard on top and bottom and lightly on sides.

" Side fitting " when it bears hard on sides and lightly on top and bottom.

By permission of the Newcastle-on-Tyne Electric Supply Co., a PARTY OF APPRENTICES from the Carville Power Station last week visited the company's Elswick Works.

If the SUNDERLAND Guardians approve of the recommendation of a sub-committee, the whole of the buildings in the workhouse grounds will be lighted, and power for the laundry and machinery supplied by electricity. The initial outlay will be £3 500 ; but there will be an annual saving of £300 as compared with gas.

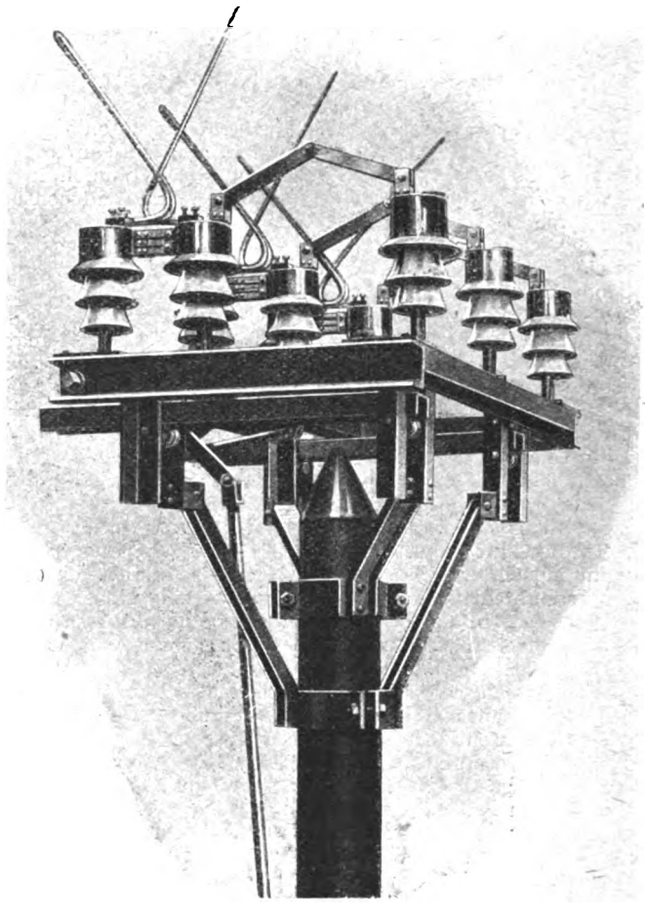
The " Iron and Coal Trades Review " states that the electric power generating plant of the CARDIFF COLLIERIES, LTD., is practically completed, and the directors have decided to sink a new pit to the Little Rock Seam, which is of good section and of coking quality. An electrically driven winding engine for the new pit has been delivered, and preparations are now being made for its erection and that of the permanent head frame.

An Air-Break Outdoor Switch.

An interesting type of air-break switch has recently been placed on the market by LA METALLURGIQUE ELECTRIQUE. This switch which is known as " Rectilique " is of outdoor type, with a twin air-break and a horn-gap. It is designed for operating voltages ranging between 10 000 and 75 000 V and is especially adapted for use in small substations, the importance of which does not allow for the provision of oil switches.

Of the two " sub-types " manufactured the " chair " type is built with a frame specially designed for mounting on poles and the " pillar " type is suitable for wall-mounting ; with the exception of these differences the two types are identical.

Turning to details the framework supports insulators fitted with fixed contacts, terminals, and arcing horns. The latter face each other as in lightning arresters and the gap is of such a length as to prevent an arc being struck even during a wet test under a voltage equal to twice the operating voltage. The framework is fitted with rollers to receive the slide bars supporting the movable contacts as well as the spindle of the cam driving them. The slide bars are connected to the lower end by a tie bar ; at the upper end they are



A NEW AIR-BREAK OUTDOOR SWITCH.

connected by a cross-bar on which the insulators bearing the movable contacts are fixed, these engage in the jaws of the fixed contacts. A rupturing contact closes the gap between the arc-horns making the contact.

The apparatus is built in such a way that when the switch is operated this rupturing contact opens the gap after the main contacts, causing the gap to arc over, the arc being finally ruptured on the arcing horns.

In the standard type of switch the distance between phases is fixed beforehand, but it is possible to alter this to suit operating requirements.

The porcelain insulators have a large factor of safety, all mechanical parts are of simple and robust design, and are not liable to get out of order. These switches can be operated through chains or by rack and pinion, and their rupturing capacity ranges from 5 to 10 kVA. It is bad practice to put insulators in tension, the line must, therefore, be anchored before it is connected to the terminals.

When chain operated the switch is held in a closed position by means of a roller engaging in a notch on the driving catch. When operated by rack and pinion the notch in the cam is out of action, but a catch holds the switch in the closed position.

The advantage of the type of switch illustrated is, it is claimed, that it can be operated without changing the inclination of the insulators ; which remain in their normal position. The switch illustrated shows one type of many manufactured by the company whose agent in England is Mr. Ashton Bremner.

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Hydro-Electric Supply for Dublin.

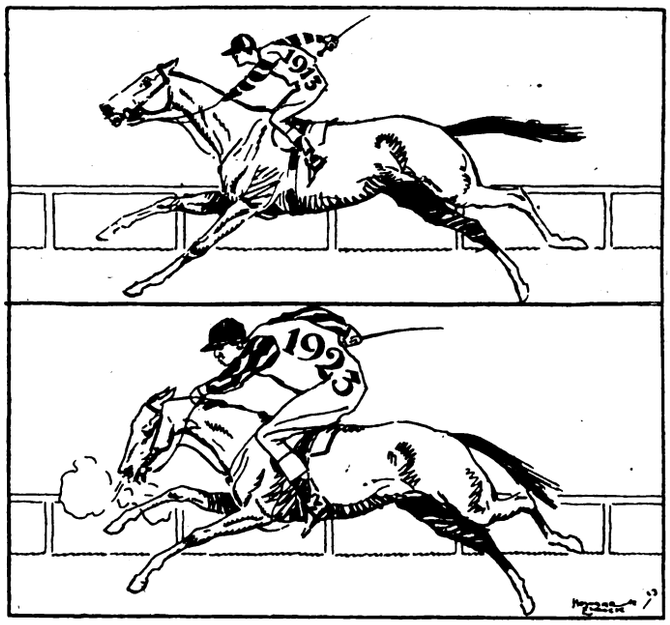
Rival Syndicates Seeking Powers.

Developments are reported in connection with the scheme for utilising the water-power of the river Liffey to supply Dublin with electricity. In January, a Swiss engineer, Mr. Buchi, submitted a report on the subject to Dublin Corporation, and his suggestions were published in THE ELECTRICIAN, January 26th, p. 101.

It now appears, according to the "Freeman's Journal," that two syndicates have been formed, apparently being rivals for the right to exploit the scheme. On April 4th, "The Liffey Syndicate, Ltd," was registered in Dublin, with offices at 37, Westmoreland Street. On April 6th, another syndicate, "The Anna-Liffey Power Development Co.," was registered.

It is stated that The Liffey Syndicate comprises a number of influential Irishmen resident in Ireland and abroad, who will have strong American financial support, and that provision will be made for enabling the local authorities and other large users of electricity within the metropolitan area to co-operate in the undertaking and become associated in its control. It is intended to introduce a private Bill at the earliest practicable moment to obtain legislative sanction for the project.

The Anna-Liffey Power Development Co., will have as its directors Senator Sir John Purser Griffith (past president of the Institution of Civil Engineers); Mr. G. Marshall Harriss (general manager of the Dublin Tramway Co.); Mr. Alfred Delap, Mr. Darrel Figgis, Mr. H. H. Jeffcott and Mr. John W. Griffith. The solicitors are D. and T. Fitzgerald, 20, St. Andrew Street, Dublin. The company is to propose to the Free State Government that it should itself guarantee the finance and take over the work of the scheme when completed, either for itself, or in collaboration with the Dublin Corporation. If, however, the State does not see its way to do this, the promoters are willing to step forward and undertake the entire scheme themselves. The intention of this company also is to proceed by way of a private Bill.



AN IMPOSSIBLE LOAD.
1913. TAXATION £3 10 0 PER HEAD OF POPULATION.
1923. TAXATION £18 4 0 PER HEAD OF POPULATION.

Post Office Estimates.

A Three Million Pound Decrease for 1923-24.

The Post Office estimates for the year ending March 31st, 1924, reach a total of £50 873 500, as compared with £53 822 450 for the year ended March 31st, 1923, a net decrease of £2 948 950. This figure can hardly be said to represent the economies which have actually been effected. The gross total estimates for 1922–23 and 1923–24 are respectively £58 483 419 and £52 860 440, a difference of £5 622 979. But "appropriations-in-aid" amounted to over 4¼ millions in 1922–23, and are estimated at under 2 millions for 1923–24, the difference being almost entirely accounted for by the fact that in 1922-23 estimates provision was made for working the Post Office services of the Irish Free State on an agency basis and recovering 2½ millions from the Free State Government for so doing. However, it was afterwards arranged that the Post Office services should be transferred to the Free State as from April 1st, 1922.

Engineering Department Salaries Down by £440 000.

The estimates for 1923–24 are thus considerably below those for the preceding year, a decrease being shown under every heading except one, viz., "Charges in respect of debt created under the Telegraph Acts, 1892 to 1922." There is an increase here of £630 223, the respective figures for 1922-23 and 1923–24 being £3 533 815 and £4 164 038.

Salaries in the Engineering Establishment are down by £439 880. This, with a saving of £50 000 in travelling expenses, brings the total decrease nearly up to half-a-million. The saving is effected almost entirely as the result of decreased bonus to officers and employees in the metropolitan and provincial services. There is also a decrease in staff from 28 174 to 25 344. It may be noted, however, that the number of executive engineers in London is increased from 42 to 45, and the number of assistant engineers in London from 179 to 190. As against this, assistant superintending and assistant staff engineers in the provinces are reduced from 19 to 15 and assistant engineers in the provinces from 174 to 166.

Engineering Materials.

The estimate under this heading for 1923–24 is £1 169 000, a decrease of £81 000 on the 1922–23 figure. From an appendix it appears that telegraph construction is to cost £423 000. This includes £95 000 as the part cost of various main underground lines, £130 000 for sites and equipment in connection with the Imperial Wireless Chain and £123 700 for telegraph extensions, fast telegraph plant, etc. New works in connection with electric light and power account for £63 000.

A new expenditure of £30 000 is incurred for 1923–24 under the heading of wireless broadcasting. This represents the payment to the British Broadcasting Co. of half the licence fees collected.

So far as the development of the telephone system is concerned, expenditure is provided for by loans raised under the Telegraph Acts, 1892–1922. As mentioned above, the estimate for charges in respect of these loans is higher by £630 223 in 1923–24 than in 1922–23, This, therefore, is presumably the amount to be spent on telephone construction during the coming year. Total cost of renewals, re-arrangements, etc., is estimated as follows:—telegraph services, £211 000; telephone services, £2 078 500. Maintenance is estimated at £314 000 (telegraph) and £2 440 000 (telephone).

The anticipated distribution of the estimate is as follows:—Postal services, £31 323 801 (71·31 per cent.); telegraph services, £6 328 399 (15 per cent.); telephone services, £13 221 300 (13·69 per cent.).

I.E.E. North-Eastern Centre.

Mr. T. Carter Elected Chairman.

The annual meeting of the NORTH-EASTERN CENTRE of the INSTITUTION OF ELECTRICAL ENGINEERS was held in Armstrong College, Newcastle, on Monday, the retiring chairman, Mr. F. G. C. Baldwin, presiding.

The annual report, presented by Mr. H. B. Poynder, the secretary, stated that the membership showed a slight increase over the previous year, and now stood at 520, made up as follows: Members 63, associate members 211, associates 7, graduates 50, and students 189. The financial statement, presented by Mr. W. T. Maccall, showed a balance in hand of £89, being an increase of £10 on the previous year.

Both reports were adopted on the motion of the chairman, and the following officials were declared elected: Chairman, Mr. T. Carter; vice-chairmen, Mr. W. T. Maccall and Mr. R. W. Gregory; past chairmen, Mr. F. G. C. Baldwin and Professor W. M. Thornton; hon. secretary, Mr. H. B. Poynder; assistant secretary, Mr. Hugh R. Viall.

Mr. P. F. Allan made an appeal on behalf of the benevolent fund of the Institution. The chairman supplemented the appeal, and also suggested that members might devote a little of their summer holiday to preparing papers for the next session.

Following the business of the meeting, Mr. A. G. Warren lectured on "The X-Ray Examination of Materials."

South-East Lancashire Advisory Board.

At a meeting of the SOUTH-EAST LANCASHIRE ELECTRICITY ADVISORY BOARD on April 10th, the Board approved of supply in bulk by the Rochdale Corporation to the Whitworth U.D.C. They also approved the principle of the erection of an oil engine substation at Alderley and Wilmslow.

The Board laid down their requirements in relation to further stations to be erected in the area, and appointed the Chairman, Alderman Dagnall; Mr. S. L. Pearce, Chairman of the Engineers' Committee, and Mr. A. H. Banks, clerk, to attend a local inquiry at Horwich in relation to two competing applications for an Order in relation to the Urban District of Horwich.

The general committee of the ELECTRICAL ENGINEERS' BALL at their last meeting distributed sixty guineas to the I.E.E. Benevolent Fund, and sixty guineas to the Electrical Trades' Benevolent Fund. These sums were voted out of the profit made at the ball on January 26th.

We regret that an error appeared in the advertisement of the ENGLISH ELECTRIC Co. on p. xxxiii of our issue last week. An illustration was described as showing part of the rotary converter bay at the "Stratford" works of the company. This should, of course, have read the "Stafford" works.

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Merchandise to Sell and Profit By.

In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

A New Production by Cecil Hodges & Co.

When a manufacturer plans to put upon the market a new device or apparatus, a great deal is effected towards the success of that device from a sales point of view, if the faults of such apparatus that have gone before are closely studied. Too many, in their anxiety to fill an immediate need, simply perpetuate the fundamental and well-rooted objections that exist in much electrical apparatus, and which, incidentally, hamper electrical progress.

CECIL HODGES AND CO. did not make this mistake when they designed their new power distribution board which it is our

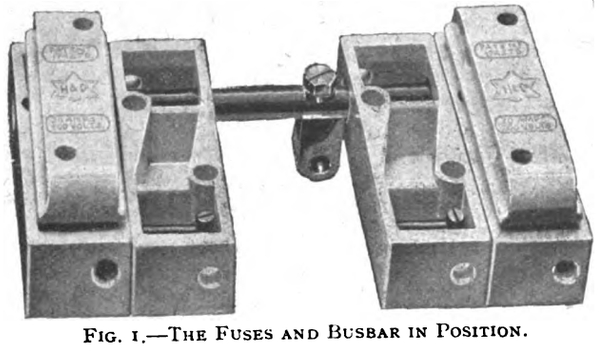


FIG. 1.—THE FUSES AND BUSBAR IN POSITION.

pleasure to comment on. To make our remarks complete we should shew several illustrations of the components of this new board but the limitations of these columns will only allow us to shew the most important, viz., the busbars and the fuses.

From these illustrations it will be noticed that instead of having the ordinary female clips for the fuse carrier to make contact in, the

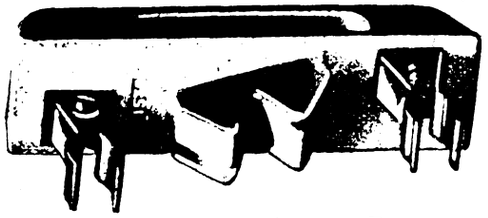


FIG. 2.—A "CLOSE-UP" OF THE FUSE.

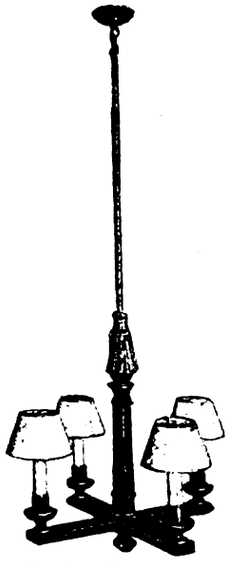
fuse carrier itself carries the clips, which grip with a bull-dog grip direct on to the busbar itself—thus doing away with loose contacts and connections.

This principle is a distinct departure from the usual type of fuse carrier which comprised a knife contact, an arrangement which (it is claimed) usually makes imperfect contact with the clips.

A porcelain chamber completely covers the busbar and sweating sockets, making the whole board comply with the Home Office regulations.

A Fitting in Wood.

What is the greatest need to-day to enable all retailers to sell more fittings? There are many needs to be fulfilled, but this column is not the place to debate the subject. One need is, however, predominant. That need is style, design, distinction—call it what we will. The BRITISH THOMSON-HOUSTON CO. have a range of fittings in wood which will at once appeal to that ever-growing section of the buying public who are acquiring a taste for something better. The fitting which we illustrate is a four-light candle fitting which can be supplied in oak. This illustration is but one of many designs shewn in leaflet L. 262. As is well known, the B.T.-H. make a feature of supplying overprinted publicity matter, and this folder L. 262 can be so supplied.

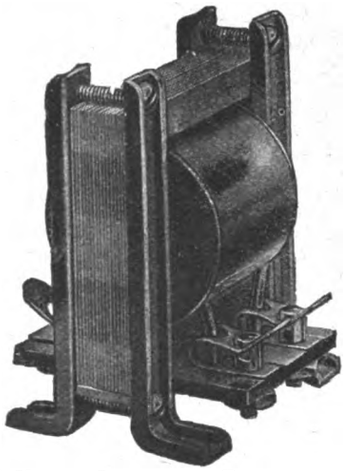


AN OAK PENDANT.

The "Igranic" Intervalve Transformer.

We have referred in a previous issue, to the publications of the IGRANIC ELECTRIC CO. describing various wireless apparatus which they are developing. We now illustrate a low frequency intervalve transformer which is dealt with in leaflet No. 2236. A brief description will doubtless be of service to buyers of wireless apparatus.

The transformer has been specially designed for operation in conjunction with any of the standard makes of valve in the detector, amplifying, or multi-stage, magnifying circuits or any others. The coil is wound by a patent cotton inter-weave process, and (it is claimed) all distortion of signals due to high frequency mechanical vibration of the wires is thereby eliminated. The results obtained in this transformer when used in conjunction with loud speakers have, we are told, been remarkable. Clarity of tone and articulation is maintained irrespective of the number of stages of magnification.

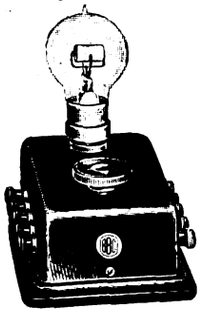


A USEFUL INTERVALVE TRANSFORMER.

The winding and core are so proportioned that little magnetic leakage occurs. In consequence, a number of these transformers can be assembled in a multi-stage amplifier without interfering one with the other. The winding has ample current carrying capacity to suit the requirements of multi-stage amplification up to 15 mA, and is insulated for voltages up to 300 V on the secondary winding. The transformer is listed at 22s. 6d.

The "Sterling" Wireless (Unit) System.

It is confidently anticipated that we shall reach at an early date the position where electrical contractors and retailers will control the majority of the business in wireless. It need not be discussed here as to whether this confident anticipation will be realised early but if it is really desired and anxiously awaited, then contractors and retailers must not spoil their future prospects by handling "cheap and nasty" sets. If they do, the effect will be like unto what happened after the opening of Pandora's box. We believe, however, there is a solid body of thought in retail circles that only the best should be passed on to the public and many are looking out for apparatus made by makers of standing. The "Sterling" unit system will be of interest to such buyers.



A GADGET FOR BROADCASTING.

Space will not permit us shewing an illustration of each piece of apparatus that goes to complete the whole scheme of this system. The units consist of the following:—(1) For holders of experimental licences: (*a*) tuner unit, (*b*) radio (high) frequency amplifier unit, and (*c*) detector unit. (2) For holders of broadcast licences: (*d*) single valve receiver unit, (*e*) audio (low) frequency amplifier unit with one, two or three valves, and (*f*) unit connectors. In giving a general description of the system it must be stated that each unit has its parts mounted on a hardwood base with moulded edges, finished black, and provided with a metal cover finished with a highly polished black surface, giving a unique and pleasing appearance.

We illustrate the one valve low frequency amplifier unit. The complete system will be described in a catalogue now in the press, and pending publication the STERLING TELEPHONE AND ELECTRIC CO.

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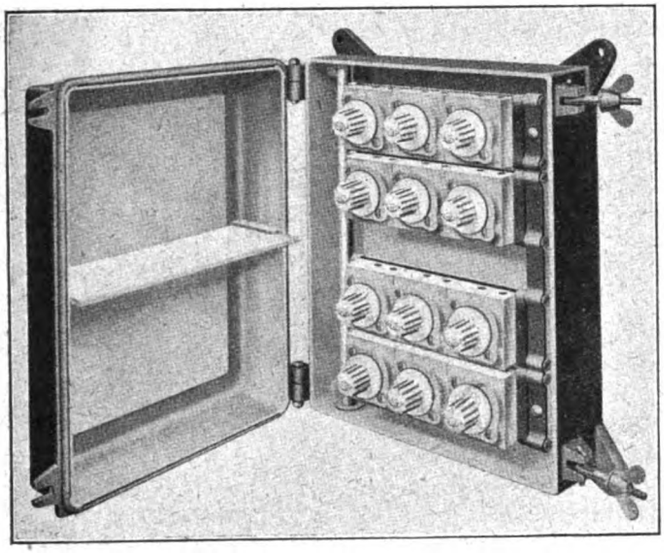
will be pleased to give particulars to inquirers. In the meantime, publication No. 352, containing prices and illustrations of some of the units and of "Sterling" receiving sets, will be sent on request to all electrical contractors and retailers. Buyers who study this list will be acquiring a sound knowledge of what is the best in the "wireless" market.

A New Fuse.

Engineers are never satisfied with the "Fuse Department" of the electrical industry. For there is still much room for improvement in this equipment in spite of the numerous types which are on the market and which are usually labelled, quite properly, "Home Office Patent." It is this knowledge that has no doubt guided the designer of the "Rotaloc" fuse manufactured by PARMITER, HOPE, & SUGDEN.



THE LATER ROTALOC FUSE.

The demand for heating and cooking apparatus means that the contractor must see that the installation is equipped with the most reliable fuses because nothing prejudices the use of such gear more than the cook's complaint that the "fuses are ever blowing." A reliable fuse on a cooking circuit is just as necessary as bristles are to a broom.

Our illustration shows an ironclad distribution board made up with the Rotaloc fuse. The complete board does not need description, but details of the fuse unit will be of interest. It consists of a china base carrying the protected fixed contacts, and a china bridge in the form of a cylindrical plug which carries a pair of springy copper contacts to which the fuse wire is easily attached. The bridge is inserted in the base and locked by a semi-rotary motion. The fuse bridge cannot be removed while the circuit is alive. It is claimed that the fuse has many advantages over any cartridge type, not the least being that it does not require expensive renewals and is easily re-wired with standard fuse wire.

Crystal Lustre Fittings.

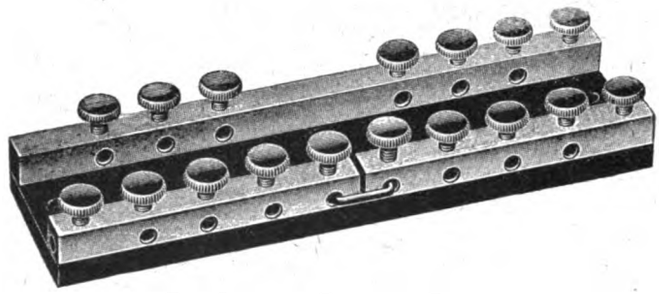
Spring trading is opportune at a time when redecorations in the home set a train of thought that new fittings would be desirable. There is, however, such a galaxy of fittings offered by so many that a wise choice must be very carefully made. It is a criticism that fittings have become very stereotyped and therefore something different will be turned to with relief. This will apply both to the retailer and to the domestic buyer. It is a curious fact that the range of fittings marketed by RICHSON AND CO. are as "old as the hills," but they are new to our generation (that is, as a strictly domestic line). Crystal lustre fittings are a distinct novelty to us and the retailer will spend a profitable hour or so in his factor's showroom looking over the many beautiful designs, where he will be able to form his own opinion as to their merits.

A HANDSOME CHANDELIER.

We have no hesitation that the fittings will appeal as a line of "merchandise to sell and profit by" quite out of the rut. We illustrate a beautiful ceiling light, No. P8446.

A Useful Wireless Accessory.

The STERLING TELEPHONE AND ELECTRIC CO. still continue to add to their range of profit-making wireless apparatus and accessories. The latest accessory they have placed upon the market is one which will find a ready sale. As will be seen from our illustration, it is a multiple terminal block for head telephones. The device has been specially designed for use in cases where it is desired to connect a number of head telephones or hand telephones for simultaneous listening-in. It is arranged to accommodate up to six pairs of receivers, which may be connected either all in parallel or in series parallel (two sets each of three pairs) by removing the connection attached. The connecting bars are of brass, mounted on a base having high insulating properties. This base is provided with two screws for securing it in any convenient position.



THE STERLING TERMINAL BLOCK.

The catalogue number is R1266 and the list price is 8s. 6d. each. Sterling publication No. 345 should be referred to for a more complete description of the terminal block, together with diagrams showing connections.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

From MAVOR AND COULSON we have received their regular monthly issue of the "M. and C. Machine Mining."

NEWALLS INSULATING CO. have just issued a pamphlet briefly describing their system of heat insulation for steam pipes, etc.

IGRANIC ELECTRIC CO., LTD., have published a series of small leaflets on several pieces of wireless apparatus which they manufacture.

"KY" cells for electric vehicles are described in the January list, copy of which we recently received from E. G. LIND AND CO., who are the sole agents in this country.

E. P. ALLAM AND CO., who are the selling agents for the Hopkinson a.c. motors, have recently issued a pamphlet quoting prices and full technical data on machines from ¾ H.P. to 18 H.P.

"Batteries for Wireless" is the title of a new list, No. 8, issued by BATTERIES, LTD. The battery is, of course, the "Nife" battery, which are made exclusively by Batteries, Ltd., at Redditch.

The "Transformer Book" and "Transformer Oil" are the titles of two publications received from J. G. STATTER AND CO., who are the English agents for W. Smit and Co., of Nijegta, Holland.

CRYSELCO is a manufacturer of lamps (vacuum and gas-filled) whose prices and quality would be taken note of by buyers. The complete range is scheduled with prices in a catalogue just published.

Contractors who specialise in industrial work will be interested in the lists published by CROFTS. The list fully describes the range of hangers and brackets and plummer blocks, all fitted with ball or roller bearings.

Readers who have the catalogues of the GLOBE ENGINEERING CO. on their files should take note of the new list, No. 5, just issued by the company. The list quotes full technical data and prices on d.c. motors and dynamos.

PLANT AND SUPPLIES, LTD., have kindly sent us a copy of a leaflet describing the crystal set marketed at £4 15s. complete. The set merits the attention of retailers. We have also secured a copy of List No. 9 on Sceando Lamps.

"Large Polyphase Induction Motors" is the title of a descriptive list, No. A3B, recently published by CROMPTON AND CO. The list is a valuable treatise on machines of this type, and is profusely illustrated with installations carried out.

AUTOMATIC AND ELECTRIC FURNACES have favoured us with copies of their catalogue printed in French, Danish, and Spanish dealing with Wild-Barfield Electric furnaces. Our foreign readers are invited to make application for copies.

Buyers of wires of every description will find that constant use of the new catalogue of the LONDON ELECTRIC WIRE CO. AND SMITHS will save them both time and money. It is an encyclopædia in wires which should be ready to hand in every buyer's office.

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The I.M.E.A. Convention.

Full Programme for June 18th to June 23rd.

The twenty-eighth annual convention of the INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION will be held, as already announced, from June 18th to June 23rd at Scarborough. The Royal Hotel will be the headquarters of the Convention, and details of the arrangements are as follows :—

MONDAY, JUNE 18TH.

Members assemble at Convention. The Convention inquiry office will be open until 10 p.m. for registration and issue of badges.

8.30 p.m. Reception by the Mayor and Mayoress of Scarborough (Councillor and Mrs. G. Whitfield) at the Town Hall (evening dress optional). Admission by invitation card issued to members and guests with programmes.

TUESDAY, JUNE 19TH.

10.0 a.m. Opening of the Convention in the Council Chamber, Town Hall. (1) Civic welcome to the Association by the Mayor of Scarborough; (2) Address by Lieut.-Col. W. A. Vignoles, President of the Association and Borough Electrical Engineer of Grimsby; (3) Paper entitled "Showrooms and Sales for Small Undertakings," by T. Hall, Borough Electrical Engineer, Burton-on-Trent.

3.0 p.m. Short charabanc tour to points of interest in and near the town.

9.30 p.m. Reception and dance in the Ball Room, Royal Hotel (evening dress), at the invitation of the President, supported by the Mayor and Deputy-Mayor of Grimsby and the Chairman and Members of the Grimsby Electricity Committee.

WEDNESDAY, JUNE 20TH.

10.0 a.m. Council Chamber. Paper entitled, "Overhead Transmission and Distribution," by J. E. Storr, of the Yorkshire Electric Power Co.

3.0 p.m. Informal meeting in Council Chamber to discuss "Development of Cooking Apparatus."

THURSDAY, 21ST JUNE.

10.0 a.m. Council Chamber. Paper entitled "Modern Generation applied to Existing Distribution," by F. W. Purse, engineer to West Ham Corporation Electricity Supply Department.

The afternoon is left open to enable visits to be made to places of interest.

7.15 p.m. Annual dinner in the Ball Room, Royal Hotel, for members and guests, including ladies. (Evening dress; decorations will be worn). Music.

FRIDAY, JUNE 22ND.

10.0 a.m. Annual general meeting.

SATURDAY, JUNE 23RD.

10.0 a.m. Visit to the works of the Scarborough Electricity Supply Co.

Tickets to and from Scarborough at not more than single fare and a third, will be available for the return journey. Further details will be issued later.

Copies of the papers, which will be read in extract, will be issued to members and guests prior to the Convention. Those who desire to take part in the discussions should notify the Secretary.

Certain hotels offer a special tariff to members of the Convention provided early application is made on the special forms provided by the Association.

British Empire Exhibition.

Progress in the General Engineering Section.

We have received from the BRITISH ENGINEERS' ASSOCIATION, a ground plan showing the progress of space letting in the Shipbuilding, Marine, Mechanical and General Engineering Section of the British Empire Exhibition, covering an area of 217 000 sq. ft. in the Machinery Hall. The first allotment of space was made a fortnight ago, and the coloured plan shows in a striking manner the remarkable progress already achieved in the sale of stand space. It is evident that the British Engineers' Association has been getting on with its job in a workmanlike way, with the result that the organisation of the Engineering Section is already so far advanced that success may be regarded as assured.

The space plan is accompanied by a schedule giving the dimensions, frontages and prices of the stand spaces still available when the plan was printed. A perusal of the plan makes it clear that eligible firms who have not yet booked space should send in their applications without further delay, as the limited number of stand positions still available will be allotted on the basis of priority of application. Copies of the plan and schedule and any other information required can be obtained from the British Engineers' Association, 32, Victoria Street, London, S.W.1.

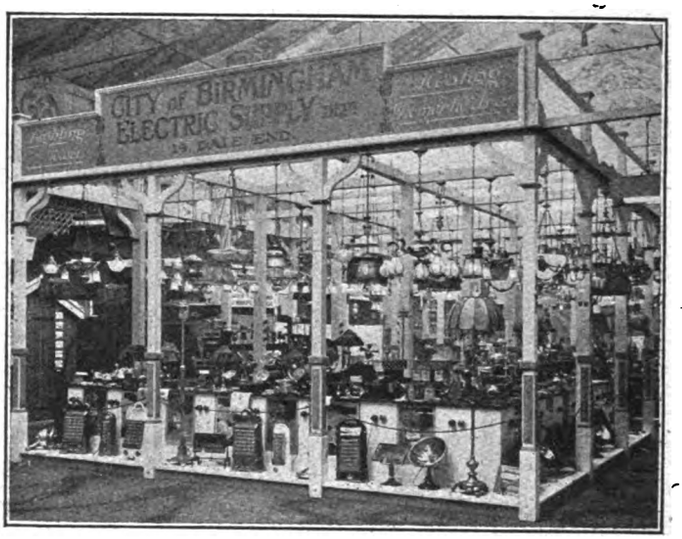
Power Station Economy.

We are asked to state that the analyses and summaries of fuel consumption and units generated for the year ended March 31st, 1922, which are made to the Electricity Commissioners under the provisions of Section 270 of the Electricity (Supply) Act of 1919, can be obtained on application to the Secretary, Electricity Commission, Gwydyr House, Whitehall, London, S.W.1. Reference is made to this useful publication in our leading article.

National Trades Exhibition.

Birmingham Electric Supply Department's Stand.

The Birmingham Corporation Electric Supply Department is to be congratulated on the excellent stand which it has arranged at the National Trades and Industrial Exhibition, now in progress at Bingley Hall. The following eight firms are showing their productions on the stand :—British Brass Fittings, Ltd., British Thomson-Houston Co., Callenders Cable and Construction Co., Edison Swan Electric Co., General Electric Co., Hobart Manufacturing Co., Metropolitan-Vickers Electrical Co., Veritys, Ltd.



A GENERAL VIEW OF THE STAND.

As may be imagined from the above list, the display of electrical goods is extremely comprehensive. It includes electric light fittings of all kinds, and the latest developments in cooking and heating apparatus, vacuum cleaners, etc. Wireless sets, valve and crystal, are well represented, and on the heavier side there are electric motors, drills and other electrically driven machinery.

Mr. W. Y. Anderson, commercial engineer to the department, informs us that over 250 000 people have visited the stand.

Long Distance Telephony.

Mr. F. Gill on Recent Progress.

Speaking at the annual dinner of the Association of Engineers-in-charge in London on Saturday, Mr. F. GILL referred to the tremendous strides in recent years as the result of telephone research. Twenty-one years ago one could speak about 30 miles by cable and 400 miles by open wire. Now one could speak about 2 000 miles over the cable and certainly 10 000 miles over an open wire. The voice could be repeated 23 times and yet be perfectly recognisable at the far end. These things were saving more than £10 000 000 per annum.

A few months ago a speech was wirelessed from New York to this country. The energy put into the transmitting gear was magnified ten million times. He did not believe there was any other system of magnification on such a scale giving a recognisable result.

He did not think we spent enough money here on research. He believed there was no limit to the profit we could get out of research, but apart from profit it meant a lessening of human effort and an increase in health and happiness. In his profession the man who remained in knowledge where he was fifteen years ago was down and out.

Institution Notes.

The council of the BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE is nominating Sir David Bruce as president of the Association at its meeting in Toronto in 1924.

The annual meeting of the IRON AND STEEL INSTITUTE will be held on May 10th and 11th at the Institution of Civil Engineers, Great George Street, London, S.W. The annual dinner will be held at the Connaught Rooms on the evening of May 10th.

The secretary of the ELECTRICAL CONTRACTORS ASSOCIATION intimates that tickets for the forthcoming annual dinner on April 24th can only be supplied to members of the Association for themselves and their friends. It is suggested, therefore, that those who wish to be present should get in touch with a member of the E.C.A.

At a general meeting of the members of the ROYAL INSTITUTION on Monday the Duke of Northumberland, president, in the chair, a resolution of condolence with Lady Dewar on the death of Sir James Dewar was moved by the president and carried unanimously. Mr. Arrol Moir, Prof. A. O. Rankine, Lady Wallace, and Miss Williamson were elected members.

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Electricity Supply.

Extensions and Developments.

Extensions of feeders for the general network are to be carried out at SWANSEA at a cost of £7 000.

BATH Electric Light Committee advises the provision of new mains at a cost of £7 577. A loan of £10 000 is proposed.

LEICESTER City Council has adopted the report of the Electricity Committee, recommending a new 10 000 kW set at a cost of £210 000.

ABERDEEN Town Council is applying to the Commissioners for additional borrowing powers to the extent of £154 000 for extensions at the electricity works.

An expenditure of £145 000 on plant extensions at BRADFORD Corporation Electricity Works is proposed, subject to the necessary borrowing powers being obtained.

BLACKPOOL'S Town Clerk has had an interview with the Electricity Commissioners, who are not prepared favourably to entertain any application for extension of generating plant at St. Anne's electricity works.

WORTHING Council is applying for sanction to a loan of £32 000 in respect of extensions to the plant at the electricity generating station, extensions to the buildings, and the renewal of the whole of the original distribution mains in the town.

BLACKPOOL Electricity Committee has decided to scrap the old type 4 000 kW "Willans" steam turbine at the electricity works and substitute a 1 250 kW high speed geared turbine, the electrical engineer to obtain tenders and the cost to be charged against the electric light reserve fund.

HACKNEY Electricity Committee recommends the replacement of ten underground feeder boxes with overground feeder pillars at a cost of £1 500; also an extension of the buildings, plant and switchgear at the Dalston Lane sub-station at a cost of £14 850. A Bruce Peebles-La Cour converter is to be installed.

DONCASTER Town Council has applied to the Commissioners for loans of £7 650 for a new 1 250 kW rotary converter, with h. and l.t. switchgear, and £18 750 for mains, services, and meters. A further loan of £2 808 has been applied for for mains and services, in connection with the housing scheme of Bentley Urban Council.

The TUNBRIDGE WELLS borough electrical engineer, Mr. R. N. Torpy, in a report to the Town Council recommends a change in the system of generation and supply at an estimated cost of £56 943. The scheme involves the provision of two new 1 500 kW sets and switchboard, and a change of the system from 2 000 V, 67·5 cycles to 6 600 V, 50 cycles, thus bringing the system more into line with modern practice.

Alterations in Charges, Proposed and Actual.

EASTBOURNE Town Council has reduced the lighting charge by 1d. per kWh.

NUNEATON Town Council has agreed to reductions in lighting and power charges as follows: Lighting, 7d. to 6½d. per kWh; power, 1¾d. to 1½d. per kWh.

COLCHESTER Town Council has reduced the charge for electricity for private and public lighting by 1d. per kWh, for general power by ½d., and for tramways by ¼d.

The following reductions in charges are to be made at WINCHESTER as from the date of the meter readings for the present quarter: Lighting, from 8½d. to 7½d. per kWh; power, from 4·2d. to 4d. per kWh; heating and cooking to remain at 1¾d. per kWh.

MELTON MOWBRAY Urban District Council is to make application to the Ministry of Transport for a further revision in the charges of the Melton Electric Light Co. as from September 15th next. The average price now charged is 10·5d. per kWh for lighting and 3·33d. per kWh for power.

BEDFORD Town Council has adopted the following revised scale of charges: Lighting, a general reduction of 1d. per kWh, less 2½ per cent. for prompt payments of accounts; heating and cooking and electric appliances, first 200 kWh per quarter, 1½d. per kWh, next 500, 1¼d. per kWh, beyond, 1d. per kWh, less 2½ per cent. Each consumer will be charged a minimum of 5s. per quarter exclusive of meter rent.

Tapping New Areas.

TITCHFIELD Parish Council has asked Fareham U.D.C. to consider the advisability of applying for powers to extend their present boundaries of electricity supply, with a view to embracing Titchfield.

WOOLWICH Borough Council has agreed to give a supply of electricity in bulk during a period of 20 years to the Dartford and Bexley Urban Councils, and a loan to cover the cost has been applied for.

SIDMOUTH Urban Council has received application for a supply of electricity in Bickwell Valley, and has decided to circularise the residents at that place in order to ascertain the probable number of consumers.

The Commissioners have advised TREDEGAR Urban Council to ascertain from the South Wales Electrical Power Distribution Co. their terms for supplying electricity in bulk, and the Council has adopted this course.

MARKET HARBOROUGH Urban Council has completed a canvass with the object of securing a supply of electricity from Kettering. The Kettering Council asked for a guarantee of 100 consumers. The canvass has shown over 200, and steps are to be taken to obtain an order to enable electricity to be supplied to the town.

HELSTON Town Council has accepted the offer of a London firm of water-power engineers to prepare a scheme of electric lighting by water power. The Commissioners have intimated to the Council that they might be prepared to consent to such a scheme if it was shown that the Council could generate power more cheaply than it could be supplied in bulk by a Cornwall company, whose charge, it was estimated, would be from 1s. to 1s. 3d. per kWh to consumers.

Inquiries and Orders.

The Minister of Transport proposes to confirm a Special Order authorising MOLD Urban District Council to supply electricity in Mold urban district. Objections to the Secretary, Ministry of Transport, Whitehall, London, by April 28th.

The SHERBORNE ELECTRIC SUPPLY CO., LTD., have applied to the Electricity Commissioners for a Special Order to supply electricity in Sherborne urban and rural districts. Objections to the Secretary, Electricity Commission, Whitehall, London, by April 23rd.

The WESTERN ELECTRIC DISTRIBUTING CORPORATION, Ltd., have applied to the Electricity Commissioners for a Special Order authorising supply of electricity in Malmesbury borough and rural district. Objections to the Secretary, Electricity Commission, Whitehall, London, by April 17th.

The DERBYSHIRE AND NOTTINGHAMSHIRE ELECTRIC POWER CO. have applied to the Electricity Commissioners for a Special Order to supply electricity in Sutton-in-Ashfield, Huthwaite and Kirkby-in-Ashfield urban districts, Basford, Skegby and Blackwell rural districts. Objections to the Secretary, Electricity Commission, Whitehall, London, by April 23rd.

Obituary.

Sydney Gedge.

Prominent in the formation of W. T. Henley's Telegraph Works Co., in 1880, and chairman of the board of directors from that date until 1917, Mr. SYDNEY GEDGE died at his residence at Mitcham Hall, Surrey, on Friday last. He was 93 years of age and was founder of the firm of Gedge, Fiske and Gedge, solicitors. Latterly, although retaining his seat on the board of W. T. Henley's Telegraph Works Co. (Sir George Sutton succeeded him as chairman in 1917), he had taken little part in business, devoting his life to religious and charitable work, his record in this respect being a long and honourable one.

Personal Items.

Mr. J. GREEN has been appointed engineer in connection with the Holywood (Co. Down) electric lighting scheme.

Mr. HARRY S. ELLIS has been appointed chief engineer and general manager of the West Gloucestershire Power Co.

We learn with pleasure that Mr. C. O. MILTON, electrical engineer to Maidenhead Corporation, is making a good recovery from his recent serious illness.

Mr. P. J. BAKER has been appointed acting manager of the Southampton Corporation Tramways. He has been works superintendent for the past two years.

Mr. CHARLES FURNESS was on Monday presented with a mahogany wardrobe and set of vases by the staff of Blackpool Electricity department, on the occasion of his completing 21 years' service as electrical engineer and tramways manager.

Sir PHILIP DAWSON, as Master of the Patternmakers' Company, last week headed a deputation of representatives of the Rubber Boot and Shoe Trade of Great Britain which attended at Buckingham Palace and presented a wedding gift to Lady Elizabeth Bowes-Lyon.

Accrington Electricity Committee has passed a resolution placing on record "high appreciation of Alderman T. E. HIGHAM'S untiring and successful efforts on behalf of Accrington and associated undertakings at the recent inquiry at Preston relative to the proposed formation of a joint electricity undertaking."

Mr. JAMES SMITH, who has retired from the post of assistant superintendent in the Telegraph Department of the G.P.O., Edinburgh, after 30 years' service, was entertained on Saturday evening by his late colleagues, and presented with a solid silver tea service. Major Jayne, the controller of the Telegraph Department, presided.

Mr. DANIEL THOMAS has retired from the post of assistant superintendent of telegraphs, General Post Office, Edinburgh, after 46 years' service. During the Nile Expedition he was attached to the Army telegraphs, and was awarded the Egyptian medal with clasp and the Khedive star, while for his services in the South African war he received the Queen's medal with four clasps.

Mr. T. DAWSON CLOTHIER was last week presented by the Mayor of Bootle at a meeting of the Town Council with an illuminated testimonial, passed under the borough seal. Mr. Clothier has, as already announced, retired from the position of borough electrical engineer, upon the handing over of the Bootle undertaking to Liverpool. He proposes to go to South Africa, where he will continue to practise as an engineer.

Mr. F. CHARLES RAPHAEL, who severed his connection with the Edison Swan Electric Co. last September, is now carrying on his consulting practice at St. Paul's Chambers, 19, Ludgate Hill, London, E.C.4 (telephone Central 3387). He will be pleased to receive catalogues, particularly from manufacturers of electric light fittings and accessories, electric domestic appliances, cable, testing instruments, wireless instruments and material.

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Foreign Notes.

AFRICA.

Diesel-Electric Engines in Tunis.

The Bone-Guelma Railway Co. of Tunis possesses a main line of normal continental gauge and subsidiary lines of narrow gauge. These latter run as far south as Gabes, as well as serving a number of branches on the company's system, says "The Engineer."

In order to improve the local service of this railway, the Administration of Public Works has elected to commence by introducing auxiliary trains propelled by ELECTRIC MOTORS WORKED BY INTERNAL COMBUSTION ENGINES. Should results warrant—and there appears to be little doubt to the contrary—there will be ample scope for extension throughout the whole of the company's narrow gauge districts and eventually to the main lines. At the present time the idea has materialised in the way of a small experiment to augment the traffic between Tunis and Hamman-el-Lif, a run of about twelve miles without gradients worth mentioning.

Trial runs of a Diesel-electric locomotive took place during the latter days of February, and, being considered satisfactory, a train was added to the regular time-table on March 1st. The firm that secured this preliminary order is Swedish, the engine being a 120 B.H.P. Polar. Being used on the same routes as steam locomotives, it is necessary to ensure a speed as great as that already obtained by them, and it is also essential that the smallest trains shall have a capacity of at least 100 passengers. The engine runs on mazout —crude oil—and the consumption of fuel is estimated at 500 grammes per kilometre run, which represents a very important saving in comparison with the steam engines, which burn at least 6 to 7 kg. of briquettes per kilometre. The *personnel*, moreover, is reduced by the elimination of the stoker. The capacity on the level is stated to be 60 km. per hour with a load of 40 tons, the load in question being counted as five small coaches with 130 seats.

Should the results be favourable, it is the intention of the Administration to order a second locomotive, of at least 210 to 250 B.H.P., in order to continue the experiments. The reason given for placing the order abroad is that the Administration was faced with the difficulty, both technical and financial, arising from the fact that no French constructor could furnish sufficient proof of satisfactory performance of this type of traction. Under these conditions it would appear that the future field is more or less open to all serious competitors who can furnish the guarantees and references necessary to inspire confidence.

EUROPE.

Demand for Electric Stoves in Spain.

"The European Commercial" reports a considerable demand for electric heating stoves in the provinces of Alava, Guipozcoa and Vizcaya (Spain).

Dutch Railway Electrification.

The question of the electrification of the railway between Rotterdam and Amsterdam was discussed on March 13th by Mr. J. J. W. Van Loenen-Martinet, chief of the Electric Traction Department of the NETHERLANDS STATE RAILWAYS, before The Hague section of the Netherlands Association of Railway Officials. He stated that on the advice of the Committee of Inquiry it had been decided to adopt the d.c. system, at 1 500 V, although this pressure could be doubled if necessary in the future.

Armstrong, Whitworth & Co. in Belgium.

The Brussels correspondent of the Exchange Telegraph Co. states that Sir W. G. ARMSTRONG, WHITWORTH AND CO. have formed a Belgian subsidiary with the title Compagnie Belge Armstrong, Whitworth Société Anonyme and a capital of 100 000 francs, divided into 200 shares of 500 francs each. It is expected that the company will not manufacture under its own name but will probably hold various agencies of the mother company.

Switzerland and Surplus Electric Power.

Certain Italian interests, it is stated, have expressed the fear that Switzerland, finding her production of electric power above her requirements, may attempt to EXPORT THE SURPLUS TO NEIGHBOURING COUNTRIES. To France the export of energy has been current for some time, while to Italy it is only threatened. Everything here depends on the quick growth of the new Italian plants, as if works are delayed recourse to Swiss production to meet the demand may prove necessary. Where, however, the feared competition is perhaps more seriously envisaged is in the eventuality of Switzerland, in attempting to sell her surplus production, trying to undersell the Italian concerns, and even inaugurating a system of "dumping" in competition with Italian electric power companies.

THE FAR EAST.

Automatic Telephones in Manchuria.

A cable from Dairen, Manchuria, states that the telephone service in that city was switched over on March 31st to a new automatic plant of 5 200 lines, which has been manufactured and installed by the AUTOMATIC TELEPHONE MANUFACTURING CO. Over 5 000 subscribers' telephones were simultaneously changed over from the old manual exchange to the new automatic equipment. The value of the equipment supplied is well over 1 500 000 yen (equal to about £160 000). The contract for the installation was negotiated with the Japanese Government, acting on behalf of the Kwantung Government.

U.S.A.

Control of the De Forest Co.

A report from New York states that prominent banking and automobile interests have purchased the control of the De Forest Radio, Telephone and Telegraph Co.

Imperial Notes.

AUSTRALIA.

Electricity Supply News.

AUBURN (N.S.W.) Municipal Council have entered into an agreement with Sydney City Council for a supply of electricity in Auburn. The work of installing the mains will probably be completed in four or five months.

The Victorian State Electricity Commission have discussed with the Public Works Department the question of establishing hydro-electric works for supplying current in the MOUNT BUFFALO CHALET, Victoria, and a survey party has commenced to make investigations.

On the occasion of the opening of the electric supply for Wentworthville district, the Lord Mayor of Sydney said the influence of the CHEAP POWER available in the other States, in competition with NEW SOUTH WALES for industrial supremacy, appeared as a menace to New South Wales. Their daily consumption of coal was 500 tons, and would be 600 tons in June next. There would have to be a reduction in the cost of coal if they were to maintain their industrial supremacy in the State.

CANADA.

Government Royalty on Exported Electricity.

The Montreal correspondent of the "Daily Telegraph" states that the Quebec Government, which is expending enormous sums on the rapid development of the hydro-electric resources of the province, announces the adoption of the principle of charging a royalty of 50c. per H.P. for electricity exported from the province. It is not stated whether the royalty will be immediately effective on the water powers already leased, although it will be applied to such leases in the future. Several large hydro-electric plants now nearing completion will pay many thousands of dollars in royalties annually.

Winnipeg Electric Railway Results.

The gross earnings in 1922 of the Winnipeg Electric Railway Co. were $5 395 223 (against $5 418 024 in 1921), and operating expenses, before charging depreciation, $3 526 715 (against 3 569 380), leaving net operating revenue of $1 868 508 (against $1 858 644). Miscellaneous income amounted to $121 853 (against $161 406); giving a total available to meet fixed charges, etc. of $1 990 362 (against $2 020 050). After meeting these charges, there is a net income of $935 374 (against $928 965), excluding depreciation. The sum of $201 050 is deducted for depreciation, leaving an available balance, including $2 047 790 brought forward, of $2 782 114. After meeting the dividends on the 7 per cent. preferred stock ($210 000), providing for additional depreciation ($138 459), and placing $56 550 to sinking fund, there remains a surplus to be carried forward of $2 377 106.

INDIA.

Electric Traction Developments.

The MADRAS ELECTRIC TRAMWAYS CO. are said to be considering the possibility of working tramway extensions in Madras by means of gas engines.

BOMBAY CORPORATION have passed a resolution, that with a view to taking some practical step at an early date towards launching a scheme for tube railways the Municipal Commissioner be requested to put himself in communication with the Great Indian Peninsula and Bombay, Baroda and Central India Railway Companies through the Government, and failing them with outside agencies, who might undertake the construction of such tube railways.

SOUTH AFRICA.

Supply and Traction Developments.

A site of a new DURBAN electric power station has been selected at Congella.

PAARL (Cape Province), ratepayers have rejected the proposed £55 000 electricity supply scheme.

JOHANNESBURG Corporation will spend in the near future £400 000 on road construction, tramway and electricity supply extensions and sewerage.

The "British and South African Export Gazette" states that the town of Molteno (Cape Province), is to have an electricity supply scheme, and tenders have been invited for generating plant and other power-station equipment.

Electrically heated iron plates are being provided in AMSTERDAM to warm the feet of policemen engaged on point duty.

For the year ended December 31st, 1922, the revenue of the GUERNSEY STATES TELEPHONE DEPARTMENT was £13 680 and the expenditure £13 262, the credit balance on the year's working amounting to £418. During the year 194 new subscribers were connected.

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Wireless News.

A Third Receiving Licence Probable.

It seems probable that the position of the user of the "home-made" receiving set will shortly be regularised by the issue of a third licence. Mr. J. C. W. REITH intimated on Tuesday that the British Broadcasting Co. would agree to such a course, and that the National Association of Radio Manufacturers and the Radio Society of Great Britain had also agreed. It is suggested that the fee for this licence shall be £1—15s. of which shall go to the B.B.C. to meet the cost of broadcasting. The company also suggest that the wireless sets thus licensed shall be constructed from British raw material, and that the complete set shall not be capable of reaction.

Mr. REITH on Tuesday also replied to the criticisms which have lately been given prominence in certain sections of the daily Press. Membership of the British Broadcasting Co., he said, was open to any *bona fide* British manufacturer of wireless apparatus. He denied that there was any monopoly, and said that already practically 600 companies had either joined or their applications were in hand.

Radio Corporation of America.

There are some striking figures in the report of the RADIO CORPORATION OF AMERICA for 1922. The gross income jumped from $4 160 800 to $14 830 900, income from the marine branch rising by 14 per cent., and from transoceanic communication by 36 per cent. The most striking increase, however, has been in sales, which advanced from $1 468 900 to $11 286 500, a result entirely due to the demand for wireless receiving sets. Such a result reflects the highest credit on the technical staff of the company, whose efforts were concentrated on the production of receiving apparatus embodying the latest improvements.

The opinions expressed in the report as to the future of broadcasting are interesting. It is stated that broadcasting "is here to stay . . . and will ultimately extend throughout the entire civilised world." The conclusion arrived at is that broadcasting must ultimately be organised along national lines. "The questions of who eventually is to do broadcasting, or of how it is to be paid for and of how to utilise the available wave-lengths so that the greatest good will come to the greatest number must be answered before broadcasting can be put upon an enduring and satisfactory basis."

In spite of the increase in its revenue, the Corporation has not yet reached the dividend-paying stage. Operating and administration expenses increased from $3 762 200 to $12 126 500, and, after allowing for sundry credits, the net income for the year was $2 974 600, as against $426 800. In 1921 the whole of the net income was placed to the reserve for amortisation of patents, and was below the required level, and this time no less than $2 480 600 is devoted to the same purpose, partly to make up for the previous year's deficiency. Of the residue, $270 000 is set aside for Federal income tax, and $224 000 is utilised in writing down organisation expenses.

Ceylon Wireless Station Condemned.

Lieut. Dick, wireless expert of H.M.S. "Southampton," who inspected the WIRELESS STATION AT COLOMBO at the request of the Ceylon Government, has submitted his report. He says the station is out of date and incapable of coping with the traffic with which it has to deal. The Government has ordered apparatus for continuous wave working, by the use of which it is hoped that the range of the station will be improved and the screening effects reduced.

Wireless Experiments Difficulties.

The Radio Society's Manifesto.

We have received from the RADIO SOCIETY OF GREAT BRITAIN, an organisation representing about 160 wireless societies and 30 000 persons, a memorandum on broadcasting which has recently been handed to the Postmaster-General. This memorandum states that the study of wireless is one of the best gateways to electrical knowledge, and the Society can therefore claim that its activities are in the highest degree of national importance. Being absolutely disinterested, it welcomed the advent of broadcasting, especially as it was hoped that some of those who begin by "listening-in" might be led on to take a thoughtful interest in wireless science.

Broadcasting and Experimenting Disabilities.

But three or four months' experience of broadcasting have brought unexpected consequences. Reception has become difficult or impossible in certain districts, and the restrictions imposed on license holders have been increased. The principal ways in which the members of the Society have been adversely affected is by the forming of experimental receiving stations, by the hampering of the work of experimental transmitting stations, by the prohibition imposed by the broadcasting regulations on the improvement of the apparatus, by the restriction of the granting of experimental licences, and by the lowering of the standard of manufacture owing to the sale of apparatus in sealed cases.

Some Technical Suggestions for Improvements.

To overcome these difficulties it is suggested that :—

1. The broadcasting stations should be prohibited from emitting high-frequency harmonics or overtones, and should be restricted absolutely to their proper wavelengths.
2. The power to be employed should not be allowed to exceed an allotted figure.
3. Modern methods of modulation should be made compulsory.
4. More blank hours should be arranged for the use of students of wireless, especially on Sundays, and the hours fixed should be adhered to. For the benefit of the listener-in, the blank hours might be taken in rotation by the various broadcasting stations.

Four Kinds of Licence.

It is also suggested that four kinds of licence should be :—

1. The broadcasting licence for use with apparatus marked B.B.C., fee 10s.
2. The experimental licence at a low fee for qualified persons not listening-in to the broadcasting transmissions, say, 10s.
3. The listening-in licence allowing the use of any apparatus, bought or home-made, for the purpose of listening-in, fee 20s.
4. A licence for hotels, restaurants, cinemas, etc., costing £5 or £10.

The Society cannot accept the suggestion that any form of license should be dependant on only B.B.C. apparatus being purchased, though a restriction to the purchase of British-made equipment might be permitted. The issue of transmitting licences for transmitting purposes should not be affected by these suggestions.

"The Wireless Monopoly."

Astonishing Discovery by a Legal Luminary.

The "Daily Express" has discovered, or rather a legal correspondent has discovered for it, that "the whole fabric of wireless broadcasting is based on an illegality." Under the Wireless Telegraphy Act of 1904 "nothing shall prevent any person from making or using any electrical apparatus for actuating machinery or for any purpose other than the transmission of messages." Receiving apparatus is therefore, according to our contemporary's legal correspondent, immune from licence, and anyone prosecuted for receiving without a licence should get a case stated for decision in the High Court (how these lawyers stick together !).

This is all very interesting, but what we should like to have explained, either by the "Daily Express" or by its correspondent or by the Radio Society of Great Britain or by all three, is how any Broadcasting Co. is going to conduct programmes without revenue. It is all very well to demand freedom from monopoly in selling, but who will buy wireless apparatus if there is no broadcasting ? The only way out of the difficulty that we can see is to provide State broadcasting, and surely the "Daily Express" would not like that.

Books Received.

"Line Charts for Engineers." By W. N. Rose, B.Sc. (London : Chapman and Hall). Pp. 95. 6s. net.

"Wireless Component Parts." Edited by Bernard E. Jones. London : (Cassell and Co.). Pp. 123. 1s. 6d. net.

"Elektrotechnische Messinstrumente." By Conrad Gruhn. Second Edition. (Berlin : Julius Springer.) Pp. 223. 5s. 4d.

"Aide-Mémoire and Schémas de l'Entrepreneur-Electricien." By P. Maurer. (Paris : Dunod.) Pp. 620. 30 francs.

"The Stock Exchange Year-Book, 1923." (London : Thomas Skinner and Co., Old Broad Street). Pp. lviii+3 172. 50s. net.

"Costing Organisation for Engineers." By E. W. Workman. B.Sc. (London : Sir Isaac Pitman and Sons). Pp. 82. 3s. 6d, net.

"Anleitungen zum Arbeiten im Elektrotechnischen Laboratorium. By E. Orlich. (Berlin : Julius Springer.) Pp. 96. 2s. 1d.

"A First Course in Heat Engines." By J. W. Hayward, M.Sc., A.M.I.M.E. Second Edition. (London : University Tutorial Press). Pp. 271. 4s.

"Printing Telegraph Systems and Mechanisms." By H. H. Harrison, A.M.I.E.E. (London : Longmans, Green and Co.). Pp. xii+435. 21s. net.

"The Technology of Slate." By Oliver Bowles. Bulletin 218. Issued by the U.S. Department of the Interior. (Washington : Government Printing Office.)

"Tait's Electrical Directory of Australia and New Zealand," 1923 Edition. Fifth Issue. (Melbourne : Tait's Publishing Co. 90, William Street.) Pp. 224. 6s.

"Abridged Scientific Publications from the Research Laboratory of the Eastman Kodak Co." Vol. V. 1921. (Rochester, New York : Eastman Kodak Co.) Pp. 172.

"Prospecting and Testing for Oil and Gas." By R. E. Collom. Bulletin 201. Issued by the U.S. Department of the Interior. (Washington : Government Printing Office.)

"Economic Combustion of Waste Fuels." By D. M. Myers. Technical Paper 279. Issued by the U.S. Department of the Interior. (Washington : Government Printing Office.)

"Monographs on Mineral Resources, with Special Reference to the British Empire. Copper Ores." By Robert Allen, M.A., B.Sc. Issued by the Imperial Institute. (London : John Murray, Albemarle Street.) Pp. 221. 7s. 6d. net.

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Tenders Invited and Accepted.

UNITED KINGDOM.

PRESTON ELECTRICITY COMMITTEE.—(*a*) Two 500 kW rotary converters, with transformers and switchgear; (*b*) e.h.t. and l.t. paper insulated cables. Particulars from the Borough Electrical Engineer.

SALFORD CORPORATION, April 16th.—Tramway points and crossings. Particulars from General Manager of Tramways Department.

EDINBURGH CORPORATION, April 16th.—Twelve months' supply of electricity meters. Particulars from Engineer and Manager of Electricity Department.

DOUGLAS (ISLE OF MAN) CORPORATION, April 17th.—Lighting equipment for (1) cable depot, (2) Crescent stables, (3) Strathallan stables, and (4) Derby Castle car shed. Specification from the Tramways Manager.

HULL CORPORATION, April 17th.—Repairs to tramway track, including electric welding of joints and hammered rails. Particulars from the City Engineer.

SCUNTHORPE AND FRODINGHAM URBAN DISTRICT COUNCIL, April 18th.—Electrical recorders, telephones, lighting plant and wiring in connection with waterworks extensions contract No. 6, and air compressor, etc., in connection with contract No. 7. Specifications from the Engineer, Council Offices, Scunthorpe.

BUXTON CORPORATION. April 21st.—(*a*) Storage battery, (*b*) automatic reversible booster, with exciters and switchgear. Specification from Borough Electrical Engineer.

WESLEYAN CHURCH, IDLE, April 21st.—Electric wiring and fitting in chapel and school. Particulars from the Caretaker, 26, Albert Avenue, Idle.

CARLISLE CORPORATION, April 23rd.—High and low pressure, paper insulated, lead-covered cables. Schedule, etc., from the City Electrical Engineer.

GLASGOW CORPORATION, April 23rd.—One year's supply of cast-iron boxes, section pillars, oils, paints, varnishes, iron tubes, etc., for the Electricity Department. Forms of tender from Mr. R. B. Mitchell, 75, Waterloo Street, Glasgow.

CARDIFF CORPORATION, April 25th.—Supply and erection of (1) water-tube boiler, (2) steel chimney, (3) induced-draught plant. Specifications from the City Electrical Engineer. Tenders are required only from contractors on the King's National Roll.

TORQUAY CORPORATION, April 27th.—15-ton overhead travelling crane for Newton Abbot power station. Specification from Borough Electrical Engineer, Torquay.

COMMISSIONERS OF H.M. WORKS, ETC. April 27th.—Heating installations at (1) Holborn Telephone Exchange, London, and (2) the Post Office, Maidenhead. Forms of tender, etc., from the Contracts Branch, King Charles Street, S.W.1.

REIGATE CORPORATION, April 30th.—(*a*) Transformers, (*b*) switchgear. Specifications from Mr. C. H. Wordingham, 7, Victoria Street, London, S.W.1, and 33, Brazennose Street, Manchester.

STOKE-ON-TRENT CORPORATION, May 16th.—5 000 kW turbo-alternator, and condensing plant. Specifications, etc., from the Borough Electrical Engineers, St. Peter's Chambers, Stoke-on-Trent.

IRELAND.

HOLYWOOD URBAN DISTRICT COUNCIL, April 19th.—Oil-driven electric generating plant. Specification from Town Clerk, Town Hall, Holywood, co. Down.

BELFAST TRAMWAYS COMMITTEE, April 21st.—Reconstruction of 11½ miles of single-track tramway. Specification from Manager of Tramways Department.

ST. JOSEPH INSTITUTE FOR THE DEAF AND DUMB, CABRA, April 21st.—(1) Overhead service and lines from Dublin supply mains; (2) internal wiring and fittings. Specifications, etc., can be seen at the Institute.

NEW ZEALAND.

POST AND TELEGRAPH DEPARTMENT, WELLINGTON, May 22nd*—Wall and desk central battery telephones.

PUBLIC WORKS DEPARTMENT, WELLINGTON, June 12th.*—Storage battery, motor generator, booster and switchboard.

BRAMLEY GUARDIANS have accepted the tender of A. V. Creasly for wiring and fitting the Board offices, Armley, Leeds.

For a battery for an electric vehicle, MAIDSTONE CORPORATION have accepted the tender of the D.P. Battery Co., £201 7s.

ILFORD COUNCIL have accepted the tender of C. H. Johnson and Son for a portable coal elevator for the electricity works, at £181.

The Ganz-Danubius Engineering Works, Budapest, have a contract for two electric locomotives for the PARIS ORLEANS RAILWAY.

ESSEX COUNTY COUNCIL have accepted the tender of E. Beckwith and Co., for electric light, wiring and fitting at Black Notley Sanatorium, £510 13s. 6d.

The Siluminite Insulator Co. have secured a contract for track insulators for the LONDON ELECTRIC RAILWAY COMPANIES' Golder's Green to Edgware line.

The tender of the British Thomson-Houston Co. for a 7 500 kW turbo-alternator and air and oil-cooling plant, at £19 565, has been accepted by WOLVERHAMPTON CORPORATION.

ROTHERHAM CORPORATION have placed contracts with Steel, Peech and Tozer for 300 tons of tramway rails at £14 a ton, and Hadfields, Ltd., for points and crossings, £595.

* Particulars from the Department of Overseas Trade.

Electric Traction.

Tramway Extensions and Developments.

GLASGOW Corporation has abandoned the proposed scheme for a tramway from Giffnock to Mearns.

LIVERPOOL City Council has ratified the decision of the Tramways Committee abolishing the first-class tram fares.

The WOLVERHAMPTON scheme for the substitution of trolley buses for the present trams on the Wednesfield route is estimated to cost £15 328.

An agreement has been reached between ABERDARE District Council and the tramway employees with regard to Sunday work. The men are to be paid time-and-a-half.

WEST HARTLEPOOL Corporation give notice of intention to promote a Bill in Parliament to authorise the provision and working of trolly vehicles partly in the borough and partly in Hartlepool rural district.

STOCKPORT Corporation has given formal notice of its intention to exercise the option of purchasing the overhead electric equipment of the tramways in Stockport and Heaton Norris, leased to Manchester Corporation.

Mr. C. Furness, BLACKPOOL'S tramway manager, has been authorised to obtain tenders for the supply of four new tramcars, and to reconstruct four old cars at Rigby Road engineering shops. Application to be made for sanction to borrow £14 000.

Work has commenced on the reconstruction of the main London-Brighton road at CROYDON. The tramway track is to be relaid at a cost of £120 000. The system will link up with the L.C.C. lines at Norbury, so that through cars may be run from London to Purley.

Complete satisfaction is expressed with the working of the specially designed car with covered top-deck on the CARDIFF Corporation tramways, to which we referred last week. The cost of the car was £1 783, and it is proposed to purchase others of the same type.

At the monthly meeting of BELFAST Corporation on April 4th it was reported that rapid progress was being made with the reconstruction of the tramway track. If the Corporation could get £20 000 or £30 000 from the unemployment grant the work could be completed in the coming summer. As a result of very strong representation on the subject, a promise of some reduction in tram fares at an early date was given.

Fares, Receipts and Passengers.

Fare reductions on the WALLASEY tramways bring the rates down to those in force in 1918-19. The 1d. and 1½d. stages are lengthened.

SOUTHPORT Corporation Tramways Committee proposes to charge a 3d. return fare for journeys costing 2d. single. The introduction of penny fares is stated to be impracticable.

DONCASTER Tramway Committee is instituting reduced fares between 9.15 a.m. and 11.45 a.m., and between 2.15 p.m. and 4.30 p.m., for three months as an experiment.

GLASGOW tramways manager is to report as soon as possible at the close of the financial year as to the financial position of the system and the propriety of reducing the fares.

The receipts of LYTHAM ST. ANNES tramways at Easter amounted to £1 470 as compared with £1 342 last year, and the passengers carried increased from 98 500 to over 100 000.

During the year ended March 31st BOURNEMOUTH Corporation tramways carried 24 541 231 passengers, an increase of 1 534 227. Receipts amounted to £209 799, an increase of £3 743.

It is reported that the Ministry of Transport has extended to March, 1924, the order authorising the present fares on the WORCESTER tramways. The City Council urged that fares should be reduced.

AT BLACKBURN Town Council, on April 5th, Alderman Higham, chairman of the Tramways Committee, said it was impossible, on present running costs, to revert to penny stages. During Easter the trams carried 29 223 more passengers than at Easter, 1922.

Electric Railway Items.

It is stated that house building schemes are being undertaken in the West Kirby district, in anticipation of the early electrification of the WIRRAL RAILWAY.

The UNDERGROUND Co. has placed two further contracts for escalators, one with the Foundation Company, Ltd., for escalators at Moorgate Street, at a cost of £42 574, and with J. Cochrane and Sons, for escalators at Shepherd's Bush, costing £21 709. The escalators at Moorgate Street are to be completed in nine months' time and at Shepherd's Bush in seven months' time. The scheme of new works on the Underground also provides for escalators at Clapham Common, Clapham Road, Stockwell, Oval, Old Street, Oxford Circus, Bond Street, Tottenham Court Road, Bank, Trafalgar Square and Elephant and Castle. These improvements will cost altogether nearly £1 000 000.

The lapsed scheme for a light railway from BARNOLDSWICK to GISBURN was mentioned at Barnoldswick Council, on April 4th, when a letter was read from the Parliamentary solicitors, stating that at a recent interview the railway companies were friendly to the scheme, and they asked what the local feeling was. The chairman thought it inopportune to reopen the matter considering the condition of trade. Mr. W. E. Harper (chairman of the Finance Committee) thought the original scheme was impossible. The scheme should be carried out by the railway company and not by an independent company. It was decided to refer the solicitors to the promoters of the lapsed scheme.

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Companies' Meetings, Reports, etc.

ALLEY AND MACLELLAN, LTD.—Dividends declared of 6 per cent. on the ordinary and 5½ per cent. on the preference shares.

EASTERN TELEGRAPH CO.—Payment will be made by warrants on May 1st of interest for the half-year ending April 30th on the 4 per cent. mortgage debenture stock.

HADFIELDS, LTD.—Final dividend recommended of 6d. per share, making 5 per cent. for the year, tax free. The dividend for 1920 and 1921 was at the same rate, against 10 per cent. in 1919.

The following companies were STRUCK OFF THE REGISTER OF JOINT STOCK COMPANIES on March 20th:—Caerphilly Electric Supply Co., Cylectric Cookers, Marlborough Electric Supply Co., Reincke's Wireless Telephones.

THE STOCK EXCHANGE COMMITTEE have ordered 830 000 £1 fully paid 6 per cent. cumulative preference shares and £190 000 5½ per cent. redeemable debenture stock of the Yorkshire Electric Power Company to be quoted in the Official List.

PRITCHETT AND GOLD AND E.P.S. CO.—Dividend recommended of 10 per cent., free of tax, on the ordinary shares, placing £15 493 to general reserve, £3 332 to special depreciation of plants, and carrying forward £30 438, subject to income and corporation taxes.

The STOCK EXCHANGE COMMITTEE have granted official quotations to 1 000 000 £1 fully-paid ordinary, and 380 605 £1 fully-paid 4½ per cent. cumulative preference shares of the Metropolitan Electric Supply Co., Ltd., and 830 000 £1 fully-paid 6 per cent. cumulative preference shares, and £190 000 5½ per cent. redeemable debenture stock of the Yorkshire Electric Power Company.

CONSOLIDATED SIGNAL CO.—The directors announce that as the Westinghouse Brake and Saxby Signal Co., from whom the whole of the income is practically derived, has not paid a dividend in respect of the year to September 30th, 1922, they do not see their way to pay the usual preference dividend of 3 per cent. They propose, however, to make a distribution of 1½ per cent., less tax, which will absorb practically the whole of the cash at present available, and to defer until the end of the current year the question of a further distribution.

Supply and Lighting.

SCARBOROUGH ELECTRIC SUPPLY CO.—Dividend recommended of 5 per cent., less tax, carrying forward £6 316. The profit for 1922 was £15 108, plus £7 613 brought forward.

CHISWICK ELECTRICITY SUPPLY CORPORATION.—Dividend recommended of 10 per cent., placing £8 000 to depreciation reserve and carrying forward £2 621. The total revenue for 1922 was £49 827, against £43 722 in 1921.

YORKTOWN AND BLACKWATER GAS AND ELECTRIC LIGHTING CO.—Dividends declared of 12½ per cent. on the "original" shares and 8 per cent. on the "old" and "additional" shares, all less tax. The credit balance for the year was £10 559.

Traction Companies' Results.

RHONDDA TRAMWAYS CO.—Dividend recommended of 5 per cent. on the preference shares, placing £6 591 to reserve and renewals, and carrying £1 880 forward.

TYNEMOUTH AND DISTRICT ELECTRIC TRACTION CO.—Dividend proposed of 10 per cent. on the ordinary shares, carrying forward £4 454 (against £6 488 brought in). The revenue for 1922 was £39 431 and the expenditure £35 299.

BRITISH AUTOMOBILE TRACTION CO.—Dividends of 10 per cent. declared on the participating preference and on the ordinary shares, placing £10 000 to reserve and carrying forward £20 824, subject to corporation profits tax. The amount available for 1922 was £61 171 compared with £49 637 for 1921.

BATH ELECTRIC TRAMWAYS, LTD.—The profit for 1922, after deducting £20 480 for repairs and renewals and £2 416 for income tax, and including £2 234 brought forward, was £17 253. After providing £5 396 interest on Debenture stock, £1 000 for instalment of sinking fund and dividend on preference shares, £5 000 transferred to contingencies and renewals account, there remains £2 107 to be carried forward to provide for contingencies and replacements.

New Companies.

COLISEUM ENGINE CO., LTD.—Reg. March 28th. Cap., £100 in 2s. shares. Mechanical and electrical engineers, tool makers, machinists, etc. Reg. office: 30, Finsbury Court, London, E.C.

SWIFT MANUFACTURING CO., LTD.—Private. Reg. March 9th. Cap., £100 in £1 shares. Importers and exporters of all electrical accessories and appliances, etc. Reg. office: 94, Stoke Newington Road, London, N.16.

COMPTOPHONE, LTD.—Private. Reg. March 21st. Cap., £2 000 in £1 shares. Manufacturers and suppliers of machinery, apparatus, fittings and accessories for wireless telephones and telegraphs, etc. Reg. office: 90, Wardour Street, London, W.1.

STEVENSTON AND DISTRICT ELECTRICAL SUPPLIES CO., LTD.—Private. Reg. in Edinburgh April 4th. Cap., £500 in £1 shares. Electrical and electric lighting engineers, plumbers, gasfitters, contractors, etc. Reg. office: 83, New Street, Stevenston, Ayrshire.

RADIO PRODUCTS, LTD.—Private. Reg. March 28th. Cap., £250 in 244 "A" shares of £1 each and 120 "B" shares of 1s. each. Electrical engineers, including wireless radio, X-ray and allied sciences and arts, etc. Reg. office: 55, Broad Street Avenue, London, E.C.2.

ETHER, LTD.—Private. Reg. March 23rd. Cap., £500 in £1 shares. Patentees, factors, manufacturers' and general commission agents, etc.: to acquire any interests in inventions relating to wireless telegraphy or telephony, etc. Reg. office: Halford Street, Smethwick, Staffs.

IRON AND NICKEL BATTERY CO., LTD.—Private. Reg. March 21st. Cap., £500 in £1 shares. Vendors and manufacturers of iron and nickel batteries, accumulators and spare parts, electrical engineers, etc. Reg. office: 301, Abbey House, Victoria Street, Westminster, London, S.W.1.

HARDWARE AND ELECTRICAL CO., LTD.—Private. Reg. March 28th. Cap., £100 in £1 shares. Hardware and enamel dealers, importers and exporters of and dealers in household furniture, ironmongery and fittings, radio, wireless and electrical engineers, etc. Reg. office: 707, Finchley Road, London, N.W.

THAMES ELECTRIC WIRELESS CO., LTD.—Private. Reg. March 29th. Cap., £100 in £1 shares. Electrical, mechanical and general engineers and contractors, manufacturers of and dealers in wireless, radio, electrical and scientific instruments and machines, etc. Reg. office: 40, Old Town, Clapham, London, S.W.4.

A. W. KNIGHT, LTD.—Private. Reg. April 4th. Cap., £2 000 in £1 shares. To take over the business of radio and electrical engineers and mineralogists carried on by A. W. Knight and H. J. Bywaters as "Knight and Bywaters." A. W. Knight, 26, Stanbury Road, London, S.E.15; radio engineer, is a permanent director.

BEAVER ELECTRICAL SUPPLY CO., LTD.—Private. Reg. March 29th. Cap., £1 000 in £1 shares. Mechanical and electrical engineers, machinists, electro-platers, manufacturers of and dealers in apparatus used in connection with wireless telegraphy and telephony, hardware, etc. Reg. office: 109, Regent Street, London, W.1.

FALLON CONDENSER MANUFACTURING CO., LTD.—Private. Reg. March 29th. Cap., £1 000 in £1 shares. Manufacturers, importers and exporters of and wholesale and retail dealers in radio-telephonic and telegraphic appliances, accessories, supplies and devices, etc. Reg. office: 230A, Hermitage Road, London, N.4.

LEAD HYDRATE BATTERY CO., LTD.—Private. Reg. March 27th. Cap., £500 in £1 shares. To acquire the business of a battery and accumulator manufacturers carried on by F. J. Sykes, J. C. Sykes, W. H. Smith and T. J. Bulley, at 26, Voltaire Road, Clapham, as the "Lead Hydrate Battery Co." Reg. office: 26, Voltaire Road, Clapham, London, S.W.4.

VENNER GRILLS, LTD.—Private. Reg. March 27th. Cap., £8 000 in £1 shares. To adopt an agreement with B. G. Battson, J. F. Woosnam and H. G. White for the purchase of a licence to manufacture, make, use, exercise and vend electrical heating and cooking apparatus under Letters Patent granted to R. F. Venner. Reg. office: 215, Piccadilly, London, W.1.

WIRELESS DEVELOPMENT SYNDICATE LTD.—Reg. March 28th. Cap., £1 000 in 5s. shares (2 000 preference and 2 000 ordinary). Manufacturers of and dealers in drawn wire electric cabling and electric lamps, and all articles made from tungsten, molybdenum and other metal, manufacturers of electrical instruments and appliances and metal products, etc. E. Holwill, Temple Chambers, London, E.C.4, merchant, is a director.

G. E. MORTLEY SPRAGUE AND CO., LTD.—Private. Reg. March 26th. Cap., £7 000 in £1 shares. (6 250 ordinary and 750 non-cumulative participating 7 per cent. preference.) To adopt an agreement with G. E. Mortley and W. Sprague, and to carry on the business of manufacturers of, agents for or dealers in supplies of electrical, mechanical, hydraulic, radio-telephone, wireless telegraph and motor engineers, etc. Reg. office: 46, Nelson Road, Tunbridge Wells.

RUBON, LTD.—Private. Reg. March 27th. Cap., £100 in £1 shares. To experiment with, manufacture and develop methods and means of light, heating and ignition, produce and destroy gases, produce neutralising effects by electrical, chemical or mechanical means, and to use, manufacture, aid in and turn to acccount by-products and waste material, and to carry on the business of builders and contractors, decorators, etc. Reg. office: 31, Fitzroy Square, London, W.1.

Business Items.

The telephone number of H. WILLIAMS AND CO., Red Lion Works, Warner Street, London, E.C.1, has been changed to Clerkenwell 6528.

The electrical department of the Victoria Brass Foundry Co., Edinburgh, will in future be known as the VICTORIA ELECTRICAL ENGINEERING CO., with office and works at Bonnington Road Lane. Mr. J. M. Devine will continue as manager.

Mr. R. E. Kimens, Commercial Secretary to H.M. Legation at Warsaw will be in attendance at the Department of Overseas Trade for one week commencing on April 18th. During that period he is prepared to interview by appointment United Kingdom manufacturers and merchants interested in TRADE WITH POLAND. Application for interviews with Mr. Kimens should be addressed without delay to the Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. The reference 4672 T.G. should be quoted in all applications.

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Reference Index to Recent Wireless Publications.

R.000. RADIO COMMUNICATION (GENERAL)

Notable Achievement in Radio Telephony (*Electrical World*, 81, p. 141, January 20th, 1923).
Reference to the Transatlantic Experiments at New Southgate and New York. R.001.
Wireless telephony has bridged the Atlantic (*La Nature*, 51, Supplement, p. 33, February 3rd, 1923).
Telephony between London and New York. R.001.
O. H. Kesler. This Radio Bill We're Hearing About (*Radio Broadcast*, 2, pp. 282-286, February, 1923). R.007.
S. W. Stratton. Proper Radio Legislation is Urgently Needed (*Radio Broadcast*, 2, p. 310, February, 1923). R.007.
O. H. Kesler. Famous Radio Patents (*Radio Broadcast*, 2, pp. 407-413, March, 1923). R.008.
The Research Laboratories of the General Electric Company at Wembley (*Wireless World and Radio Review*, 11, pp. 775-776, March 10th, 1923). R.010/307.
A Glossary of Terms used in Wireless Telegraphy and Telephony (*Modern Wireless*, 1, pp. 198 and 207, April, 1923). R.030.
The Radio Conference (*Wireless World and Radio Review*, 11, pp. 587-588, February 3rd, 1923). R.060.
The British Wireless Relay League (*Wireless World and Radio Review*, 11, p. 706, February 24th, 1923). R.060.
R. F. Gowen. Teaching the Chinese Radio (*Radio Broadcast*, 2, pp. 381-386, March, 1923). R.070.
Starting Wireless—A beginner's advice to beginners (*Model Engineer*, 48, pp. 69-71, January 18th, 1923). R.070.
J. A. Tomkins. Wavelength Abacs. Simplifying Inductance and Capacity Calculations (*Wireless World and Radio Review*, 11, pp. 823-825, March 24th, 1923). R.080.
P. Gibbs. The Future of Wireless (*Popular Wireless*, 1, p. 130, March 17th, 1923). R.090.
Who Invented Super-Regeneration (*Wireless World and Radio Review*, 11, p. 830, March 24th, 1923). R.000.
The Origin of Wireless Telegraphy (*The Broadcaster*, 1, pp. 84-85, April, 1923). R.091.

R.100. RADIO PRINCIPLES AND THEORY

T. Bialolijeski. On the Theory of Metallic Conduction (*Philosophical Magazine*, 45, pp. 161-168, January, 1923). R.100.
G. G. Blake. The Elementary Principles of Radio Telephony (*Wireless World*, 11, pp. 726-729, March 3rd; pp. 757-761, March 10th, 1923). R.100.
J. A. Fleming. Electrons, Electric Waves and Wireless Telephony (*Wireless World and Radio Review*, 11, pp. 466-472, January 6th; pp. 498-500, January 13th; pp. 528-531, January 20th; pp. 562-565, January 27th; pp. 596-600, February 3rd; pp. 626-629, February 10th; pp. 666-668, February 17th, 1923). R.100.
J. A. Fleming. Electrons, Electric Waves and Wireless Telephony (*Radio News*, 4, pp. 1 614-1 617, March, 1923). R.100.
O. Lodge. The Transmission of Wireless Waves (*Modern Wireless*, 1, pp. 9-10, February; pp. 101-103, March, 1923; pp. 179-182, April, 1923). R.110/113.
G. H. Daly. When Signals Fade (*Popular Wireless*, 3, p. 178, March 24th, 1923). R.113.
Long-distance Radio Telephony (*Nature*, 3, p. 123, January 27th, 1923).
Tests being made at New Southgate works of Western Electric Co., Ltd.; daily measurements of intensity of signals and atmospherics. R.113.
R.Tingey; J. A. Fleming. Transatlantic short-wave transmission (*Wireless World and Radio Review*, 11, pp. 640-641, February 10th, 1923).
Correspondence *re* mode of transmission of short-waves over large distances. R.113.
S. R. Winters. The Washington Monument as Radio Antenna (*Wireless Age*, 10, p. 59, March, 1923). R.113/129.
W. H. Eccles. The Problem of Atmospherics and some Suggestions for Experimental Investigations (*Wireless World and Radio Review*, 11, pp. 662-665, February 17th, 1923). R.114.
R. A. Watson Watt. Directional Observations of Atmospheric Disturbances (*Proceedings of the Royal Society*, 102A, pp. 462-478, January, 1923). R.114.
The Antennæ. The Transmitting Station's Radiating System (*Wireless World and Radio Review*, 11, pp. 652-655, February 17th, 1923). R.121.
J. O. Warner. Experiments with the Two Plate Condenser Antenna (*Radio News*, 4, pp. 1 618-1 620, March, 1923).
Gives results of tests made at Bureau of Standards. Curves of signal strength, effective capacity and resistance are given with comparisons with loop aerials. R.122/322.
Frame Aerials in Radio Reception (*Wireless World and Radio Review*, 11, pp. 555-559, February 27th, 1923). R.124.
Wireless Telegraphy—The frame aerial; the collector of waves (*La Nature*, 51, pp. 13-14, Supplement, January 13th, 1923).
Instructional Article. R.124.
J. F. Johnston. *Re* Double Reaction (*Modern Wireless*, 1, p. 207, April, 1923). R.134.
J. Scott-Taggart. A new Double-Reaction Circuit (*Modern Wireless*, 1, pp. 205-206, April, 1923). R.134.
G. G. Blake. The Elementary Principles of Radiotelephony (*Wireless World and Radio Review*, 11, pp. 757-761, March 10th, 1923). R. 150/160.
The Poulsen Arc (*Modern Wireless*, 1, pp. 171-174, April, 1923). R.153.

R.200. RADIO MEASUREMENTS AND STANDARDISATION.

Development of Radio Standards. Institute of Radio Engineers and American Institute of Electrical Engineers to Co-operate in a Standardisation Programme (*Wireless Age*, 10, pp. 55-56, March, 1923). R.200.
S. C. Hooper. The Navy's example in Standardisation (*Radio Broadcast*, 2, pp. 387-3A, March, 1923). R.200.
O. Lodge. A plea for Easy Specification (*Popular Wireless*, 3, p. 156, March 24th, 1923). R.201.
Secondary Standardisation of Radio Wave-meters (*Electrical World*, 81, p. 114, January 13th, 1923). R.210.
J. E. Anderson. Measuring the Capacity of an Aerial (*Radio News*, 4, p. 1 653, March, 1923). R.220.
O. Lodge. Comparison of the Absolute Magnitudes of Capacity and Self-Induction (*Popular Wireless*, 3, p. 103, March 17th, 1923). R.220/230.
R. R. Batcher. Litzendraht v. Solid Wire (*Radio Broadcast*, 2, pp. 319-320, February, 1923). R.240.
D. J. O'Conor. How Synthetic Insulation is Made and Used (*Radio Broadcast*, 2, pp. 414-415, March, 1923). R.281.

R.300. APPARATUS AND EQUIPMENT.

The Exhibition of the Physical Society of London (*Wireless World and Radio Review*, 11, pp. 534-535, January 20th, 1923). R.306.
The Manchester All-British Wireless Exhibition (*Wireless World and Radio Review*, 11, p. 835, March 24th, 1923). R.306.
The New York Radio Show (*Radio News*, 4, pp. 1 632-1 633, March, 1923). R.306.
Wireless Exhibits at the Model Engineer Exhibition (*Model Engineer*, 48, pp. 122-125, February 1st, 1923). R.306.
B. Mittell. Your Aerial (*Modern Wireless*, 1, pp. 91-94, March, 1923). R.321.
Another New Electron Tube (*Electrical World*, 81, p. 261, February 3rd, 1923). R.330.
Dry Cell Vacuum Tubes (*Scientific American*, 128, p. 136, February, 1923). R.330.
J. A. Fleming. The Thermionic Valve—Its Development and its Application to Wireless (*Wireless World and Radio Review*, 11, pp. 693-694, February 24th, 1923). R.330.
Notes on the WD-11 Tube (*Radio News*, 4, p. 1 651, March, 1923). R.330.
100 kW and 1 000 kW thermionic valves (*La Nature*, 51, p. 17, Supplement, January 20th, 1923).
An account of developments in valves due to the Western Electric Co. R.330.
"Dry-cell" Tubes for Receiving (*Radio Broadcast*, 2, pp. 267-268, February, 1923). R.331.
A New Non-Interfering Detector Tube (*Radio News*, 4, pp. 1 622-1 623, March, 1923).
Describes and gives results of tests on a receiving valve using a liquid sodium electrode invented by H. P. Doyle. R.331.
A New Type of Power Tube (*Radio Broadcast*, 2, p. 269, February, 1923). R.331.
The Making of a Thermionic Valve (*Model Engineer*, 48, pp. 96-97, January 25th, 1923). R.331.
Research Staff General Electric Company. Cathode Disintegration (*Philosophical Magazine*, 45, pp. 98-112, January, 1923). R.331.
S. Edgar. The Radio Flivver (*Radio News*, 4, pp. 1 624-1 625, March, 1923).
Describes a simple super-regenerative receiver, using the descriptive term applied to it by Major E. H. Armstrong. R.343.
P. D. Tyers. The Negatron (*Modern Wireless*, 1, pp. 167-169, April, 1923). R.334.
Power Transmission by Electron Tubes (*Radio Broadcast*, 2, pp. 271-272, February 1923). R.340/581.
A New Non-interfering Detector Valve (*Modern Wireless*, 1, pp. 161-162, April, 1923). R.341.
A. H. Curtis. Intervalve Transformers (*Modern Wireless*, 1, pp. 95-96, March; p. 177, April, 1923). R.342.
A. H. Lynch. Radio-Frequency Amplification (*Radio Broadcast*, 2, pp. 393-397, March, 1923). R.342.
P. W. Harris. The "Conquest" Wireless Magnifier (*Conquest*, 4, pp. 142-144, February, 1923). R.342.
Radio Frequency Amplifiers (*Scientific American*, 128, p. 120, February, 1923). R.342.
J. H. Reeves. Semi-aperiodic H.F. Transformers (*Wireless World*, 11, pp. 681-684, February 24th; pp. 720-723, March 3rd, 1923). R.342.
J Scott-Taggart. High-Frequency Amplification (*Modern Wireless*, 1, pp. 186-193, April, 1923). R.342.
F. M. Squire. Making Tubes do Double Duty (*Radio Broadcast*, 2, pp. 297-302, February, 1923). R.342.
M. Wolf. Rectified A.C. for Plates of Amplifier Tubes (*Wireless Age*, 10, pp. 69-70, March, 1923). R.342.
F. J. Andrews. A Bulb Receiver using rectified Alternating Current (*Radio News*, 4, p. 1 632, March, 1923). R.343.
P. F. Godley. A Super Sensitive Long-Range Receiver (*Radio Broadcast*, 2, pp. 330-335, February, 1923). R.343.
J. O. Haley. Unrectified a.c. for Receiving (*Wireless Age*, 10, p. 71, March, 1923). R.343.
P. Hemardinquer. A curious receiving apparatus (*La Nature*, 51, p. 15, Supplement, January 13th, 1923).
Receiving set mounted to look like a table lamp, in bronze, with silk shade, and consists of a three-stage amplifier, detector and two low frequency valves. R.343.
T. L. Hogg. Notes on the Armstrong Super (*Wireless World and Radio Review*, 11, pp. 755-756, March 10th, 1923). R.343.
A. W. Miller. A.C. for Receiving Tubes (*Wireless Age*, 10, p. 70, March, 1923). R.343.
Notes on the "Conquest" Receiver (*Conquest*, 4, p. 145, February, 1923). R.343.
J. Scott-Taggart. Some new Dual Amplification Circuits (*Modern Wireless*, 1, pp. 87-90, March, 1923). R.343.
J. Weinberger. Selectivity of Single Circuit Regenerative Tuners (*Wireless Age*, 10, pp. 60-62, March, 1923). R.343.
Two unusual Single-valve Circuits (*Model Engineer*, 48, p. 180, February 15th, 1923). R.343.
J. Scott-Taggart. Choke-Control Modulation (*Modern Wireless*, 1, pp. 97-99, March, 1923). R.345.
R. W. King. Telephoning to England (*Radio Broadcast*, 2, pp. 425-426, March, 1923). R.346.
N. J. Rohan. Radio—the "Knocker-Up" (*The Broadcaster*, 1, pp. 29-32, April, 1923). R.359/367.
H. Chadwick. A Transatlantic Receiving Set (*Modern Wireless*, 1, pp. 124-128, March, 1923). R.360.

R.500. APPLICATIONS OF RADIO.

G. Scott. "Seeing" a World's Series by Radio (*Wireless Age*, 10, pp. 31-32, November, 1922). R.550.
W. Seeley. How Broadcasting is Rendering a Stupendous Service in the Remoulding of Rural Life, Aiding Farmers to Produce at a Profit and Increasing Everybody's Prosperity (*Wireless Age*, 10, pp. 24-26, January, 1923). R.550/534/556.
H. F. Shoemaker. Ship Concerts Broadcast to Canadian Exposition (*Wireless Age*, 10, pp. 63-64, November, 1922). R.550.
R. H. White. The London Station of the British Broadcasting Company (*Wireless World and Radio Review*, 11, pp. 389-392, December 23rd, 1922). R.550/610.
2 LO's "Hello Man" (*Popular Wireless*, 1, p. 727, January 6th, 1923). R.550.
P. J. Risdon. Radio in the next Great War (*Popular Wireless*, 1, p. 675, December 23rd, 1922). R.560.
R. Phillips. Wireless Control of Mechanism (*Broadcaster*, 1, pp. 360-362, January, 1923). R.570.
Finger Prints by Radio. Enlisting the Long Arm of Radio in the search for Europe's Malefactors (*Scientific American*, 127, p. 386, December, 1922). R.580.
Wireless Transmission of Power (*Wireless Age*, 10, p. 17, November, 1922). R.581.
C. H. Claudy. Motion Pictures by Radio. The Promise of "Movie" Broadcasts, with Receiving Stations in Every Home (*Scientific American*, 127, p. 320. November, 1922). R.582.
S. O'Connor. Seeing by Wireless (*Popular Wireless*, 1, p. 685, December 23rd, 1922). R.582.

R.700. RADIO MANUFACTURING.

Practical information for the Wireless Dealer (*The Wireless Trader Supplement to the Photographic Dealer*, 36, p. iv., November, 1922). R.700.
S. R. Winters. The Radio Corporation's New President (*Wireless Age*, 10, pp. 47-50 January, 1923). R.700.
M. B. Sleeper. Distributing Problems of Radio Manufacturers (*Wireless World and Radio Review*, 11, pp. 401-402, December 23rd, 1922). R.740.

R.800. NON-RADIO BUT ALLIED SUBJECTS.

A. V. Ballhatchet. Notes on the l.t. Current (*Model Engineer and Electrician*, 48, pp. 45-46, January 11th, 1923). R.800.
G. H. Daly. A Radio Guide Cable (*Popular Wireless*, 1, p. 628, December 9th, 1922). R.800.
Greeting for the Prince of Wales (*Wireless World and Radio Review*, 11, p. 442, December 30th, 1922). R.800.
G. H. Dacy. Taking the Riddles out of Radio (*Scientific American*, 126, pp. 298-299, May, 1922). R.800.
H. M. Towne. When lightning flashes nearby. What Electrical Storms mean to the Radio Antenna (*Wireless Age*, 10, pp. 56-58, January, 1923). R.800

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Commercial Intelligence.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

B. N. B. WIRELESS, LTD., Liverpool.—Registered March 29th. £300 debenture, to J. McCurdy, 19, Cressingham Road, New Brighton, master mariner. General charge.

CAMBRIDGE ELECTRIC SUPPLY CO., LTD.—Registered April 3rd. £550 debentures, balance of £3 000. General charge. Also registered April 3rd, £30 000 C debentures and premium of 2 per cent. (including £13 000 already registered). General charge. *£57 450. March 14th, 1923.

GAYNER (STANLEY) AND CO., LTD., Cardiff, electrical engineers. —Registered March 28th. £750 debentures, General charge. *Nil. December 14th, 1922.

TEIGNMOUTH ELECTRIC LICHTING CO., LTD.—Registered March 24th. £800 debentures, part of £5 000. General charge.

WHITSTABLE ELECTRIC CO., LTD.—Registered March 27th. £250 debentures, part of £10 000. General charge. *£5 366 13s. 4d. December 23rd, 1918.

Receivership.

WHITSTABLE ELECTRIC CO., LTD.—S. G. Leech, of 11, Dacre Street, Westminster, S W., ceased to act as Receiver or Manager on March 23, 1923.

Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

WM. J. FERGUSON (REDDITCH), LTD., electrical and mechanical engineers, Redditch. A meeting of creditors has confirmed the voluntary liquidation of the company, with Mr. W. J. Ferguson as liquidator, a committee of three of the principal creditors being also appointed. The statement of affairs shows liabilities of £607, the indebtedness to the trade being £256, and net assets estimated to realise £156. At the date of the passing of the resolution for voluntary liquidation the Ediswan Electric Co. and the English Electric and Siemens Co. were in possession.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Companies Winding-up.

LEITNER ELECTRICAL CO., LTD., Maybury, Woking, Surrey Last day for receiving proofs, April 21st. Liquidator, H. E. Burgess, Senior Official Receiver and Liquidator, 33, Carey Street, Lincoln's Inn, London, W.C.2.

STANDARD ELECTRIC SIGN CO., LTD., 62, Oxford Street, London, W.1. Meetings of creditors, April 17th, 11.30 a.m., and contributories, 12.30 p.m., Bankruptcy Buildings, Carey Street, Lincoln's Inn, London, W.C.2.

Bankruptcy Information.

CONTAMIN, L., 9, Wingate Road, Hammersmith, London, electrical engineer. Receiving order, March 27th. Creditor's petition. First meeting, April 16th, 12.30 p.m., and public examination, June 14th, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

Partnerships Dissolved.

R. M. BAKER AND CO. (Richard Maurice BAKER and Allan Mair TOD), electrical engineers, 1, McLean's Buildings, New Street Square, London, by mutual consent as from March 25th, 1923. Debts received and paid by R. M. Baker, who continues the business.

GRIFFITHS, Humphrey Thomas, and TIDD, Cyril, electrical engineers, 17, Duke Street, Leicester, by mutual consent as from March 10th, 1923. Debts received and paid by C. Tidd.

TURTON AND LUCKETT (John William TURTON and Thomas Cyril LUCKETT), electrical engineers, Banbury, Oxford, by mutual consent as from November 30th, 1922. Debts received and paid by T. C. Luckett, at No. 57, High Street, Banbury.

The GENERAL ELECTRIC Co. is among the firms belonging to the Industrial Welfare Society which have been invited to nominate one of their boy workers to attend the wedding of the Duke of York.

The new "FARADAY" was taken to sea on April 6th and 7th for her trials. These were highly successful, a speed of about 13 knots being obtained, the machinery working very smoothly throughout.

Forty Years Ago.

"The Electrician," April 14th, 1883.

SOLENOID.—It may be news to some of our younger readers to know that our word solenoid is derived from the Greek σώλην, a tube.

THE QUESTION OF THE WIRES.—The Marylebone Vestry have resolved to send a deputation to wait on the Government with reference to the liability of local authorities for the safety of overhead wires, and as to whether they have the power to stop the erection of such wires.

TATE'S ELECTRICAL ENGINE STOPPER.—At a recent meeting of the Royal Society of Arts, at Edinburgh, the report of a committee which was appointed some time since to examine and report upon Tate's electric valve-closing apparatus was submitted. The report stated that this invention seemed admirably adapted for the purpose specially in view—viz., the immediate stoppage of machinery in the event of an accident, either to the machinery itself or to persons employed. The value and importance of an arrangement, the report proceeded, by which the actuating power in large mills could be rapidly controlled and brought to a stand, could not, in the opinion of the committee, be over-estimated. The facility with which this could be accomplished from any part of the factory, however distant from the engine, by the easy and instant application of electricity in the mode proposed by Mr. Tate, appeared to them to merit the highest commendation of the society. This apparatus was described and illustrated in our issue for October 24th, 1882, p. 535 of Vol. IX.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"Soft Furnishings"; "London Window Displays of Soft Goods"; "Sideboards, Old and New."

THE CHEMICAL AGE.—"The Influence of Science on Human Life," by A. R. Tankard; "Technical Chemistry at Edinburgh University"; "Relation of 'Chemists' and 'Pharmacists.'"

THE EUROPEAN COMMERCIAL.—"The International Chamber of Commerce Congress"; "New Polish Foreign Bill Regulations"; "Need for More Modern Plant in Spain."

THE FRUIT GROWER.—"Regulation of Horticultural Imports"; "Presentation to Mr. James Bradnum"; "Food Habits of the Chaffinch."

GARDENING ILLUSTRATED.—"Grafting of Fruit Trees"; "Planting out Wintering Flowering Plants"; "Tufted Pansies."

THE GAS WORLD.—"Meeting of Scottish Gas Managers"; "Gas News from Australia"; "About Gas Calorimetry."

THE HARDWARE TRADE JOURNAL.—"Industrial Falkirk—The Centre of the Light Castings Trade"; "Renovating Hardware Stocks"; "Engineers' Shop Drawings."

Prices of Metals, Chemicals, etc.

TUESDAY, April 10.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£78 10 0	£1 0 0	—
Electro Wirebars	,,	£82 10 0	—	10s. 0d.
H.C. Wire, basis	per lb.	11 7/16d.	—	1/16d.
Sheet	,,	11 3/8d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 3 7/16d.	—	1/16d.
Brass 60/40—				
Rod, basis	,,	7½d.	—	—
Sheet, basis	,,	10½d.	—	—
Wire, basis	,,	11d.	—	—
Pig Iron—				
Cleveland Warrants No. 3	per ton	£6 7 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 10 0	—	—
Lead Pig—				
English	,,	£29 0 0	—	5s. 0d.
Foreign or Colonial	,,	£27 17 6	—	7s. 6d.
Tin—				
Ingot	,,	£214 0 0	—	£5 5 0
Wire, basis	per lb.	2s. 9½d.	—	⅛d.
Aluminium Ingots	per ton	£110 0 0	—	—
Spelter	,,	£35 2 6	—	£1 5 0
Mercury	per bottle	£11 10 0	—	5s. 0d.

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2¾d.
,, (Roll-Brimstone)—,, £7 15s. *Sulphuric Acid* (Pyrites, 168°) per ton, £7 10s.
Copper Sulphate.— ,, £26
Boric Acid (Crystals). ,, £55 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 3½d.; plantation 1st latex, 1s. 4⅛d. to 1s. 4⅝d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

190 847 E. SCHRODER. Electrically welding high-speed steel to tool shanks or bodies. (22/10/21.)
190 857 FALK, STADELMANN AND CO., and E. BARNARD. Globes and their fittings for electric lamps. (7/11/21.)
190 861 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Circuit breakers. (9/11/21.)
187 934 F. KRUPP AKT.-GES. Arc lamps for projecting purposes. (22/10/21.)
172 002 SIEMENS AND HALSKE AKT.-GES. Telephone systems. (23/11/20.)
190 899 J. DAVIS AND SON (DERBY) and C. DAWSON. Means for unlocking magnetically-locked lamps. (14/12/21.) (Addition to 176 203.)
190 902 R. AMBERTON. Resistances. (15/12/21.)
190 906 IGRANIC ELECTRIC CO. (CUTLER-HAMMER MFG. CO.). Thermally-operated circuit controllers. (20/21/21.)
190 908 F. WOOD and H. E. JOHNSON. Electric equipment of motor vehicles of the Ford kind. (27/1/22.)
190 911 A. L. DAVIS. Switch-boxes. (22/12/21.)
173 780 ELEKTRIZITATSWERK LONZA. Process for improving electrolytic mercuric oxide. (8/1/21.)
190 924 A. E. KNOWLES. Electrolytic cells. (12/1/22.)
190 934 ENGLISH ELECTRIC CO, J. W. HOWARD and J. A. St. C. RICHARDSON. Electric transformers. (1/2/22.)
190 940 K. KAISSER. Contact devices working with liquid, especially mercury. (13/2/22.)
190 942 ALBION MOTOR CAR CO. and T. B. MURRAY. Rheostat for controlling electric lights for vehicles. (16/2/22.)
176 381 GES. FUR DRAHTLOSE TELEGRAPHIE. Radio antenna systems. (5/3/21.)
190 953 F. W. PELLANT. Contact lugs for thermionic valves and electric couplings. (11/3/22.)
190 967 M. P. ENYEART. Trolley harps for collecting electricity. (20/4/22.)
180 326 M. BLASI. Electrolytic production of aluminium. (18/5/21.)
186 047 KIRCHHOFF AND CO. and E. OPPEN. Electric gas purifiers. (16/9/21.)
190 988 W. H. ILLINGWORTH. Apparatus involving the use of a number of cut-outs. (26/9/21.) (Divided Application on 189 284.)
191 125 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Wireless signalling receiving systems. (30/9/21.) (Cognate Application 26 431/21.)
191 143 HARVEY FROST AND CO., LTD., and FROST, W. Electrically-heated vulcanising-apparatus. (4/10/21.)
191 148 PHI-KAPPA SYNDICATE and D. WATSON. Electric heating-apparatus. (5/10/21.)
191 151 H. W. SULLIVAN. Submarine telegraph cables. (5/10/21.) (Patent of addition not granted.)
191 157 E. C. HATCHER. Commutators for electric machines. (6/10/21.)
191 159 R. T. SMITH. Inductances and inductance coils. (6/10/21.)
191 161 A. HOUGARDY. Switches. (7/10/21.)
170 834 BRITISH THOMSON-HOUSTON CO. Electron discharge devices. (28/10/21.)
191 184 E. C. R. MARKS, (MCGILL MANUFACTURING CO.) Wall switches. (12/10/21.)
191 195 A. E. WHITE (MAGNETIC POWER TRANSMITTER CO.) Electrical operation of type-bars of typewriters. (18/10/21.)
191 214 H. A. T. PACKFORD. Transformers. (31/10/21.)
191 228 S. G. BROWN. Relays. (11/11/21.)
191 236 A. WEST AND CO., and G. PAGE. Dash-pot regulators. (18/11/21.)
172 640 OPTISCHE ANSTALT C. P. GOERZ AKT.-GES. Electric drives for calculating-machines. (11/12/20.)
191 257 WESTERN ELECTRIC CO. (WESTERN ELECTRIC CO., INC.) Telephone systems. (8/12/21.)
191 273 C. A. M. BUCKLEY. Switches for starting motors. (23/12/21.)
191 275 J. W. V. THURGOOD. Terminals for electric wires or cables. (24/12/21.)
191 278 BROLT, LTD., and W. HOLT. Dimming-device for motor vehicle lamps. (28/12/21.). (Addition to 178 976.)
191 280 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.) Circuit-breakers. (29/12/21.)
191 290 EFANDEM CO., and J. EATON. Electric syrens. (25/1/22.)
191 293 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.) Protective devices such as lightning-arresters. (26/1/22.)
191 297 W. L. LORKIN, E. E. DAGLISH and H. B. SWIFT. Electric generators. (31/1/22.)
191 299 T. HARRISON. Indicators for ships' electric signal lamps. (6/2/22.)
176 354 A. KIESEWALTER. Electric furnace for production of calcium hydride. (Ca H_2.) (3/3/21.)
191 313 R. MICHL. Synchronous motors for driving clockworks. (9/3/22.)
178 095 M. F. H. GOUVERNEUR. Insulators. (7/4/21.)
191 334 C. CONRADTY. Current collector bow for electric vehicles, with turntable carbon slip piece. (13/2/22.)
191 337 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.) Incandescent arc devices. (17/6/22.)
183 119 GENERAL ELECTRIC CO., LTD. Transformation of crystal structure of drawn wires of refractory metals, such as tungsten. (13/7/21.)
191 342 IGRANIC ELECTRIC CO. (CUTLER-HAMMER MANUFACTURING CO.) Controllers for motors. (3/8/22.)
191 427 J. B. TUCKER. Fuse boards. (9/9/21.)
191 430 J. C. GRANT. Telegraphic transmission of pictures. (12/9/21.) (Addition to 178 145.)
191 443 A. M. TAYLOR. Detection and localisation of faults in underground cables. (8/10/21.)
170 008 M. FELDINE. Ignition and lighting generators for automobiles. (8/10/20).

APPLICATIONS FOR PATENTS.

March 26.

8 466 J. E. CHANEY. Low voltage lamp and torch battery protector.
8 468 C. D. ASTON and E. D. GLEDALL. Contact means for potentiometers.
8 491 and 8 492 BRITISH INSULATED AND HELSBY CABLES, L. B. WILSON and S. C. BULLOCK. Electric welding machines.
8 512 C. COX. Crystal detectors.
8 535 B. J. LYNES. Electro-mechanical sound transmitting and reproducing devices.
8 536 A. J. EASTON. Electric kinematagraph projector.
8 540 W. S. DENNETT. Dynamos.
8 541 F. J. H. PHILLIPS. Brushes for electrical machines.
8 574 E. O. BURN. Magnetic power transmission device.
8 584 TILLING-STEVENS MOTORS, LTD., and H. K. WHITEHORN. Control of vehicles with electrical transmission.
8 585 TILLING-STEVENS MOTORS, LTD., and H. K. WHITEHORN. Electric braking of vehicles.
8 586 C. FRENCH. Thermally actuated electric switch.
8 593 BURNDEPT., LTD., and C. F. PHILLIPS. Wireless apparatus.
8 597 COVENTRY AUTOMATIC TELEPHONES (MCBERTY). Machine switching telephone system.

March 27.

8 665 WHIPP AND BOURNE and F. WHIPP. Automatic cut-out and cut-in devices for battery charging.
8 675 LODGE-COTTRELL, LTD. (METALLBANK U. METALLURGISCHE GES.). Mechanically rectifying h.t. polyphase current.
8 680 L. A. C. EWART. Insulator for wireless lead-in.
8 688 S. A. HUSS. Induction coil for wireless telegraphy.
8 694 P. E. CLAY and J. T. MORTON. Magneto contacts or collectors.
8 696 E. POTTER (PERNOT). Means for receiving a.c. signals.
8 702 W. H. SCOTT. Device for opening and closing circuits.
8 718 J. R. QUAIN. Automatic fire alarms.
8 741 E. A. GRAHAM. Sound directing or amplifying horns.
8 747 A. BURLI. Terminal blocks for electric conductors.

March 28.

8 830 WESTINGHOUSE BRAKE AND SAXBY SIGNAL CO. Relays. (29/11/22, U.S.
8 755 H. B. FITZJOHN and J. J. HINE. Wireless aerial.
8 758 D. S. B. SHANNON. Wireless receiving apparatus.
8 762 C., N. C. and R. C. HARRISON and G. NORRIS. Wireless receiving sets.
8 778 T. DE Q. MEARS. Aerials for wireless telegraphy.
8 781 E. O. CATFORD. Operating automatic electric signals.
8 782 J. KYNASTON. Radio receiving apparatus.
8 798 C. E. JACOBS. Wireless headphone supports.
8 812 L. MURPHY. Automatic motor-control.
8 820 A. W. VINCENT. Basket aerials for wireless reception.
8 825 F. BASTOW and and A. E. THORNE. Crystal detector.
8 828 METROPOLITAN-VICKERS ELECTRICAL CO., W. J. BROWN and C. R. BURCH. Wireless telegraphy.
8 829 J. N. ROBINSON. Cut-out insulators. (26/5/22, N.Z.)
8 834 E. BENEDETTI. Preventing sparking in switches.
8 862 GAMEWELL FIRE ALARM TELEGRAPH CO. Signal boxes. (27/12/22, U.S.)
8 866 RADIO PRESS, LTD., A. D. COWPER, and J. SCOTT-TAGGART. Signalling receiving systems.
8 868 RADIO PRESS, LTD., A. D. COWPER and J. SCOTT-TAGGART. Wireless receiving apparatus.
8 872 and 8 873 BRITISH THOMSON-HOUSTON CO. and F. P. WHITAKER. Electric machines.
8 874 H. BARON (ALDENDORFF). Automatic telephone systems.
8 875 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Phase advancers.
8 880 SILUMINITE INSULATOR CO., and W. E. WINDSOR-RICHARDS. Insulators.
8 881 F. H. EELES. Luminous electric signs.
8 887 C. W. MERRICK. Trolley poles and standards for overhead wire systems.

March 29.

8 898 S. H. LONG. Thermionic valve circuits.
8 899 S. H. LONG. Receiving continuous wave wireless signals.
8 901 H. POOLEY AND SON and J. DOBSON. Electrically indicating and recording weights.
8 914 R. V. RAWNSLEY. Operating variable condensers for wireless telegraphy.
8 920 C. R. BELLING and C. L. ARNOLD. Interlocking devices for wall plugs and sockets.
8 965 B. BISCHOF and C. HACCIUS. Refrigerating machines with electric drive. (10/4/22, Switzerland.)
8 966 C. T. A. SHEARER. Regulators for generators, etc.
8 969 J. SPATLEY and E. F. CAVENDER. Commutators for ignition systems of internal combustion engines.
8 973 CROMPTON AND CO. and W. F. JONES. Electric drum-type controllers.
8 975 MASCHINENFABRIK OERLIKON. Device for operation of a circuit breaker. (4/4/22, Switzerland.)
8 985 G. KENT, LTD., A. H. AVERY and D. R. A. PISTOR. Rheostat.
8 990 SOC. ANON. POUR L'EXPLOITATION DES PROCEDES M. LEBLANC-VICKERS. Vacuum tube apparatus. (22/4/22, France.)
8 991 METROPOLITAN-VICKERS ELECTRIC CO. Ventilation of electrical machines. (13/4/22, U.S.)
8 996 WESTERN ELECTRIC CO., W. L. MCPHERSON and C. P. SMITH. Transformers for wireless sets.
8 997 WESTERN ELECTRIC CO. Signalling systems.
8 998 WESTERN ELECTRIC CO. Telephone systems.
9 022 WESTERN UNION TELEGRAPH CO. Cable telegraphy. (23/10/22, U.S.)
9 031 BRITISH THOMSON-HOUSTON CO. Electron discharge apparatus. (8/4/22, U.S.
9 035 L. W. AND C. G. BENNETT. Switches.

Arrangements for the Week.

FRIDAY, APRIL 13th. (To-day.)

ELECTRICAL POWER ENGINEERS' ASSOCIATION.

7 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Lecture on "Power Plant Testing," by Mr. W. M. Selvey.

JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At 39, Victoria Street, London. Paper on "Instrument Equipment of Aeroplanes," by Mr. C. B. Clapham.

ROYAL INSTITUTION OF GREAT BRITAIN.

9 *p.m.* At the Institution, Albemarle Street, London, W.1. Lecture entitled "Studies from a Wireless Laboratory," by Dr. W. H. Eccles.

SATURDAY, APRIL 14th.

BIRMINGHAM AND DISTRICT ELECTRIC CLUB.

7 *p.m.* At the Grand Hotel, Colmore Row, Birmingham. Paper entitled "Engines for Small Electric Generating Plants," by Mr. E. Caudwell.

MONDAY, APRIL 16th.

INSTITUTION OF ELECTRICAL ENGINEERS.
(MERSEY AND NORTH WALES (LIVERPOOL) CENTRE).

7 *p.m.* At the University, Liverpool. Lecture entitled "The Drive of Power Station Auxiliaries," by Messrs. L. Breach and H. Midgley.

TUESDAY, APRIL 17th.

INSTITUTE OF TRANSPORT.

5.30 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. Lecture on "The Prevention of Traffic Accidents," by Mr. H. E. Blain.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.

7.30 *p.m.* At Rankine Hall, 39, Elmbank Crescent, Glasgow. Special General Meeting.

INSTITUTION OF ELECTRICAL ENGINEERS. (NORTH MIDLAND CENTRE.)

8 *p.m.* At the Royal Victoria Hotel, Sheffield. Address by the President of the Institution, Mr. F. Gill, and Smoking Concert.

WEDNESDAY, APRIL 18th.

LIVERPOOL ENGINEERING SOCIETY.

At the Royal Institution, Colquitt Street, Liverpool. Lecture on "Rating of Machinery," by Mr. E. W. Pierce.

FRIDAY, APRIL 20th.

INSTITUTION OF MECHANICAL ENGINEERS.

6 *p.m.* At the Institution, Storey's Gate, St. James's Park, London. General Meeting.

INSTITUTION OF ENGINEERING INSPECTION.

7.30 *p.m.* At the London Society of Arts, John Street, Adelphi, London. Paper on "The Inspection of Ball Bearings," by Mr. C. H. Richardson.

JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette entitled "The Business of Engineering," by Mr. H. N. Munro.

The Editorial, Advertisement and Publishing Offices of "THE ELECTRICIAN" *are at 8, Bouverie Street, London, E.C.4. Telegrams: Benbrotric, Fleet, London. Telephone: City 9852 (6 lines).*

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THE ELECTRICIAN

ESTABLISHED 1861.

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CONTENTS.

Notes of the Week	411	Legal Intelligence	432
Pulverised Fuel Progress	413	Stock Exchange Year Book	432
Telegraph Machinery. A Book Review by Donald Murray	414	Mr. S. Parker Smith's Appointment	432
Automatic Sub-Stations. By L. C. Grant. Illustrated	415	Institution Notes	432
The Control of the Speed and Power Factor of Induction Motors. Illustrated	418	Books Received	432
The X-Ray Examination of Materials	421	Parliamentary Intelligence	433
The B.B.C. Controversy. By Frank W. Challis, M.A.	422	Grimsby Electrical Exhibition	433
Power Factor: Its Technical and Commercial Aspects. By H. E. Yerbury	423	Obituary	433
Advertising in the Engineering Press. By Hugh M. Goody	424	Personal Items	433
A Multi-Speed Automatically-Controlled Cascade Motor Installation. Illustrated	425	I.E.E. North Midland Centre	433
Seven Years' Work of the Conjoint Board	426	Foreign Notes	434
Correspondence	426	Imperial Notes	434
Merchandise to Sell and Profit By. Illustrated	428	Electricity Supply	435
The Woman's Exhibition	430	Tenders Invited and Accepted	436
Women's Engineering Society	430	Electric Traction	437
Electric Power Transmission for Ships	430	Forty Years Ago	437
Municipal Finance	430	Wireless News	437
The London Electricity Scheme	431	Companies' Reports, Dividends, etc.	438
The Budget	431	New Companies	438
E.D.A. Electrical Slogan Competition	431	A Reyrolle Showcard	438
		Business Items	438
		Commercial Intelligence	439
		Prices of Metals, Chemicals, etc.	439
		Patent Record	440
		Arrangements for the Week	440

Notes of the Week.

The Broadcasting Controversy Examined.

The political side of broadcasting has become so complicated by newspaper controversy that members of the electrical industry who are interested in the matter, whether commercially or merely as listeners-in, are liable to have their ideas confused and to experience great difficulty in discovering the rights and wrongs of the case. That this is so we are amply aware, both from conversation and correspondence. We have therefore thought it well that the case for the prosecution and for the defence should be stated in the comparative calm of our columns so that our readers may have the opportunity of judging for themselves the various arguments that have been put forward without these being festooned by extraneous considerations. With that end in view we propounded to Mr. F. W. CHALLIS, secretary of the Electrical Importers' and Traders' Association, a series of questions, and especially asked him how broadcasting would be carried on were the market in sets thrown open, and how sufficient revenue for the obvious needs of the broadcasting authority would be obtained if that were done. Mr. CHALLIS'S reply to these questions is given on another page of this issue, and next week we shall hope to publish the case of the Broadcasting Company, stated by one of their representatives. We shall also, of course, be pleased to have the views of our readers on a matter which is of first-class importance to the electrical industry.

The Case for the Prosecution.

MR. CHALLIS'S case (the case for the prosecution) is briefly as follows: The present system has failed administratively. Both licence fees and royalties are being lost owing to "piracy"; and the revenue would therefore be increased by making the licence fee higher and doing away with royalties altogether. This would enable British apparatus to be sold more cheaply and prevent a most undesirable traffic in B.B.C. transfers, which Mr. CHALLIS states is taking place. It would also remove the injustice of charging the person who wants to improve his apparatus with an unreasonable extra fee and improve the reputation of the trade. Mr. CHALLIS also deals with the question of foreign apparatus. The B.B.C. mark was intended to form a protection against the import of such apparatus. How is that protection to be afforded if that mark disappears? Mr. CHALLIS wishes to call in the aid of the Safeguarding of Industries Act. At present the departmental embargo rather assists than hinders the importer and penalises the listener-in as against the amateur or experimenter. The position, as Mr. CHALLIS remarks, is obscure, but the matter is so important that there should be no delay in clearing it up.

Any Change Must be Fundamental.

In view of the fact that the POSTMASTER-GENERAL will not accept the proposal to obtain the whole of the revenue required from licence fees, Mr. CHALLIS suggests as an alternative the substitution of Government for B.B.C. control as regards manufacturing and dealing and a scale of licences for this service. He also remarks that the revenue so obtained would be sufficient to remunerate the Broadcasting Company and leave something over. This would confine the company's monopoly to broadcasting and give the industry a free hand to manufacture and sell parts. In a word, though there must obviously be control over transmission, there should be free trade in everything else, and the constitution of the Broadcasting Company should be altered to make that possible. We do not propose to comment further on these proposals at the moment, except to say that if there are to be changes they must be fundamental changes. To tinker, as appears to be the tendency at present, would only make matters worse.

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London's Electricity Supply—The Rule Dismissed.

In discharging on Thursday last the rules *nisi* for *certiorari* and prohibition obtained last term by the London Electricity Joint Committee the Lord Chief Justice said that he had come to the conclusion that the companies thought the scheme too good to be true and the object with which these rules were sought was not to quash the scheme, but to make sure that when that which was so much desired had come to pass no one else could question it. We wonder! The judges were, however, mainly concerned with the point that this was not the time to raise the question. "Has a Court of law," said Mr. Justice Avory, "ever been asked to decide the legitimacy of a child in embryo." Mr. Tyldesley Jones thought the child had been born, but the Court held that much had got to happen before that occurred. The result is that after a month's delay we are where we were; or rather not quite for a month has been lost. It is to be hoped there will be no further delay in holding the enquiry, and that all concerned, however foreign it may be to their inclinations, will do their utmost to obtain for London what she has long required—an adequate electricity supply.

The End of a Bad Tax.

We may justly claim that the reduction of the Corporation Profits Tax from 1s. to 6d.—a reduction which is, of course, only a preliminary to abolition—is a great triumph for The Electrician. From its introduction we have opposed this tax as unfair and vicious, operating as it does against a class of trading concerns which should be encouraged rather than handicapped. When it was introduced in 1920, we said it would be "particularly harsh in its operation on young and expanding businesses," and that "to sap the life blood of industry in this way was most harmful." Time has justified our strictures. A year ago we called attention to a particular case of the harm caused to commercial progress by this tax and described it as vicious, inequitable, and discriminating. During the past twelve months we have not grown to like it any better and we shall be greatly relieved to see the last of it. It was an experiment in taxation that was never justified, and it is an experiment which should never be repeated.

The Budget and the Future.

On the whole the Budget will be welcomed by business men. The reduction of the Corporation Profits Tax and the Income Tax will help to stimulate trade, and the allocation of over £126 000 000 out of revenue to debt redemption should have an equally good effect. On the same score the reduction in the rates on letters, printed papers, parcels, and telephone calls will be an assistance, though we could have wished that these reductions might have been extended to newspapers and telegrams. But though Mr. Baldwin's first budget is a good budget and has been hailed as first-class finance, there is still need for persistent effort in the reduction of national expenditure. Money is still being spent by the nation which could be saved, and money is still being spent on services which could be better applied to such matters as education. To ensure that our financial policy is directed along these lines during the coming year should be the duty of all business men.

A Poor Exhibition.

It is to be regretted that the Woman's Exhibition followed so closely at Olympia on the heels of the Ideal Home Exhibition. The electrical industry has, on the whole, fought shy of making a second display within a fortnight or so of the first, and this reluctance is not unnatural in view of the labour and expense which these exhibitions involve. But it is a pity that in an exhibition "with the interests . . . of women as its exclusive appeal" (we quote from the catalogue), electricity makes such a poor show. There are, it is true, one or two excellent stands, but they are so few and far between that the woman who visits the exhibition is bound to come away without any true idea of what electricity can really do for her. This is not as it should be, since it is to women that the engineer must mainly look for the development of his cooking and heating load. The exhibition would have been of far more use to the industry if it had been held in six months' time. Admittedly, every step must be taken for demonstrating publicly the manifold uses of electricity in the domestic sphere, but the trade is evidently of opinion that two exhibitions in six weeks are too much of a good thing.

Wanted—A Slogan.

The British Electrical Development Association have followed our example by starting a competition. They want a slogan; and prizes of ten pounds, five pounds and three pounds respectively are being offered for the three best slogans sent in during the months of May and June. The sort of thing required is some phrase with a something in it that will make people stop, look and think about electricity; for thinking is the first step to using. "Electricity Saves More than It Costs," "Do It the Electric Way," are given as examples of what is required, with the proviso that they do not satisfy all the requirements. These requirements are a few simple words creating a pleasant impression and making some appeal to sentiment or humour. It is not so simple as it sounds. It is often much easier to write 1 500 words than 250, and it is certainly very difficult to compress pleasantness, sentiment, humour and kick into three or four. All the same, we hope a great many people will have a try, and we feel sure the results will be satisfactory to all concerned.

Real Co-operation.

The Year Book of the Commonwealth Edison Co. of Chicago contains an example of real co-operation which might be more widely followed in this country. As we have often pointed out it is the policy of the company to enlist its consumers and employees among its shareholders. This has been carried out with such success that there are now no less than 36 000 names on the share register and one-third of the employees own shares or stock. The company keeps a special staff of salesmen to sell shares and bonds to the middle and industrial classes and easy payment arrangements are in force. At one time it was the custom of the company to come to this country for capital but it is now, very wisely, following an increasing tendency in America and is spreading its capital over its own people. That one-third of the employees are shareholders in the concern for which they work is a revolution in industrial fundamentals and if the working classes of America continue as rapidly as they have done during the past few years in this direction, a condition of stability will be secured which will place that great continent beyond the reach of all the troubles and problems that so sorely afflict the older world. In the supply industry of this country such co-operation might be more difficult, though it is quite possible, but it is an idea which might well be carried out by manufacturing firms.

Result of the First "Electrician" Competition.

The judges have so far completed their examination of the solutions sent in to the "All-Electric" House competition that we are able to announce that the names of the three prize winners will be published in next week's issue of The Electrician. We shall also publish the judge's report on the competition as a whole, and the plans, specifications and other matter which make up the prize-winning solution. We can assure our readers that the report, no less than the solution, will be highly interesting. Perfection has not been attained; it was hardly expected that it would be, but an advance has been made, great interest has been aroused, and the crystallisation of

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ideas which was the main thing we sought from the competition has without doubt been obtained. In such a case standardisation is not to be sought and if sought would not be attained. What can be sought and attained is good practice. We hope that this competition has done something towards that end.

Pulverised Fuel Progress.

It is well known that progress in the employment of pulverised fuel in Europe has lagged considerably behind that in the United States. But during the last few days the situation has been suddenly changed by the order for a pulverised fuel installation on the "Lopulco" system which has been placed by the Union d'Electricité of Paris for their Vitry Station on the Seine. The decision to adopt pulverised fuel at this station is all the more remarkable since at the famous Gennevilliers station—only recently completed and regarded as probably the most efficient plant in Europe—mechanical stoking was adopted throughout, both on the forced draught chain grate and the multiple retort systems.

The New Plant at Vitry.

The new plant at Vitry is to consist of four boilers, each of 16 685 sq. ft. heating surface, with a normal evaporation of 160 000 lb. of water from and at 212° F., and a reasonable overload duty of 185 000 lbs. These boilers will therefore easily be the largest outside the United States; the "Stirling" boilers at Gennevilliers being, it will be remembered, of 132 275 lb. normal evaporation each. The boilers at Vitry are to be constructed by the well-known French firm of Delaunay-Belleville to the general design of the "Ladd" boiler, which type is now running in the United States—in connection with the "Lopulco" system of pulverised fuel—in units far exceeding in size the boilers for Vitry.

The equipment at the latter station is also to include Delaunay-Belleville superheaters, and steel tube economisers of the small tube high velocity positive circulation pattern, with 9 687·6 sq. ft. heating surface. The working pressure is 270 lb. per sq. in., and the guaranteed net working efficiency of the whole installation is no less than 84 per cent., calculated on the higher value of the coal. There seems to be no question, however, that these remarkable results will be obtained without difficulty, since the well known Lakeside installation at Milwaukee of 40 000 kW has been running since December, 1920, on 85 to 86 per cent. efficiency, and monthly bulletins are now being issued of its performance. It is stated, in fact, that with the very latest refinements in pulverised fuel firing, which will be adopted at the Cahokia Station of 240 000 kW, now being erected at St. Louis, the boiler plant efficiency will be 88 per cent.

Essential Features of the System.

The essential features which have made the success of the "Lopulco" system, apart from the triplex burners, coal feed mechanism to the burners, and the design of the furnaces on the multiple retort system, are the water screens to prevent "slagging" of the ash, hollow fire bricks and the new small vertical continuous self-contained drier for the coal, heated by the exit boiler plant gases only.

The Prevention of Slagging.

The "Lopulco" water screen has completely prevented "slagging" troubles—that is, the formation of a molten mass of ash due to the great intensity of the heat. This water screen consists essentially of a special arrangement of steel tubes, generally 4 in. in diameter, placed at the back of the furnace, through which circulates the boiler feed water under full boiler pressure, so that the temperature is kept down and the ash does not become molten. As a typical example of this, the Lakeside "Edge-moor" boilers of 13 060 sq. ft. heating surface have water screens of 22 tubes and an average length exposed to the furnace of 13½ ft., giving a total heating surface of 320 sq. ft. This arrangement also reduces the wear and tear of the brickwork, which is stated in fact to be actually less than with mechanical stoking.

Improved Driers.

The new small stationary "Lopulco" vertical driers for the crushed coal are an enormous improvement on the old-fashioned large and heavy revolving cylindrical drier heated by direct fires, which consumed an amount of coal equivalent to about 1 per cent. of the steam production of the plant. The new driers consist of vertical cylinders placed under the coal hopper and directly on top of the pulverisers, and the crushed coal falls down through these vertical cylinders as the coal is taken by the pulveriser underneath. There is then circulated through the coal, by means of a suitable fan, about 10 per cent. of the final exit chimney gases, mixed with air, so that the temperature does not exceed 215° F. In this way there is practically no loss of volatile matter in drying, the cost is infinitesimal and the space occupied small, whilst the whole process is absolutely automatic.

The firebricks of the furnace walls are hollow, and through these is circulated the large amount of secondary air required for the pulverised fuel burners, which at the same time increases the efficiency of combustion and still further reduces the wear and tear.

Auxiliary Power Required Very Small.

As a result of the most elaborate investigations carried out for many months on the Lakeside plant, it has been proved that the total amount of auxiliary power for the whole of the plant, including drying, crushing, and pulverising the coal, together with all other accessories, does not exceed about 1·75 per cent. of the steam production of the plant, and it is expected that with the very latest improvements—such as will be installed at Vitry—this figure will be cut down to 1·0 per cent., so that the modern system of pulverised fuel does not take any more auxiliary power than mechanical stokers. Also the cost of labour is less than with mechanical stokers, amounting to about 1s. 2d. per ton under British conditions, whilst the wear and tear and maintenance is claimed also to be less than mechanical stoking.

Further Developments Taking Place.

It may be stated further that the developments now taking place in the United States are remarkable. In addition to the Cahokia plant already mentioned, the Lakeside plant at Milwaukee is being doubled in capacity, another 40 000 kW being at present installed, whilst at the Cleveland Electricity Station there on being erected four "Ladd" boilers to be fired entirely with "Lopulco" pulverised fuel. These will be the largest in the world, no less than 30 500 sq. ft. heating surface each and a normal duty of 300 000 lb. water from and at 212° F., with an overload capacity of probably something like 375 000 lb. These boilers are, therefore, bigger than the Detroit Edison Maryville plant, on which "Stirling Type W" boilers of 29 880 sq. ft. heating surface are installed, and far larger than the boilers at the River Rouge plant, Detroit, of 26 400 sq. ft. heating surface.

What Will be the Effects in Great Britain?

Finally, it may be remarked that the Detroit Edison Co. have come to the conclusion that pulverised fuel is to be installed on all their future plants, and this will be adopted in the new Trenton Channel Station now under consideration, and which, it is stated, will be the largest in the world. We shall watch with interest the effect in this country of these interesting developments. We believe that where pulverised fuel has been used it has given satisfaction, and if efficiency is to be obtained its claims certainly ought to be considered.

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Telegraph Machinery.*

A Book Review by Donald Murray.

Amongst the many blessings bestowed on us by the War, not the least has been our liberation from servitude to Germany in the production of technical books. Our emotions used to be stirred by German music ,our mental outlook was coloured by German books, and our physical surroundings were tinted by German dyes seen through spectacles and binoculars and microscopes made in Germany. With the collapse of the mark that phase seems to have passed, and we are getting English music and English dyes and English books—or at least books printed in English, because it must be confessed that the sceptre in the production of technical books seems to be passing to America. A brilliant exception is Mr. H. H. Harrison's new book on "Printing Telegraph Systems and Mechanisms," which splendidly upholds the motto printed on the flyleaf—"Made in Great Britain."

This is the second of a series of about a dozen manuals on telegraph and telephone engineering which are being produced by Longmans under the editorship of Sir William Slingo, late Engineer-in-Chief of the British Post Office. Mr. J. G. Hill's fine book on "Telephonic Transmission" was the first of the series, and Mr. Harrison, by the infinite pains he has taken with the second, has set a standard to which it will be hard for his successors in the series to live up.

Amazing Industry and Research.

The industry and research devoted to the production of this book is amazing. Indeed it is no secret to Mr. Harrison's friends that the chief part of his diet for the past 15 or 20 years has been patent drawings and specifications and old telegraph tomes in English, French, and German. The result has been the production of what is certainly one of the finest technical books in the world to-day. There are now three telegraph books in the English language that no student of telegraphy can afford to be without, namely, Herbert's British "Telegraphy," Maver's "American Telegraphy," and Harrison's machine telegraphy, or as he calls it "Printing Telegraph Systems and Mechanisms." The last is the most remarkable and original of the three books, and it is indispensable, beyond question, to any telegraph man who wants to keep in touch with and understand modern developments of telegraph machinery. It is a storehouse of concentrated information now for the first time made accessible to all, and the wonderfully clear illustrations—642 of them all drawn by Mr. Harrison himself—make it a real handbook for telegraph engineers.

Telegraph Engineering and Exact Science.

Instead of a tiresome description of various printing telegraph systems, Mr. Harrison has broken boldly away, and with extraordinary industry and patience has dissected out the various systems into their elements and shown us how to make printing telegraphs for any given requirements. Telegraph engineering has now become an exact science, and Mr. Harrison has given us the first and only existing book on the comparative anatomy of printing telegraphs.

One great advantage of this plan is that no matter how rapidly machine telegraphy may develop in the future, this book will not lose its value with age. It deals with principles of construction and structural elements that must be used by all telegraph engineers in designing new telegraph systems or modifying and improving those already in use. It is this comparative anatomy feature of Mr. Harrison's book that renders it so useful, and I personally know that if I had had a copy of this book twenty-five years ago it would have saved me at least ten years of mis-directed labour. We—Mr. Harrison no less than I and others—were pioneers, and we had to blunder along and find the various pathways which are now so obvious. It remains for us and our successors to improve these roads and make them into magnificent, smooth, dustless highways for the easy and accurate transmission of intelligence all over the world.

What the Book Contains.

Mr. Harrison starts, as all good telegraph engineers must, with telegraph alphabets and the elementary principles of signalling, followed by a useful chapter on the mechanical elements used in telegraph machinery. Then come the general principles of stock and bulletin printers, followed by the Hughes and by keyboards, keyboard transmitters, perforators, distributors, synchronism, translators (printers), single-channel systems, circuit arrangements, overlap, flip-flap systems, start-stop systems, high-capacity systems automatic and multiplex, with good analytical accounts of the Baudot, Murray, Creed and Siemens, and the American multiplexes, together with an excellent general account of carrier, superposing and interlinking arrangements which are going to be so important in future

For a first edition of such a mass of extremely technical information the book is free from errors to a praiseworthy extent, and such few errors as are noticeable do not interfere with the sense of the book. For instance in Fig. 93 the detent magnet BM should obviously be DM. On page 310 "contracts" in the last line should clearly read "contacts." In Fig. 134 A and B, the selector-bars are immovable. They require joints. Fig. 155 has evidently reached Mr. Harrison second-hand, because the Monoman typecasting patent has no electrical transmitter contacts as shown in Fig. 155, and does not use the five-unit alphabet. It is a typecaster pure and simple, and when stopped the five transmitting levers do not send spacing current to line, because there are none. The Monoman patent is dated 1907 (British 17864/1907 and Brand's U.S. patent 862800), and the Murray paper of 1903, as Mr. Harrison points out in other parts of his book, provided the automatic start and stop feature for the transmitter four years before Brand or anybody else. These errors are trifling and can be easily remedied in future editions.

A Plea that Requires Attention.

A more serious point, to which Mr. Harrison would do well to direct his attention, is the need for a list of authorities, sources or Quellen, preferably as an appendix to his book, followed in each case by the page or pages of Mr. Harrison's book dealing with the subject of that reference. Mr. Harrison has an unrivalled knowledge of such sources, important patents, papers by Baudot and others, books and references of all kinds, and such an appendix would greatly increase the value of the book to students, and would save months of weary labour to anyone following in Mr. Harrison's footsteps.

* "Printing Telegraph Systems and Mechanisms." By H. H. Harrison. (London: Longmans, Green and Co.). Pp. 429. 21s. net.

National Illumination Committee of Great Britain.

The chairman's report for 1922 refers to the provisional definitions of photometric terms and units proposed by the British National Committee, and officially adopted by the constituent societies of the Committee. These definitions differed from those approved by the American Engineering Standards Committee, but a sub-committee is now considering how they can be amended so as to minimise the points of difference.

A preliminary list of symbols has also been prepared by this sub-committee, and, after submission to the British Committee, these have been communicated to a number of societies, publication being deferred until their criticisms, if any, have been considered.

In view of the fact that a large and increasing part of the work of the British National Committee relates to standardisation, it was decided, with the approval of the three constituent societies, to ask the British Engineering Standards Association to form a sectional Committee on Illumination, to which such matters could be referred.

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Automatic Sub-Stations.

By L. C. GRANT.

Below we give the second part of an article on "Automatic Sub-stations," the first part of which appeared in our issue of October 27th, 1922. Publication has been delayed owing to circumstances over which we have had no control, but we hope to complete the article in our next issue. In this part of the article the author applies the general principles of sub-station construction, with which he dealt in the first part, to particular cases. He describes the functions of control apparatus and automatic operation and gives some interesting figures of costs.

Function of the Control Apparatus.

The function of the control apparatus is, firstly, to determine when the machinery is to be started and then to actuate the starting apparatus; and, secondly, to determine when the plant is no longer required and upon differentiating, to close it down. Obviously, then, this part of the equipment must be continuously working and having a 24-hour day job with an onerous duty, it must be essentially a dependable piece of apparatus. Having only control currents to deal with, it may be quite small but not by any means necessarily delicate—a very important point to be borne in mind.

Connected to the control gear by the linking up conductors there is next the starting and stopping switchgear to be considered. Before this type of gear can be decided upon the class of rotary converter to be used must be considered.

The means available for starting a rotary are: (1) Starting motor, (2) transformer taps, (3) d.c. starting. Style (3) is for our purpose out of the question, as, were it used, heavy starting current would be required at the very time that the d.c. mains were already being hard pressed. (1) and (2) only are feasible. With (1) the motor stator can be connected in series with the converter armature during the starting period, this securing automatic synchronisation.

Minor troubles may be experienced with scheme (2) such as flashing at the slip rings and commutator, insufficient starting torque and reversal of polarity. Fig. 2 shows schematically the connections proposed for scheme (1). This arrangement, although quite feasible, is not put forward as a finished scheme but has been drawn up to indicate broad principles and the general method of operation. Only four relays are shown, and these are coupled into the circuit in the simplest manner possible. Relay (A) has been termed the starting relay. Its function is to switch in the starting equipment whenever the conditions require this to be done.

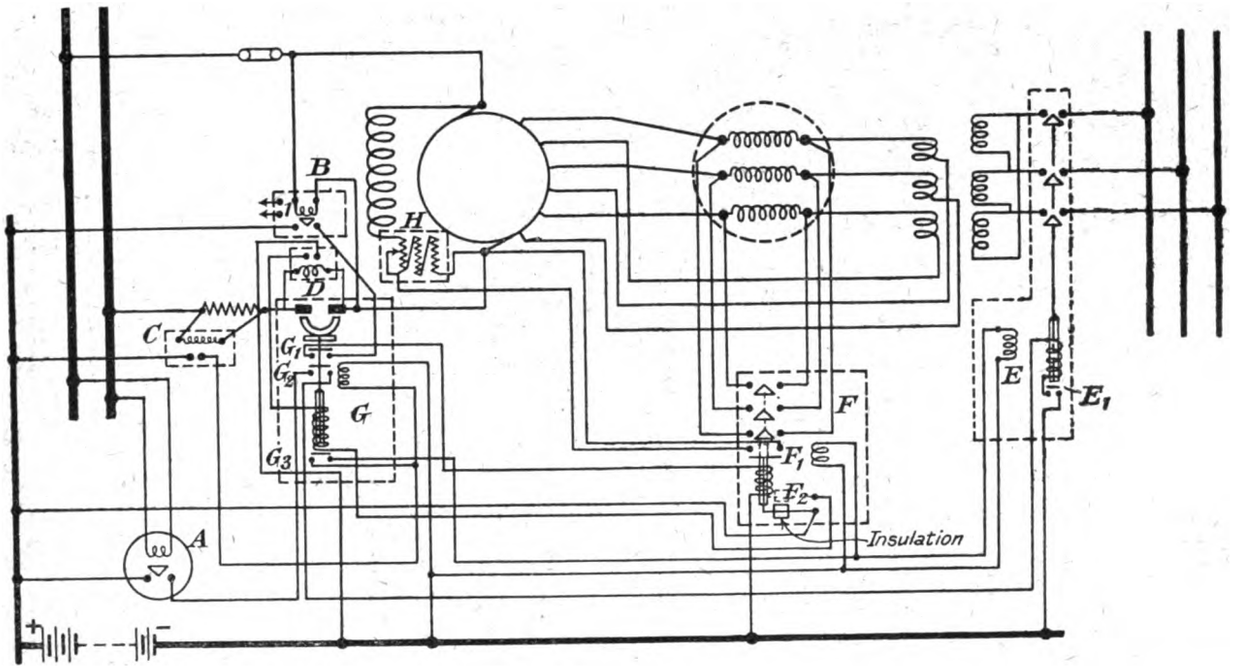

FIG. 2.—ELEMENTARY DIAGRAM OF AUTOMATICALLY CONTROLLED ROTARY CONVERTER.

RELAYS.
A. Starting Relay.
B. Synchronising Relay.
C. Stopping Relay.
D. External Fault Relay.

OTHER ITEMS.
E. High Pressure Starting Switch.
F. Synchronising Switch (Short Circuits Starting Motor).
G. D.C. Circuit Breaker.
H. Synchronising Resistance.
*B*1. Field Reversing Connection (optional).
*E*1. High Pressure Circuit Breaker Closing Coil Cut-off Switch (open when oil switch closed).
*F*1. Synchronising Field Contact. Closed when Synch. Switch is closed, thus shortcircuiting *G*.
*F*2. Delay Switch to ensure that m/c is Synchronised before D.C.C.B. is closed.
*G*1. Interlock to prevent Rotary being Synchronised if D.C. Breaker is open.
*G*2. Interlock to prevent Rotary being switched in a High Pressure side if D.C. breaker is open.
*G*3. Interlock to trip Main and Starting A.C. Switch when D.C. Breaker operates.

Methods of Operation.

Most power and sub-stations are run by one of two methods—i.e., by the time-table or by the busbar pressure. That is to say, in the first case, machines are switched in and out at pre-determined times each day irrespective of all other factors; this occurs, for instance, on a traction system where a time-table is usually rigidly followed. The only departures are made on Saturdays, Sundays and holidays, when the load conditions are different from those obtaining on the other days of the week. In a sub-station of this description, relay (2) can well be replaced by a time switch; the week-end and other modifications to the schedule can be looked after by using a 168 hours' dial, or a five-day clock with 24-hour dial may be used, winding it up on Friday and Sunday evenings when the necessary alterations to the schedule can be made.

For lighting service and similar supplies the conditions are different, and the time-table method can be adopted in very few instances. It is then better to work on the voltage. If the pressure falls and remains down for (say) 20 minutes, the starting relay should operate and switch in the starting equipment.

It has already been mentioned that the voltage relay should be essentially robust. An ordinary voltmeter movement is as reliable as most electrical apparatus. Fitted with a time lag relay device to take care of intermittent kicks, this would fulfil the purpose admirably. Some years ago, Siemens and Halske placed on the market a particularly well made relay for controlling voltage *via* an induction regulator. This relay could be set up to within ± 2½ per cent. It was of sound design and substantial construction, the contact making tongue consisting of a ball which oscillated between carbon contacts making it very reliable in operation.

Automatic Operation.

The operation of the automatic scheme shown is as follows:—

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Upon relay *A* closing, a battery circuit is made through interlock *G*2 (to ensure that the d.c. breaker is closed), thence to the closing coil of a high pressure circuit breaker *E*, which closes up the starting motor *via* the converter armature. The machine then runs up to speed, and as it nears synchronism, transformers. Attached to the cross head or other convenient point of switch *F* is an auxiliary contact *F*1, the function of which is to bring up the rotary converter field from synchronising point to the strength necessary for the power factor and direct current voltage required. A further auxiliary contact

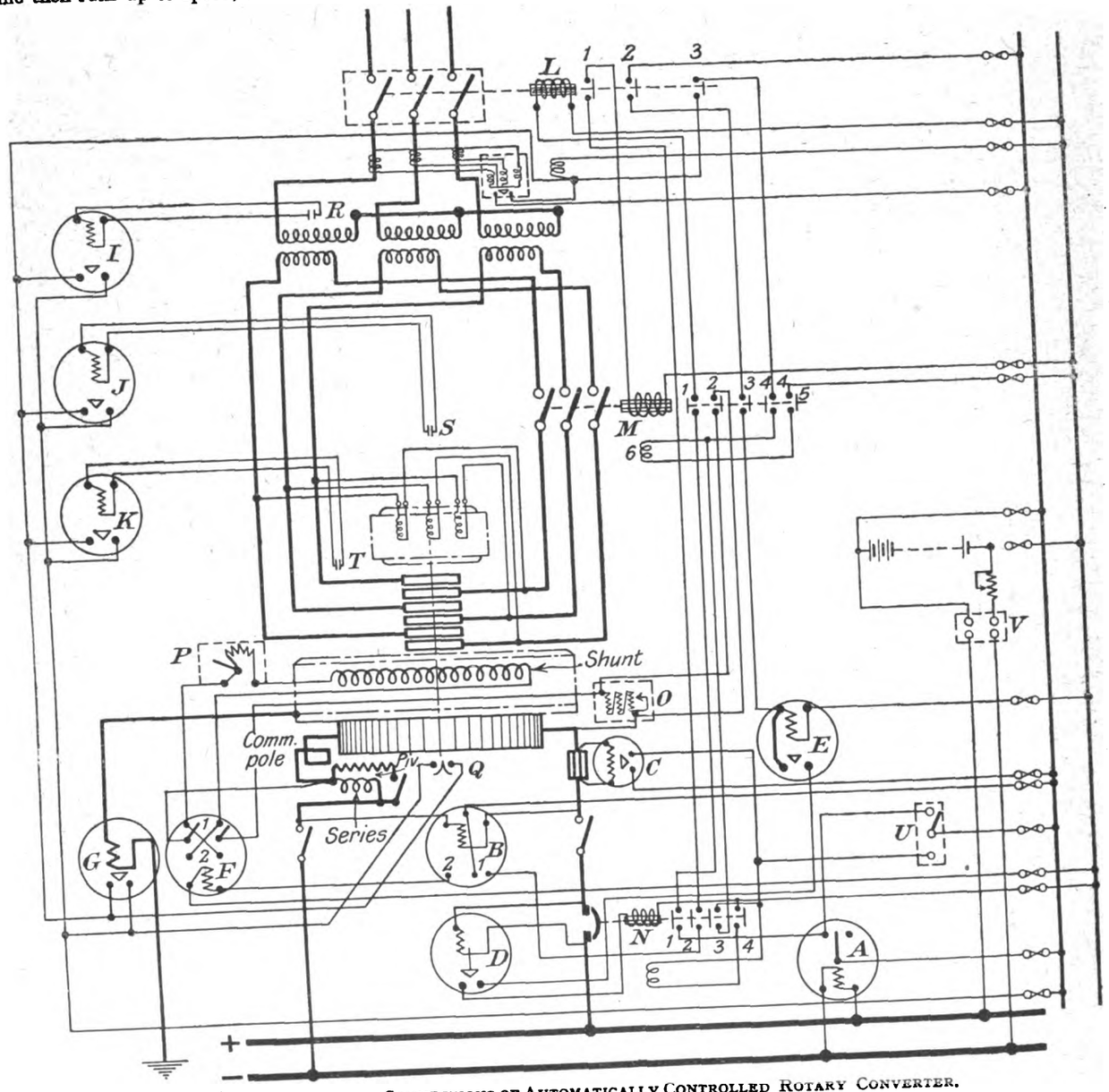

FIG. 3.—DIAGRAM OF CONNECTIONS OF AUTOMATICALLY CONTROLLED ROTARY CONVERTER.

RELAYS.

A. Starting Relay.
B Synchronising Relay.
C. Stopping Relay
D. External Fault Relay.
E. D.C. Circuit Breaker Time Lag Relay.
F. Field Reverse Relay for Synchronising.
G. Internal Fault Relay (in machine).
H. Machine High Pressure Overload Relay.
I. Transformer Temperature Relay.
J. Machine Bearing Temperature Relay.
K. Machine Temperature Relay.

OTHER ITEMS.

L. High Pressure Starting Switch.
M. Synchronising Switch.
N. D C Circuit Breaker.
O. Synchronising Resistance.
P. Machine Field Rheostat.
Q. Overspeed Switch.
R. Transformer Thermo-Couple.
S. Bearings Thermo-Couple.
T. Machine Thermo-Couple.
U. Hand Control Switch.
V. Control Battery Auto Cut-in and Cut-out.

*B*1 Normal Field Contact.
*B*2. Reverse Field Contact.
*F*1. } Field Reverse Switch.
*F*2. }
*L*1. Synchronising Interlock prevents *M* being closed until *L* is first closed.
*L*2. D.C.C.B. interlock prevents *N* being closed until *L* is first closed.
*L*3.
*L*4. Cut-off Switch for Trip Coil *L*5 on High Pressure Switch *L*.
*L*5. High Pressure Oil Switch Trip Coil.
*M*1. Interlock to ensure that *L* closes before *M* and that *M* cannot be closed before *L*.
*M*2. Synchronising Resistance Short Circuiting Switch.
*M*3. Interlock to ensure that *M* (and incidentally *L*) are closed before D.C. Circuit Breaker *N* is closed.
*M*4. Interlock to trip *L* ensures that *M* trips before *L*.
*M*5. Cut-off Switch for Trip Coil on *M*.
*N*1. Starting Interlock: to ensure that *N* is open before *L* can be closed and machine started.
*N*2. Synchronising Interlock: to prevent Switch *L* being closed if D.C. Breaker is not open.
*N*3. Switch to Trip-out Synchr. Switch *M* immediately after *N* ensures that *N* is open first.
*N*4. D.C. Circuit Breaker Trip Coil Cut-off Switch.

polarised relay *B* becomes more and more sensitive to the polarity beats as these become of longer duration. When the machine reaches synchronism and correct polarity, relay *B* operates and closes up the control battery circuit through interlock *G*1 to the closing coil of synchronising switch *F*. When the latter operates, the stator of the starting motor is short circuited and the machine is fed direct from the power *F*2 is closed at the same time, and this closes up the direct current circuit breaker *G* (in practice *via* a time lag device so as to allow the rotary converter field to attain a steady value). Interlocks *G*1 and *G*2 are not essential, unless holding coils are used on the two a.c. switches (i.e., when no trip coils are fitted). Then the operating circuits are actually interrupted by the interlocks. This prevents the switches operating, and,

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more important still, opens the a.c. switches, thus securing a positive interlock. The machine is taken off by means of relay *C*, which is the only special relay required. Relay *C* is a low current time lag device which operates after a pre-determined period of load depression and closes up the trip circuit of d.c. circuit breaker *G*, thus opening the latter. When *G* operates, interlock *G*3 is closed, which switches out a.c. switches *F* and *E* in the order given.

Relay *D*, which has been termed "external fault relay," is intended to keep open the closing coil circuit of switch *G* so long as the resistance of the external load circuit remains below a pre-determined value, thus denoting that a fault exists between the busbars and the outgoing feeders. The heavier the potential short circuit the greater will be the difference in potential across *D* and the more strongly will it hold. This relay must be of the self-resetting variety.

Connections of Automatically Controlled Rotary.

Fig. 3 shows a complete diagram of connections for an automatically controlled rotary converter, the scheme being developed on the previous lines. "*A*" is the starting relay; upon its operating the control battery circuit is closed up through auxiliary contact *N*1 (to ensure that the d.c. breaker is open), through *M*1 (to ensure that the synchronising switch is open), thence through closing coil of main oil switch contact and back to control battery. The switch then closes, the rotary starts up, and, upon reaching synchronism, synchronising relay *B* operates. Should the machine develop reverse polarity, the moving contact of *B* moves over to contact *B*2 and closes up to *F*, which changes over the field reverse switch. Upon the field falling to zero, relay *B* moves slowly over to the control position again and awaits the correct polarity being generated across the machine terminals, and when this takes place contact *B*1 is connected up to the control battery and circuit is made through interlocks *N*2 and *L*1, thence through the closing coil on the synchronising switch which short-circuits the starting motor. Auxiliary *M*2 is then closed, which short-circuits the synchronising resistance "*O*" and gives a normal running field. Interlock 3 also closes, and circuit is made through *L*2 and *M*3 to a time lag relay "*E*" (lag 1–10 seconds), to allow the field to rise to full value. The circuit is next completed through time lag relay *E* to closing coil of d.c. breaker *N via* internal fault relay *D*, the function of which has already been explained.

The machine is then on load and remains so until the clearing relay *C* operates. Upon this taking place, the battery circuit is made through the d.c. circuit breaker trip coil, which opens the switch and clears the machine from the direct current bus bars; the circuit breaker trip coil is cleared by auxiliary contact *N*4. Immediately *N* is open, a further circuit is made through *N*3, through the trip coil of the starting motor switch *M*, and the trip coil is cleared by *M*5. When *M* operates, the high pressure circuit breaker trip circuit is made through auxiliary *M*4 and is cleared by *L*4, thus closing down the rotary.

Control can be taken over from *A* by means of hand switch *U* which covers but does not cut out the relays *A* (starting) and *C* (stopping). The machine is protected in the usual way against overloads by means of the relay *H* on the high pressure side.

Relay *G* is operated by leakage currents and is connected directly in the circuit of the conductor used for earthing the frame of the rotary converter. Obviously, leakage currents must take this path whether due to breakdown of windings or to flashing to earth. Relays *I*, *J*, and *K* take care of overheating in the transformers, bearings and field coils respectively, by means of their thermal couples *R*, *S*, and *T*. Overspeed is guarded against by means of a centrifugal switch *Q* on the shaft of the converter.

The control battery is kept charged by means of an automatic cut-in and cut-out *V*. The control battery can be replaced by means of a potential transformer, if required.

Fig. 4 shows the modification necessary if starting by means of transformer taps is required instead of the induction motor start. The general principle is the same and the interlocks have not been altered in any way. The change-over switch is normally (when the machine is not running) in the bottom contacts. In this position, the auxiliary contacts are closed to the right. When the machine falls into step, the change-over switch *M* operates and applies full voltage to the armature. In this position, the auxiliary contacts move over to the left, their functions are the same as those corresponding to them and given on the previous diagram.

Low and Medium Pressure A.C. Switchgear.

The synchronising switch for short-circuiting the starting motor in the smaller sizes well take the form of an ordinary open type heavy duty contactor. Up to 500 A this can safely be adopted. Above this current, automatic oil switches should be used, the commercial type of switch can be used with no alteration save the addition of the interlock contacts which it will be necessary to add, no matter which type of switch be adopted.

There are several excellent types of contactor available, and stocked in sizes up to 400/500 A. The cost per contactor in the 200 A capacity is £12 to £16 per phase: the 400 A size costs £16 to £25 per phase. Thus the cost of a 200 A set would probably not exceed £35, and the 400 A size £45. The cost of electrically operated 200 A and 400 A 3-pole oil switches would be £90 to £120 and £100 to £130 respectively. Above 400 A, oil switches are advisable in all cases. in the same range, the 1 000 A switch costs £180 to £200, the

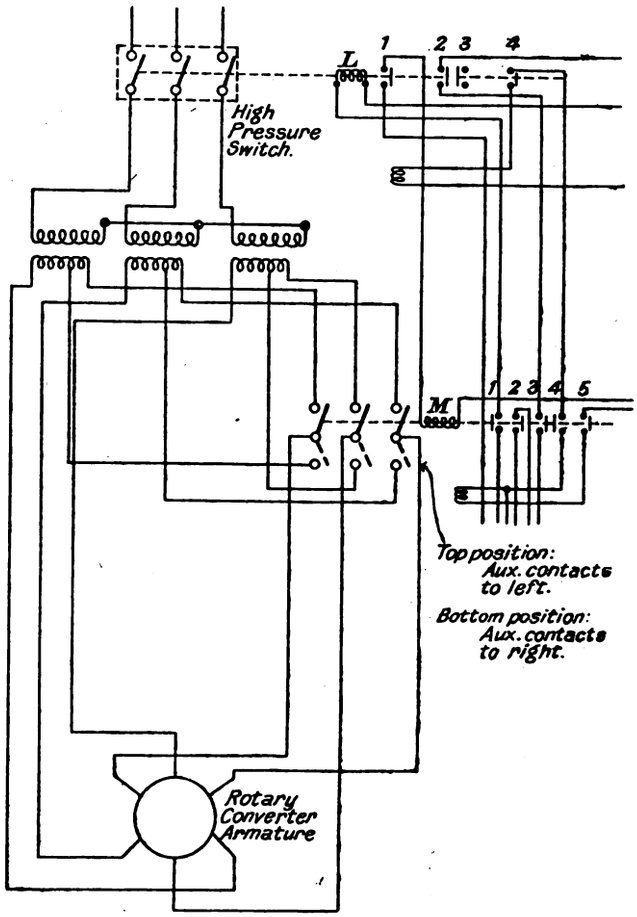

FIG. 4.—MODIFICATION TO PREVIOUS FIGURE FOR AUTO. TRANSFORMER TAP START.

1 500 A £200 to £250. These prices are all for voltages up to 600 per phase.

In Brown Boveri's design of the automatic sub-station, a motor driven switch has been adopted. This switch stops consecutively in the "off," "start," and "synchronising" positions. The high tension switch is also motor operated but does not carry out any starting function, merely switching the transformers on to the high pressure supply. The three-position switch then moves successively from the "off" to the "start," and then to the "running" position.

(To be concluded.)

The hon. secretary of the WHITWORTH SOCIETY informs us that a circular letter, copy of the rules, and subscription form have been posted to every Whitworth scholar, exhibitioner and prizeman whose present address is known. The preliminary dinner is to take place on September 11th at the Shipping, Engineering and Machinery Exhibition, Olympia, London, where the members will be received by the chairman, Dr. F. S. Hele-Shaw, who is also chairman of the Committee of Experts of the Exhibition. Anyone eligible for membership, who has not already received the above information, is requested to communicate at once with the hon. secretary, at the Institution of Mechanical Engineers, Storey's Gate, Westminster, London, S.W.1.

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The Control of the Speed and Power Factor of Induction Motors.

In the fourth and last lecture of the course, which he recently delivered before the University of London, Prof. Miles Walker began by referring to the place of the commutator in the a.c. motor and its use in connection with phase adjustment and frequency conversion. Several types of phase advancing apparatus were then described. The first part of this lecture is given below.

Lecture IV.

A.C. Winding and Commutator.

Many developments in connection with alternating current machinery depend upon the action of an armature provided with a commutator. The addition of this device to an a.c. armature makes possible a number of things which without it would be impossible; and if experience shows that there is not injurious sparking, there is no reason why we should not make use of a commutator in a.c. work. It is well for the student to make a careful study of the polyphase commutating machines: they exhibit some very interesting phenomena.

Let us consider an ordinary two-pole armature provided with a commutator at one end and polyphase slip rings at the other. Four rings tapped into the winding at four equally spaced points will do for our purpose.

Alternating Current Fed to the Rings.

Let the armature at first be stationary, and let the rings be fed with two-phase currents at 50 cycles. The currents will produce a magnetic field revolving, let us say anti-clockwise looking at the commutator end, at a speed of 3 000 revs. per min. This will set up a back e.m.f. to balance the e.m.f. of supply. The flow of current will be limited mainly by the inductance of the winding, and will lag behind the applied e.m.f. If there are two brushes at 180° to one another on the commutator, the voltage between these will alternate at 50 cycles, and will have the same virtual value as on the rings.

Phase Adjuster.

By rocking the brushes on the commutator we can get any *phase* of e.m.f. Such an apparatus provided with a suitable magnetic circuit constitutes a phase adjuster.

Now make the armature rotate in the direction opposite to the magnetic field. In our case we will rotate it clockwise, looking at the commutator end. The speed of the field relatively to the tappings remains the same, namely 3 000 revs. per min., but the speed relatively to the stationary brushes is less and less as we increase the speed up to 3 000 revs. per min. The virtual value of the voltage across the brushes remains the same. At 3 000 revs. per min. the field becomes stationary relatively to the brushes, which then have a steady voltage across them.

The apparatus is then a synchronous converter, and may be used either to yield d.c. current from an a.c. supply or to yield a.c. current from a d.c. supply.

Frequency Converter.

At speeds either above or below synchronism the apparatus operates as a frequency converter, yielding at the brushes a frequency equal to the difference between the frequency of supply and the frequency of rotation.

If three brushes placed at 120 deg. are put upon the commutator, then three-phase currents at any frequency can be obtained, depending on the speed at which the armature is rotated; but the voltage is independent of the speed of rotation, and depends only upon the voltage supplied to the rings and the number of brushes. By rocking a brush to a suitable position the phase of the voltage between that brush and the neutral point can be made anything we like, so that the apparatus operates both as a frequency converter and a phase adjuster.

Alternating Current Fed to the Commutator.

Let us now consider the operation of this type of apparatus when the winding is fed with alternating current from the brushes on the commutator.

First consider the armature at rest with the rings open-circuited. Apply three-phase voltage to three brushes at 120 deg. apart. The effect is, of course, exactly the same as when the voltage was applied to the rings: a rotating field is produced rotating at 3 000 revs. per min. in an anti-clockwise direction, and a back e.m.f. is set up to balance the applied voltage. If, now, the armature is rotated in a clockwise direction, it makes no difference in the speed of rotation of the field relatively to the brushes, but relatively to the conductors on the armature the field revolves at a speed higher than 3 000 revs. per min., and as a consequence the back e.m.f. for a given flux is increased. If the virtual value of the voltage applied is constant the flux will decrease as the speed is increased, and at 3 000 revs. per min. of the armature (=6 000 revs. per min. of the field) the flux will be reduced to one-half. If a constant current is forced through the armature the voltage will rise with the speed. The voltage appearing at the rings has a frequency equal to the sum of the frequency of supply and the frequency of rotation.

Now let the armature be revolved in the same direction as the field. The effect is to reduce the speed of the conductors with respect to the field, and the voltage required to drive a given current falls lower and lower as the speed is increased. At a speed of 3 000 revs. per min. there is no relative motion between field and conductors. Apart from the resistance drop, no voltage would be required to make current flow. We have, in fact, an armature without any inductance. The voltage on the rings would fall to a low value depending upon the resistance drop in the armature.

Phase Advancer.

If the speed is now increased so as to exceed the speed of the rotating field the inductance of the winding becomes negative. The current flowing in any phase creates a flux which by virtue of the rotation generates an e.m.f., leading by 90 deg. on the current. The apparatus can be used to neutralize the effect of inductance in a circuit.

The Addition of a Stator Winding Surrounding the Armature.

Imagine, now, an armature of the same kind as that considered above surrounded by a laminated iron core provided with slots and wound with a two-pole three-phase winding.

First let the armature be locked so that it cannot revolve, and let three-phase current be fed to the stator. The apparatus behaves as a polyphase transformer yielding two-phase voltage at the four rings and any number of phases at the commutator, according to the number of brushes spaced evenly around it. If the rings are short-circuited the apparatus becomes an induction motor, and if released will run up almost to synchronism and behave exactly as an induction motor. If the rings are open-circuited and the brushes on the commutator are short-circuited, the apparatus exerts a torque, and will run as an induction motor, but the fixed position of the brushes gives the motor peculiar characteristics of its own.*

Constant Frequency Maintained.

The frequency of the voltage at the brushes is always the same as the frequency of supply. If the rings are open-circuited, the brushes on the commutator connected to an external circuit and the armature run at a speed above synchronism in the direction of the revolving field, the apparatus becomes a phase-advancer. But it differs from the phase-advancer which has no stationary winding in a very important particular, namely: that the orientation of the magnetic field for a given phase datum line in the supply is constant and does not depend upon the position of the brushes, whereas, when there is no stationary winding, the rocking of the brushes (which supply the current to the armature and produce the field) naturally carries the said orientation round with it. As a consequence, the phase-advancer without a stationary winding can only produce an e.m.f. at right angles to the current, while a phase advancer with a stationary winding can produce† an e.m.f. in any required phase. We are, therefore, able with such a machine not only to improve the power factor but we are able to oppose or assist the e.m.f. generated in the winding of the rotor of an induction motor and in that way either to increase or to decrease the slip.

As it is convenient to have a name for a machine of this type, we may call it a Le Blanc a.c. exciter. It bears the same relation to the rotor of an induction motor as a d.c. exciter does to the field magnet of an alternator. The field magnet is only designed to receive direct current, while the

* See "The Induction Motor," Behrend, p. 128.

† "Journal I.E.E.," vol. 42, p. 599; *ibid.* vol. 50, p. 329.

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rotor of the induction motor may be fed at any frequency and the e.m.f. of the exciter can have any desired phase with respect to the current.

Maurice Le Blanc, in 1895, showed that an induction motor could be given a leading power factor by injecting into each circuit of the rotor an e.m.f. having a frequency equal to the rotor frequency, and having a phase position in advance of

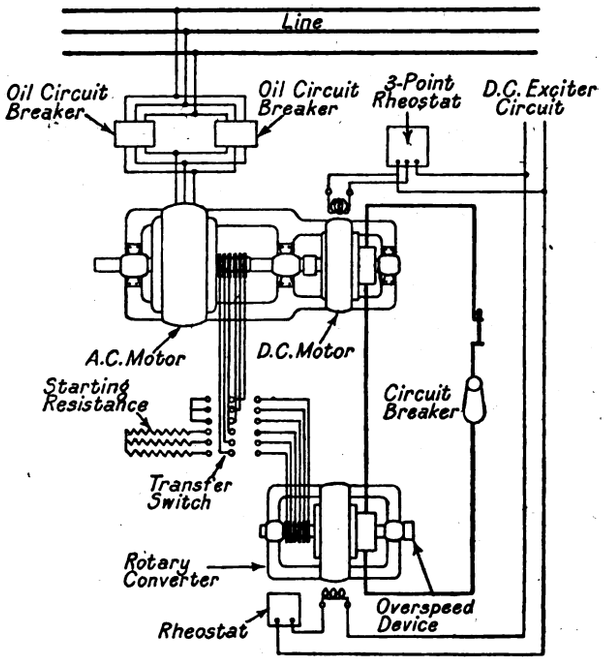

FIG. 34.—CONNECTIONS FOR KRAMER SYSTEM OF SPEED CONTROL.

the current flowing in that circuit. Any apparatus serving to inject such an e.m.f. is known as a phase-advancer.

Types of Phase Advancing Apparatus.

Several types of apparatus may be used for the purpose. These may be classified as follows :—

(*a*) A rotary converter as in the Krämer system.

(*b*) A frequency converter driven by a synchronous motor is described with reference to Fig. 35.

(*c*) A frequency converter on the shaft of the induction motor with slip rings connected to supply mains giving low-frequency voltage on the commutator.

(*d*) A frequency converter on the shaft of the induction motor with the brushes on the commutator connected to the supply giving a low-frequency voltage on the slip rings or to the winding direct.

(*e*) The Le Blanc exciter, consisting of an armature built like a continuous current armature and excited by the rotor currents flowing either in the armature itself or in a field magnet surrounding the armature.

(*f*) A Kapp vibrator.

(*g*) An electrochemical condenser.

Of these (*a*), (*b*), (*c*), (*d*) and (*e*) can also be used to boost or oppose the rotor e.m.f. and change the speed of the induction motor. It is convenient to consider both functions together

VII.—Rotary Converter in Series with Slip Rings of the Rotor.

Instead of wasting the slip energy it is much more economical to make it operate an electro-magnetic machine, which will enable a large fraction of it to be returned to the system. The difficulty in doing this arises from the low frequency and low value of the rotor e.m.f.

Where the required drop in speed of a 50-cycle induction motor is 20 per cent. or more the frequency of the rotor currents will be varied from 10 or more to a low value as the slip is reduced. At frequencies of this order a rotary converter is found to give satisfactory operation so long as care is taken to keep the slip and the rotor e.m.f. great enough to maintain the rotary in synchronism. The induction motor should be designed for a synchronous speed considerably higher (say 10 per cent. higher) than the running speed required, so that the slip may never be reduced below, say, 10 per cent. With a 50-cycle induction motor this would give a minimum frequency of five cycles and a voltage on the rotor rings about five times as great as the ohmic drop. If the voltage on the rings becomes small as compared with the ohmic drop the rotary converter becomes unstable.

The power appearing on the d.c. side of the rotary can either be used for driving a d.c. motor on the same shaft as the main motor or for driving a d.c. motor attached to a generator connected to the supply. An asynchronous generator is suitable for returning the power to the supply.

The scheme of connections when a d.c. motor is mounted on the main motor shaft is shown in Fig. 34. The slip is controlled by changing the excitation of the d.c. motor. The back e.m.f. of this operates through the rotary converter to oppose the e.m.f. generated by the slip, and thus the slip is increased until a current flows sufficient to give the required torque. A potentiometer type of rheostat is used for controlling the field of the motor.

The power factor of the induction motor is controlled by varying the excitation of the rotary. For a given voltage on the rotary there is a certain excitation which will give unity power factor on the rings. An increase of the excitation beyond this will cause the current to lead and improve the power factor of the induction motor.

If the speed of the main motor is low the cost of a d.c. motor on the same shaft may be prohibitive. In this case it is cheaper to return the power to the supply system by means of a high-speed motor generator set. The effect is to lower the H.P. output from the motor shaft as the speed is reduced. For some classes of work calling for a constant torque this plant is quite suitable. Where constant H.P. output at all speeds is required it is better to mount the d.c. motor on the shaft of the main motor.

VIII.—Frequency Converter in Series with the Slip Rings of the Rotor.

If a frequency converter (consisting of an armature like a rotary converter surrounded by stator iron to complete the magnetic circuit) is revolved at synchronous speed by means of a synchronous motor, and connections (see Fig. 35) are made between the rings of the main induction motor and the brushes on the commutator, the frequency appearing at the rings of the converter will be the supply frequency minus the slip frequency—in other words, the frequency of revolution of the main motor, if it were a two-pole motor. If, now, we connect the rings of the frequency converter to the terminals of a synchronous motor (see Fig. 35) mounted on the same shaft as the main motor, the synchronous motor will develop a torque when it receives current from the frequency converter.

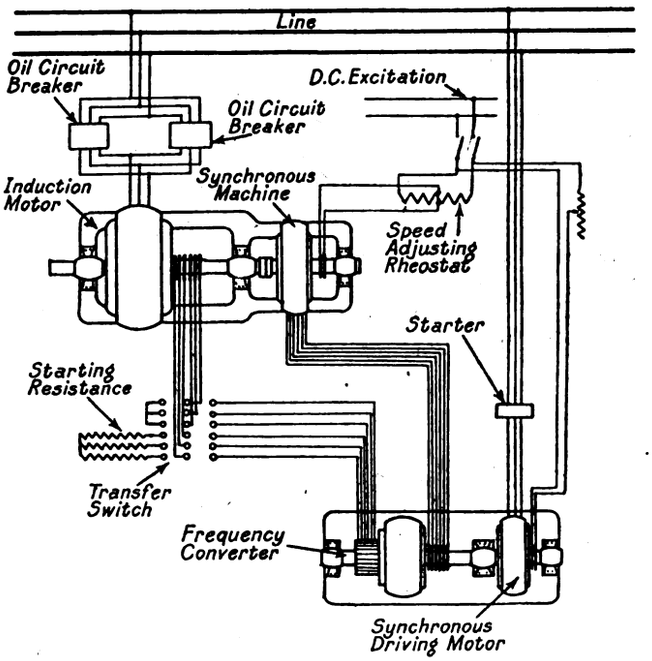

FIG. 35.—CONNECTIONS FOR SPEED CONTROL BY MEANS OF A FREQUENCY CONVERTER.

This happens as soon as the main motor takes load and begins to slip.

A variation on this method is to mount a frequency converter on the shaft of the main motor. The current from the rings is then fed to the brushes on the commutator, the direction of rotation of the magnetic field being the same as the direction of rotation of the motor. The frequency of the slip is thus added to the frequency of rotation, the sum being

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equal to the frequency of supply. Thus the slip power, instead of being wasted, can be returned to the supply mains. This is case (*c*) set out above.

Heyland proposed to make a squirrel-cage motor run on unity power factor by feeding high-resistance rings with current derived from tappings from the stator. The high-resistance rings would behave like a commutator, and if fed from brushes carrying the frequency of supply, the rotor bars would receive current at slip frequency whose phase could be adjusted by rocking the brushes.

A more perfect apparatus working on this plan can be made by providing the rotor of the motor with a commutator to the brushes in which currents are fed from the supply mains. This is case (*d*) set out above. The phase of the voltage received by the rotor winding can be controlled by rocking the brushes.

IX.—The Le Blanc Exciter or Phase Advancer.

(*a*) The Le Blanc a.c. exciter—or, as it is now generally called, phase advancer—has been described before the Institution of Electrical Engineers* and in the technical press. I would like to call special attention to an article by Mr. John I. Hull, in the "General Electric Journal," vol. 23, p. 630 (1920), in which the graphic constructions for obtaining the characteristics of a motor fitted with a Le Blanc exciter are very fully given. This article is not as well known as it should be, so I will take the liberty of giving some of the substance of it,

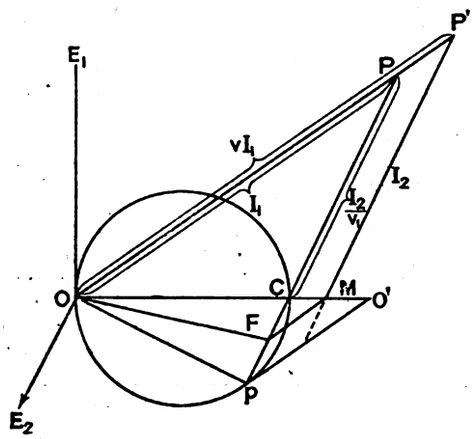

FIG. 36.

altering the notation to one that may perhaps be more familiar to students in this country.

Fig. 36 is part of a well-known graphic construction which gives the relation between the stator and rotor currents, the working flux and the leakage fluxes of an induction motor The student will find a complete description of it in the text-books,† in which are demonstrated the following relationships :

To the current scale :—

$OP = I_1$ = stator current per phase.

$PF = I_2$ = rotor current per phase (ratio of transformation = 1 : 1).

$PC = \frac{I_2}{v_1}$

OC = no load current.

To the flux scale (and turned through 90 deg. if a space diagram be required) :—

OP = the flux which the stator current would produce across the air gap if acting alone and if there were no magnetic saturation.

$P'M = PF$ = the flux which the rotor current would produce across the air gap if acting alone.

OF = the resultant flux which *is* produced when both I_1 and I_2 are acting.

$FM = PP'$ = stator **leakage** flux proportional to I_1.

Fp = rotor leakage **flux** proportional to I_2.

$\frac{P'O}{PO} = v_1$ = leakage **coefficient of stator** = ratio of total stator hypothetical flux (including **leakage flux**) to stator hypothetical flux minus the leakage.

$\frac{Pp}{PF} = v_2$ = leakage coefficient of the rotor.

$$PC = \frac{P'M}{v_1} = \frac{I_2}{v_1}; \quad CF = PF - PC = I_2\left(1 - \frac{1}{v_1}\right)$$

$$Fp = Pp - PF = I_2(v_2 - 1).$$

$$Cp = CF + Fp = I_2\left(v_2 - \frac{1}{v_1}\right) = \frac{I_2}{v_1}(v_1 v_2 - 1).$$

* "Journal I.E.E.," vol. 42, p. 599; *ibid.*, vol. 50, p. 329.

† See "Polyphase Electric Currents," by S. P. Thompson. "The Induction Motor," Behrend.

Mr. Hull has greatly simplified his construction by making use of the similarity between triangles CPO and Cpo'. In the latter po' is parallel to OP.

$$\frac{Cp}{CP} = \frac{OP}{o'p} = \frac{OC}{o'C} = (v_1 v_2 - 1).$$

We see that instead of taking the lines OP and PC to represent

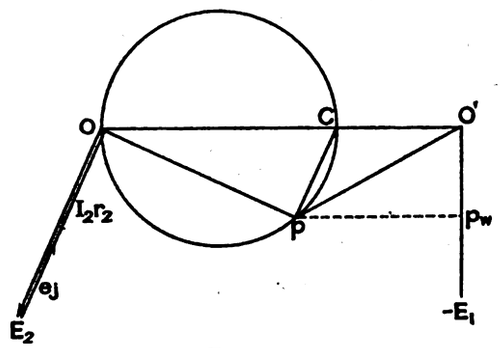

FIG. 37.

the stator and rotor currents, we can take o'p and pC by merely altering the scale.

The scales are varied in the following way : If OP represents the stator current to the scale 1 cm. = 1 *A*., the PC represents the rotor current to the scale—

$$1 \text{ cm.} = v_1 A.$$

o'p represents the stator current to the scale—

$$1 \text{ cm.} = \frac{1}{(v_1 v_2 - 1)} A.$$

pC represents the rotor current to the scale—

$$1 \text{ cm.} = \frac{v_1}{(v_1 v_2 - 1)} A.$$

If we now take the rotor leakage flux Fp from the total flux OF we get Op the flux that sets up the e.m.f. OE_2 in the rotor to overcome the rotor resistance. OE_2 is at right angles to Op and is in phase with Cp the rotor current. As OpC is a right angle and OC is constant, the locus of p as the load changes is the circle of which OC is the diameter.

We can now reconstruct the diagram as in Fig. 37, leaving out all but the important lines. It is convenient to draw E_1 downwards, so as to see more easily the relation between the stator current and the voltage driving it. If $o'p_w$ is the wattful stator current for a given load, the dotted line parallel to o'O gives the position of p.

Suppose now that a Le Blanc exciter (Fig. 38) or other apparatus is made to inject an e.m.f. = ej into the rotor circuit, the

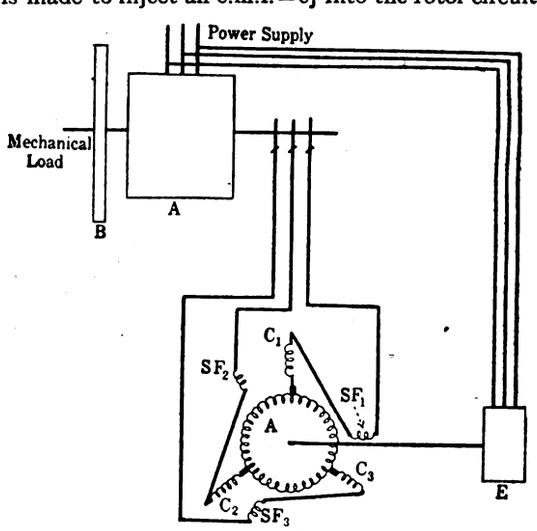

FIG. 38.—CONNECTIONS OF SERIES WOUND LE BLANC EXCITER.

speed of the rotor must be such that the flux Op can generate an e.m.f. E_2 equal and opposite to the sum of e_j and $I_2 r_2$, the ohmic drop. If e_j is in direct opposition to Cp, the effect will simply be to increase the slip. But if e_j has a component which is 90 deg. ahead of Cp the effect will be to make Cp lead. As in Fig. 37, the locus of p as the load changes will depend upon the relation that exists between the rotor current and the injected e.m.f. e_j.

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The X-Ray Examination of Materials.

At the meeting of the INSTITUTION of ELECTRICAL ENGINEERS on Thursday, April 12th, Mr. A. G. WARREN gave a lecture on "The X-Ray Examination of Materials." Mr. F. Gill, President of the Institution, was in the Chair.

Mr. WARREN said inspection work by X-rays resolved itself into the detection of faults—lack of homogeneity, flaws, cavities, presence of foreign materials, bad welds, etc.; the detection of hidden bad workmanship; the examination of sealed bodies which it was undesirable or unsafe to dismantle such as the examination of shells and fuses to check correct assembly, or the examination of shells of unknown construction; the examination of alloys, etc. Such work demanded the hardest or most penetrating radiations that could be obtained and the application of X-rays to these purposes was only limited by the construction of tubes and the subsidiary gear to withstand, and to produce, the pressures required.

Practical Radiographic Problems.

Only those rays which passed through the material unaltered and undeviated contributed to the production of an effective image, and all scattered radiation which penetrated only helped to fog the plate and mask the image. Therefore, it was the object of radiography to obtain as large an undeviated radiation as possible—to render the exposures reasonably short—and at the same time to keep down the scattered radiation. When the illumination due to scattered radiation was sufficiently small, it was surprising what contrast could be obtained if the technique were correct. Surface scratches on a block of metal producing only the minutest variation of thickness, showed up quite distinctly on a radiograph.

Eliminating Stray Radiation.

The problem resolved itself into two parts: (1) eliminating as far as possible all radiations which were not directly contributing to the formation of the image and (2) making the plate as sensitive as possible to the hard radiations. In radiographing an object which called for a moderate penetration, using rays which were projected vertically downwards, the plate was placed first upon a thick sheet of lead, to absorb radiation which passed through the plate and to prevent the latter being fogged by "scatter" from below. The object was then placed upon the plate, and if it was regular, it was completely surrounded by lead so that no radiation could possibly reach the plate except through the object to be radiographed. If the body was irregular, it was mounted on plasticene which was trimmed flush with the edge, and lead dust to a depth of several millimetres was distributed round it. The exposure was then made. When the penetration attempted was considerable, the advisability of backing the plate with lead was doubtful, because the particularly penetrating characteristic radiations of lead were excited and caused a certain amount of fogging. A lighter backing, such as iron, would often give better results. Much reduction in exposure could be effected by the suitable use of intensifying screens and by increasing the absorptive power of the plate or film. Thin films were of little use and it had been found that rays which had penetrated 2 in. of steel were rather scornful of 2 mils. of emulsion. It was too much like trying to stop bullets with a tennis racket.

"Duplitised" Films.

"Duplitised" films having a layer of emulsion on both sides were commonly used, and oxides of lead and thorium were often added to the silver bromide to increase the absorptive power of the emulsion. Intensifying screens of calcium tungstate placed in contact with the film produced a similar effect. The action of all such absorbents was to limit fluorescent radiation —not necessarily visible—and this soft copious fluorescent radiation was particularly actinic.

Limits of Penetration.

Dealing with the limits of penetration, it was indicated that the greater the mass of substance to be penetrated the higher was the optimum voltage for good definition. In addition, exposures were greatly reduced at high potentials, and a diagram was exhibited, illustrating the penetration of ½ cm., of copper at 100 000 V and also at 200 000 V. It was commonly stated that 3 in. of steel was the present practical limit of penetration but Mr. Warren said he regarded that as rather a conservative estimate; assuming it for the moment, however, he showed another curve of the penetration of 2½ in. of steel from which he said it was clear that if greater thicknesses were to be penetrated the voltage must be increased so that the amount of radiation penetrating the material remained constant.

High Tension Supply Problems.

The biggest problem in the electrical equipment, continued the lecturer, was the high tension supply. What was desired was a steady d.c. voltage, though that could rarely be obtained. It was extremely desirable for the period the pressure was applied that it should be maintained as close to its maximum value as possible, as any pressure lower than the optimum voltage for the work in hand produced heat with little radiographic result. When voltages were very low, such as for spectroscopic work, batteries or a d.c. generator might be used, but a limit was soon reached in this direction and the direct generation d.c. of voltage could not be considered at present for general work. High tension electrostatic machines had been used for low current tubes but at present they were not very practicable. For small powers, the induction coil, was perhaps, the simplest solution and it involved no running machinery except the turbine interrupter. On the other hand the voltage was extremely variable; on no load, the inverse approximated to the forward pressure, and on load it exceeds it. Undoubtedly the best solution up to the present was based upon the method used for obtaining a d.c. supply in wireless work—i.e., by charging condensers from an a.c. supply rectified by thermionic valves.

The "Interrupterless" Machine.

For some time, at any rate, the most general outfit would consist of the absurdly named interrupterless machine. This was simply a high tension a.c. transformer with a mechanical rectifier. The function of the latter was not only to rectify the high tension voltage, but, in addition, to connect the transformer to the tube only near the peak of the voltage wave. The rectifier might be driven by a synchronous motor, but undoubtedly the system worked better when an inverted rotary was used for the low tension a.c. supply, with rectifying discs fixed upon the rotary shaft. It was imagined by many radiologists that the transformer, when rectified in the manner indicated, gave a more or less uniform potential across the tube. This, said Mr. Warren, was not the case; high frequency oscillations of considerable amplitude were produced.

For a great deal of work it might be possible to construct the whole outfit in one unit. The transformer need have no expensive terminals but could be connected through its rectifier to the tube working in oil. The set could be reduced to a box with a couple of terminals to which 250 V would be applied and X-ray current received in exchange, passing through a suitably disposed aperture. The voltage control might be effected by either an auto-transformer or by resistance in the primary circuit. The latter, in spite of its inefficiency, possesses distinct advantages when the power wasted was not too costly. Personally, Mr. Warren was inclined to favour a combination of the two methods. Resistance might undoubtedly save the tube in the case of a sudden evolution of gas and might even enable a gassy tube to be run more or less satisfactorily, but it might produce risks of its own if carried too far.

Lines of Force Slides.

At the conclusion of the lecture MR. G. L. ADDENBROOKE exhibited a number of slides of lines of force prepared by Mr. E. E. Brooks, who was unable to be present through illness. Mr. Addenbrooke related how Mr. Brooks had come round to have a chat with him and had shewn him these photographs in a casual way. The moment he saw them, said Mr. Addenbrooke, they appealed to him as demonstrating in a clearer manner than had ever been done before, how lines of force really went and he could not help thinking that if they were put into some of the text books, they would teach more than pages of disquisition. Personally he had never seen anything to touch these photographs in clearness. He fancied the lines of force as shewn in the slides would be worth while investigation by some of our skilled mathematicians. Hitherto, diagrams of lines of force had been those worked out by Maxwell mathematically from Faraday's work and we assumed we knew all about them, but they had never been shown so clearly as this before.

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The B.B.C. Controversy.

By FRANK W. CHALLIS, M.A., Secretary, Electrical Importers' and Traders' Association.

The editor of THE ELECTRICIAN has asked me to state the general views of the Electrical Importers' and Traders' Association in regard to the broadcasting controversy, and especially to state how we propose that broadcasting should be carried on if the market in broadcasting sets and apparatus is thrown open—i.e., is not made dependent on membership of the B.B.C. The broadcasting revenue must be obtained from some source, and it is suggested that with free trade in wireless apparatus it is difficult to see how sufficient revenue will be forthcoming to meet the obvious needs of the broadcasting. I reply as follows :—

Present System an Administrative Failure.

In the first place, it is admitted by the defenders of the present system that it has failed so far administratively, and the complaint is made that the revenue is not coming into the coffers of the company as it should do. The moment is, therefore, perhaps not inopportune for criticising *the present method of raising revenue*. I quote the following from a memorandum which we have handed to the Postmaster-General embodying our criticisms on this particular point. It is, of course, only an extract from a reasoned and fairly lengthy document :—

Free Trade and Revenue.

It is fully recognised that sufficient revenue must be raised to maintain the broadcasting stations and that this revenue should be paid by the people who enjoy the concerts—i.e., the licence holders.

The concerts under present licences are to be maintained for two years. The listener-in knows what period of service he is to get for the licence fee. On the other hand, he has no guarantee whatever that the broadcasting service for which he has paid will still be available and that the capital invested in the apparatus royalties will not be lost in January, 1925.

Cost from Licence Fees Alone.

The proper method of raising revenue would appear to be to meet the cost of the concerts entirely by annual licence fees. It has been objected that the increase in the licence fees would lead to evasion of payments on an extended scale; the answer is that, owing to the chaos at present existing in the trade, piracy is encouraged, and both licence fee and royalties lost. Many listeners-in have apparatus in their possession which is not stamped "B.B.C." They do not wish to evade the licence fee, but if they give their names to the Post Office by applying for a licence they fear they are liable to have their sets inspected and forfeited.

On the other hand, the B.B.C. transfer may not be used legitimately even by a manufacturer whose apparatus has been approved by the Post Office unless he joins the B.B.C. and submits to the B.B.C. agreement. The result is that the Post Office is losing fees, and at the same time the B.B.C. is losing not only fees that should come through the Post Office but also the larger sums in royalties which it is endeavouring vainly to secure. Also the B.B.C. transfer can be easily bought and is being put upon apparatus of inferior quality.

Abolish the Royalty Method.

It would therefore appear to be desirable to abolish the royalty method and throw the weight of the revenue collecting on to the licences. In support of this suggestion the following further reasons are advanced :—

(*a*) The public have the idea that these royalties are in some way or other connected with patents, which is not the case.

(*b*) If a member of the public wishes to add extra valves to his set for the purpose of listening to Continental stations it is unreasonable that he should have to pay extra royalties to the B.B.C., from whom he gets no extra service thereby.

(*c*) Loading the cost of apparatus with these royalties gives the impression to the public either that the cost of British manufacture is quite abnormal as compared with foreign manufacture or else that the British manufacturers are grossly profiteering. This is thoroughly bad for the reputation of the trade, and is the last way to encourage the development of the industry in this country.

The Question of Imports.

Reference to foreign manufactures leads to the question of imports. Parliament has never sanctioned an embargo on these imports except in so far as certain parts may be dutiable under the present Key Industries Schedule of the Safeguarding of Industries Act (Part I)—e.g., wireless valves.

The effect of the present wireless broadcasting licence is to attempt an import embargo by the indirect method of departmental administration. In connection with an industry of this kind it is submitted that this is bad. Parliament not having closed the ports to these goods, there is nothing to prevent them coming into the country, and facilities to import will be exploited by the pirate in the trade who stops outside the B.B.C. and "takes his risk." The man who is penalised is the established importer or importing manufacturer (for many large manufacturers—not excepting the "Big Six"—have been considerable importers of certain component parts), because he cannot take the risk of ordering forward goods however badly they are needed if they may be left on his hands. Also the public loses the benefit of improved service which they might derive from use of improved parts available from abroad from time to time.

The whole burden of this import embargo falls upon the listener-in, who alone is required to pay the royalties, and who alone is restricted from using foreign-made apparatus or parts. The amateur or experimenter is under no such restriction. This is clearly unfair.

At the present moment it is a very great grievance in the trade at large that the whole position is so obscure.

We therefore strongly urge upon the Postmaster-General that restrictions should as far as possible be lifted from the industry which is endeavouring to meet the public demand, and that if a case exists for protection (either against depreciated currency imports or foreign dumping) it should be sought under the machinery provided by Parliament in the Safeguarding of Industries Act (Part II).

The Broadcasting Agreement Impossible.

I will endeavour to confine myself to answering the question put to me by the editor, and therefore refrain from developing our criticisms as to the monopolistic character of the British Broadcasting Co. and the oppressive character of the present B.B.C. agreement. I will observe in passing that the agreement, as it now stands, seems to be an impossible document. Clause 4 (j), which has been much discussed, but remains unaltered, is a direct contradiction of the whole preamble to the agreement, and actually as it stands prevents a B.B.C. member from supplying apparatus to the public! This may not have been intended, but it is at least an example of very bad draughtsmanship. It has been stated that 485 firms have already joined the B.B.C. As a matter of fact, the official figure given through the Postmaster-General in Parliament in Easter week was 260, and it is not stated how many of the firms who have "applied for membership" have actually signed the agreement. That many of them have not is within my own knowledge.

Alternative Suggestions.

I will, however, add that while making the above suggestion to throw the whole weight of revenue collecting on to the licence charges (in which suggestion my Association has the entire support of the British Radio Manufacturers' and Traders' Association), my own Committee have realised that it is possible that Sir Willian Joynson-Hicks will not feel able to adopt this suggestion, and from remarks attributed to him in the Press during the last week I think it is increasingly likely that he will take this view. My Committee, therefore, have put forward to him in a letter an alternative suggestion along the following lines. We have pointed out :—

That where a monopoly of any industry is necessary or advisable it should be held by the Government and not by an individual or a group of individuals.

That the trade has no objection to the wireless industry being a Government monopoly or to its granting a concession or licence to the B.B.C. for broadcasting provided that the Government grants a licence to applicants who desire to manufacture or deal in wireless apparatus, and to other members of the public who wish to instal receiving sets.

That sufficient income could be obtained from fees for such licences amply to remunerate the B.B.C. and to leave a handsome balance to be transferred to the national revenue towards reduction of taxes.

The following fees for licences are therefore suggested :—

Licence to manufacture wireless apparatus, say, £10 per annum.
Licence to deal in wireless apparatus, say, £2 per annum.
Licence to instal wireless sets, say, £1 per annum.

The above receipts to be apportioned between the G.P.O. and the B.B.C. as may be thought fit. By this method fees would be collected as easily as those for tobacco and other licences. It would satisfy the trade that "broadcasting" was the only monopoly held by the B.B.C. The wireless industry would have a free hand to manufacture parts and sets and not be hampered by the irritating conditions and unfair restrictions imposed by a present agreement.

Whether that agreement would hold in a court of law from the point of view of the Statute of Monopolies in so far as it attempts to compel people to buy unpatented goods from any particular firm or combination—whether this is in principle illegal as being in restraint of trade I do not argue.

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Power Factor: Its Technical and Commercial Aspects.*

By H. E. YERBURY.

The effect of load factor is well known to all station engineers, but its effect seems to assume a place of secondary importance to many suppliers and users of electrical energy. Consider a town with two power stations, with plant-capacity 80 000 and 20 000 kW respectively, inter-connected by duplicate cables each capable of carrying 5 000 kW. Assume the power factor of the entire undertaking to be 0·8; then if this could be brought up to unity the smaller station could be dispensed with or would be available for supplying at least an additional 15 000 kW to additional consumers, bringing in a revenue of £1 500 per annum. A station of this capacity represents a capital expenditure of about £450 000. A power factor of 0·8 also means a 25 per cent. increase in kVA with a corresponding expenditure.

The Economic Side.

An improvement from the present general average of 0·7 to 0·9 would mean 30 per cent. greater revenue-earning capacity for the same plant. Raising the power factor to unity is not a commercial proposition. It takes four times as great a wattless component to change the power factor from 0·8 to unity as from 0·8 to 0·9. With a low power factor the duty of switches is more onerous, and circuit-breakers are called upon to withstand more severe duty. Induction motors are the chief offenders in causing low power factor, and motors of needlessly high rating are often installed. It is necessary to educate consumers regarding the undesirable results of a low power factor and to frame a tariff making it advantageous for them to correct it at their premises or near motor terminals. Advice should be rendered gratuitously, and where synchronous or other plant which draws current at unity or leading power factor a rebate should be allowed.

Where special machines or apparatus have to be installed it is essential to show that the annual saving will justify the initial expenditure and also the running costs. Alternators and transformers are purchased on a kVA basis, hence it is reasonable to suggest that each consumer should pay the capital charges and running costs of the plant required for his supply on a kVA basis, with a concession where such supply is not required during the hours of peak load.

A Simple and Equitable Arrangement.

A simple and equitable arrangement would be to base the tariff on the average kVA demand for a period of twenty to thirty minutes, in order to provide for capital charges, plus a charge per unit to cover the operating costs, with a sliding scale or basis of charge below or above the agreed standard power factor. This sliding scale would operate in a similar manner to the usual coal-price clause.

Meters and Measurements.

To arrive at a consumer's general working conditions often involves averaging one or more of the required factors. This is fairer than to take maximum records which may not be sustained for more than a few minutes. Integrating ampere-hour meters for kVA-hour measurements have not yet been perfected. There is a difficulty in compensating for voltage fluctuations. A simple instrument is still required to integrate and record direct the average kVA during any time, as distinguished from the momentary value.

It is not desirable for power-factor-correcting devices—such as static condensers—to be kept in circuit continuously, thereby cancelling during the night-time some or the whole of the kVA registered by the meter on the lagging side during usual working hours.

There appears to be no standardised system of charging for high-tension electrical energy on a kVA basis at the present time; neither is there any standard method of arriving at the power factor of individual consumers' loads. A recording power-factor meter and a wattless-component meter, together with a maximum-demand indicator of the thermal type and a kWh meter, form too expensive a combination for small consumers. It is suggested that the energy in kW and kVA should be separately allocated and invoiced so that a consumer may check and understand the state of his installation, and if possible improve his power factor and thereby obtain a rebate. For two-phase and three-phase circuits two integrating watt-hour meters of the ordinary construction should be used, and the monthly power factor ascertained by the ratio of the units registered by these two meters.

The maximum demand in kVA with a reasonable time-lag should also be determined monthly, for if this is taken over a period of, say, twelve months, it is often found that consumers refrain from using motors, etc., at certain times, so as to keep the maximum demand at the lowest figure. This is disadvantageous to a supply department, and a clause has had to be inserted in some agreements specifying that if the total price under a kVA charge proves higher than under the flat-rate kWh charge, the accounts will be invoiced at the lower rate.

Ignoring the usual coal clause, the ultimate price would be:

The basic price at standard power factor (say £4 per kVA at 0·8 power factor) $= \frac{\text{standard power factor}}{\text{average power factor}}$.

It is further suggested that a rebate of 1 per cent. on the maximum-demand charge should be allowed for each 1 per cent. improvement beyond unity.

Various Devices for Correcting Power Factor.

In conclusion, the author deals with various devices for correcting low power factor. A simple, cheap and effective device, in addition to the static condenser, is badly needed. Phase advancers, of the rotating or vibrating type, are only suitable for large slip-ring motors. The static condenser does not supply magnetising current to the motor, and therefore does not affect its efficiency. It has been stated that it may cause resonance, but little trouble of this kind has been experienced. It has the merit of simplicity. Where d.c. is required from an a.c. supply rotary converters or motor-generators which draw current at unity power factor, or may even have a slightly leading power factor, have advantages. An average power factor of 0.93 has been obtained by some undertakings where a large d.c. load is supplied through rotary converters. Where there are long overhead transmission lines rotary synchronous condensers have been used with good effect, but idle-running machines are naturally not often used by consumers, as the energy losses compare very unfavourably with those of phase advancers or static condensers.

DISCUSSION.

In the discussion of this paper before the Sheffield Sub-Centre of the Institution of Electrical Engineers, Mr. W. E. BURNAND said that it was low power factor which caused high power cost, but he was not in agreement that supply tariffs corresponded to the cost of production. He contended that wattless current had its use, and was essential for the working of induction motors. In France both "wattfull" and wattless current were measured either independently or together, in which case only one dial was required. This method, however, had its disadvantages. The tariff should be framed to take account of load factor and diversity factor, and it was time maximum kVA demand was buried.

Mr. A. E. JEPSON did not agree that transformers only required a small wattless current, and gave instances where this was in the region of 11 per cent. of the total current. A special type of meter used in Newcastle-on-Tyne for indicating power factor recorded at the end of every hour the units consumed, and the power factor could thus be determined.

Dr. T. F. WALL remarked on the interest taken in power-factor correction since Kapp introduced his phase advancer, and described his own apparatus which we have recently described in THE ELECTRICIAN.

Mr. A. R. FEARNLEY did not agree with the method of charging according to maximum kVA demand. From the tramways standpoint, it would be a handicap to adequate public service on special occasions, such as football matches. It stood to reason that they would not run a number of extra cars for a few hours and so run up the maximum demand if they had to pay for it as if that demand had existed for a month or so, whereas it was only for a very short period.

Mr. H. YERBURY, in reply, said that in his opinion the correct way of charging for maximum kVA demand should be monthly. He also said that he had always found that when improvement was made to power factor, the efficiency of the motor was improved considerably over the whole range of its operation. Dr. Wall's new device for power factor improvement was interesting and appeared to have useful possibilities.

* Abstract of a paper read before the Institution of Electrical Engineers.

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Advertising in the Engineering Press.

The Campaign.

By HUGH M. GOODY.

Important as it is to decide correctly the advertising appropriation, it must be remembered that the value derived from any expenditure depends quite as much upon the way it is spent as upon the amount that is spent. This remark would seem almost unnecessary until one remembers the prominent engineering undertakings who honour such an obvious rule in its breach. In most industrial concerns certain classes of expenditure come to be looked upon as inevitable and are subjected to but little scrutiny. Not infrequently advertising is regarded as one of these unavoidable expenses—necessary evils one had almost said—and once the amount is decided upon, little further interest is taken in the matter.

Some Necessary Deductions.

In planning a campaign, be it large or small, certain deductions from the press advertising appropriation must be made before the actual space contracts are considered. First of all a small but reasonable margin for contingencies—say 5 per cent.—must be allowed. This will permit the advertiser to take advantage of any " special issues " or other opportunities which may arise after the contracts are placed. Then an allowance must be made for the drawings, blocks, etc., which will be necessary if the space is to be filled to advantage. It is difficult to express this allowance as a percentage of the appropriation since, although it will rise in proportion to the sizes of space employed and to the frequency of insertion, it is not directly dependent upon the number of media. In fact it is possible to double the number of journals which are made use of, without seriously increasing the block charges. However, for the purposes of this article, 10 per cent. may be taken as a reasonable allowance under this head, leaving 85 per cent. to be spent upon actual space.

Shall an Agent be Employed?

At this point it is as well to consider whether or not it would be advisable to employ an advertising agent. If the advertiser is ignorant of the subject and has no one on his staff who is more at home with advertising technique than he himself, then the services of an agent are almost essential. In other cases, he may perhaps be dispensed with, but a decision should be reached at this stage. If it is desired to employ an agent it is important to choose one who numbers upon his staff someone who is acquainted, at any rate superficially, with engineering apparatus.

Having chosen your agent, get him to submit a list of advertising rates in every paper which could possibly be of use to you. If you are handling the matter yourself, these rates may be obtained direct, but in either case the list should be carefully compiled and kept up to date from time to time for purposes of comparison. In making a choice from this list, there are two factors to be borne in mind, one the *quantity* of the circulation of each journal, and the other the *quality*—that is to say, what proportion of the total circulation is beneficial as far as you are concerned. It is a fairly general practice amongst technical journals not to publish circulation figures. In some cases however, they can be obtained without trouble, and where this is not the case it will be necessary to approximate as closely as possible to the actual figures.

Quantity and Quality in Circulation.

The *quality* of the circulation (from your individual standpoint) will prove more difficult to determine. Your advertising agent may be able to help you to some extent and your yourself will have a fair idea of the relative value of each medium. In this connection your salesmen may prove a valuable source of information. They are in personal touch with your prospective clients and are often in a position to say which papers are to be found on their desks or are most likely to catch their eye. Having ascertained as exactly as you can the rates, circulation and circulation-quality of each medium, you will, in conjunction with your agent, be in a position to prepare a preliminary list of media for your campaign. Circulate this amongst your salesmen for comment. You may obtain what appears an embarrassing volume of advice but, sifted carefully, this will probably prove extremely useful. Your final choice of media and sizes of space will require to be made in the light of your appropriation. Do not take smaller spaces than will adequately display your announcements. On the other hand, do not be tempted by the occasional " big spread." Continuity tells in advertising as in everything else. Insert your announcement regularly and, speaking generally, not less frequently than fortnightly in weekly journals and monthly in monthly journals. Regularly, because your reader will know where to find it when he wants it; frequently, because he won't bother to search half-a-dozen back numbers. If you can spend money in " special issues " in addition to your regular advertisements, do so, but don't sacrifice regularity. Let the criterion in each case be—just how far is that particular advertisement likely to appeal to prospective buyers? It is fatally easy to fall a victim to the " big spread—special issue " habit under the impression that such advertisements enhance the dignity and glory of the firm. If business, not dignity, is your object you will find a steady gradual influence on the buying public is far more productive than spectacular advertising.

As to length of contracts, speaking generally, these should be placed for a period of twelve months. By so doing you will obtain the advantage of the lowest rates and in any case it is usually difficult in any shorter period to form an opinion on which to base a revision.

Gleaning and Storing Information.

Having placed your contracts, it is of the greatest importance to glean and store, during the ensuing twelve months, all information which will be of assistance to you when, in due course, you come to revise them. This is perhaps a matter of greater difficulty in technical advertising than elsewhere.

Responses to advertisements in the engineering press are more often indirect than direct. That is to say, the interest of a buyer is aroused and he sends you an inquiry, or he is willing to receive one of your salesmen to whom he would otherwise have been " engaged." Business may eventually result, but it is impossible for you to say to what journal the credit is due and it is doubtful if the buyer himself could tell you, since his interest is probably the result rather of continuous advertising in various papers than of any particular announcement. Furthermore, in the case of heavy apparatus for which the buyer is only occasionally in the market, there may be a considerable lapse of time between the impression being made upon his mind and the receipt of any response in the form of an inquiry. This makes it all the more difficult to trace results, but nevertheless, there will always be at any rate a proportion of direct inquiries in reply to advertising. The number will probably be too small in most cases to give any clue to the total effectiveness of the campaign, but it will be exceedingly useful in so far as it can be made to indicate the relative values of the several journals employed.

" Keying " Essential.

For this purpose, some form of " keying " is essential. The prejudice against any noticeable " key " is, perhaps, stronger in the engineering world than elsewhere, so that if a key is to be employed it must be as unobtrusive as possible. The simplest way is probably to invite applications for a piece of printed matter, the serial number of which will be preceded by a key letter which will differ in each journal. An alternative is to advertise an important catalogue or other piece of literature in one journal at a time. Replies within a given period may then be credited to the journal in question and the same process repeated in other journals will give a basis for comparison. In some cases the inquirer will mention a specific journal (without a key having been employed), but this cannot be relied upon.

" Keyed " replies should be tabulated carefully both as to media and, where that is possible, as to the particular advertisement to which response is made. (This latter piece of information is useful as indicating the relative value of different styles of appeal). These tabulated results, though possibly small in number, will be of the utmost value when you are renewing your advertising contracts. Due allowance must, of course, be made for the indirect results which may not necessarily be in the same proportion as those which are directly observable.

One other point. Keep your salesmen and agents fully *au fait* with your campaign. If possible, send them advance proofs of all advertisements. When dealing through the trade, it will often pay to treat the more important factors in the same way. This will go far to co-ordinate the selling force of your advertising.

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A Multi-Speed Automatically-Controlled Cascade Motor Installation.

The problem of varying efficiently the speed of three-phase alternating current motors is becoming daily of greater interest, and the plant described, supplied as it was to take the place of what would otherwise have been a direct current motor with shunt speed control, may be considered to be a sign of the times.

The plant in question consists of motors driving vacuum pumps in connection with a Lamson Pneumatic Tube Co.

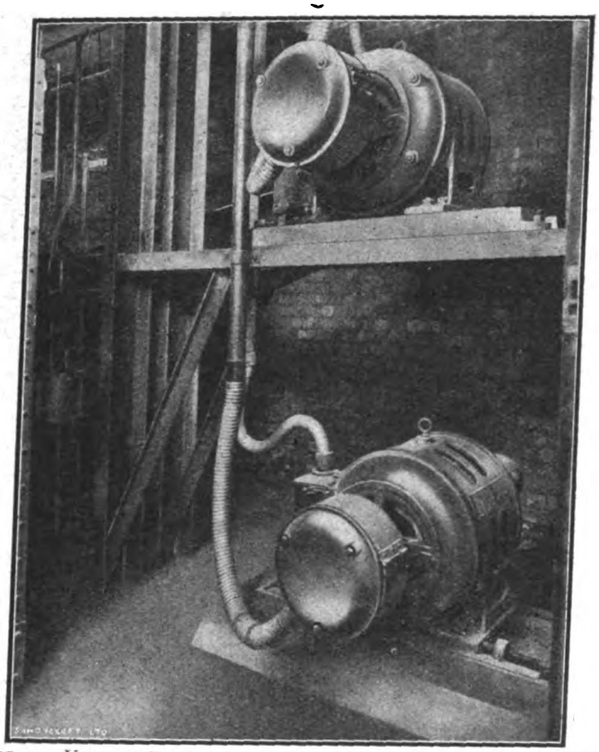

FIG. 1.—VIEW OF THREE-PHASE VARIABLE SPEED MOTORS USED IN CONNECTION WITH PNEUMATIC TUBE INSTALLATION.

vacuum tube installation in a large drapery store, and it will be readily understood that, whilst the plant must be capable of dealing with the maximum amount of business which occurs at various seasons of the year, it must also be capable of running efficiently at other seasons and of following the daily and hourly fluctuations if the most economical conditions are to be maintained.

The power supply being three-phase alternating current, the choice of drives lay between a three-phase variable-speed a.c. motor and a motor generator set and d.c. motor. It was found on investigation that, not only would a multi-speed cascade motor be considerably less in first cost, but that the overall efficiency would be appreciably higher than that of a motor-generator-motor set, apart from the very obvious advantage of cutting out two possibly troublesome links in the chain.

A cascade motor of the patent type manufactured by SANDYCROFT, LTD., was, therefore, decided upon, and it was considered that three definite economical speeds would adequately meet the conditions, the high speed for use under abnormal conditions (during sales, etc.) when, it was estimated, the amount of business would be approximately double that at any other time; the medium speed of half the value of the high speed for dealing with the maximum demand at non-sale times; and the low speed, two-thirds the value of middle speed, for dealing with the easy periods of non-sale times.

Under normal conditions, therefore, the two lower speeds are used, the high speed being available for emergencies, and it has been found that the fluctuations are of such an order that automatic control of speed is essential, to the best results.

The motors supplied were designed to give the following outputs:—

30 B.H.P at 1 450 revs per min., 400 V, 50 cycles.
15 B.H.P. at 725 revs. per min., 400 V, 50 cycles.
10 B.H.P. at 485 revs. per min., 400 V, 50 cycles.

and they were of the enclosed ventilated endshield bearing type, arranged for a belt drive, and are illustrated in Fig. 1.

The control gear is of the contactor type governed by master controllers; these master controllers themselves being

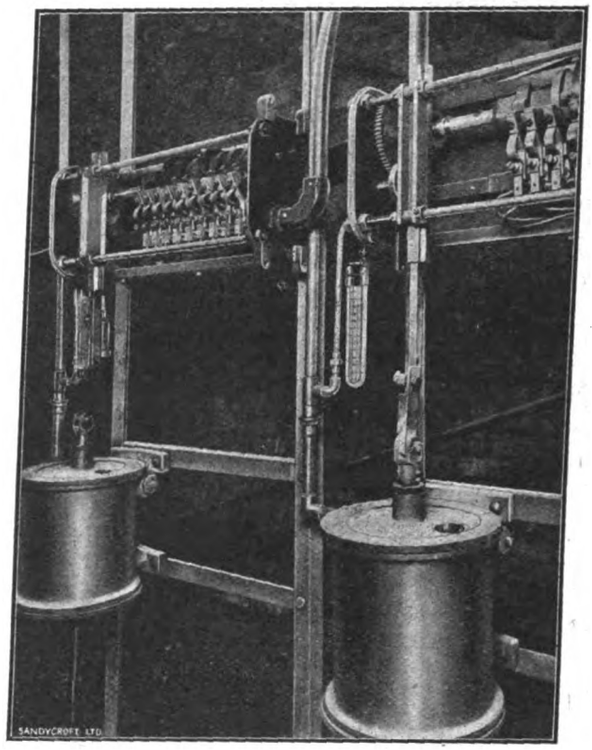

FIG. 2.—THE VACUUM CYLINDERS.

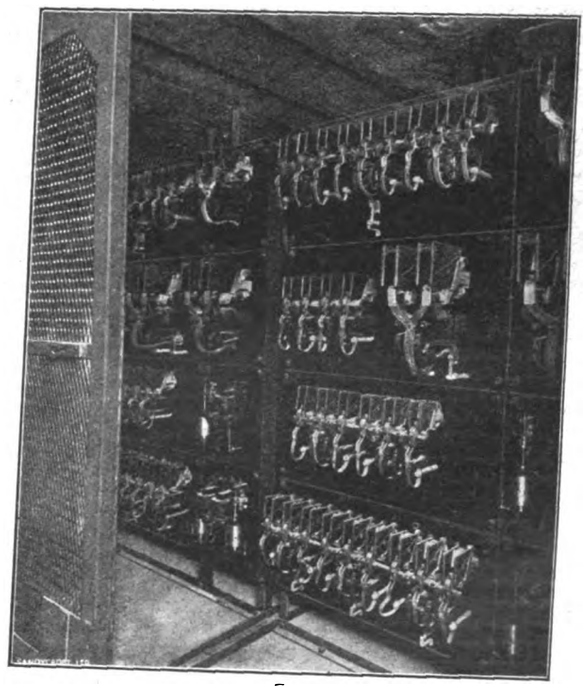

FIG. 3.—GENERAL VIEW OF THE CONTACTOR BOARD.

operated by vacuum cylinders, the position of the pistons of which is indicative of the actual demand at the moment.

It will be understood that the movement of the controlling pistons is of necessity slow and erratic, and for this reason it was necessary to devise a movement which would be quick and definite for the operation of the controllers. After some

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thought and experiment a very satisfactory mechanical device was evolved which, while giving the correct motor speed, is arranged to "flick" over the master controller and avoid any burning of the contacts or erratic operation of the control gear. Fig. 2 illustrates the vacuum cylinders and

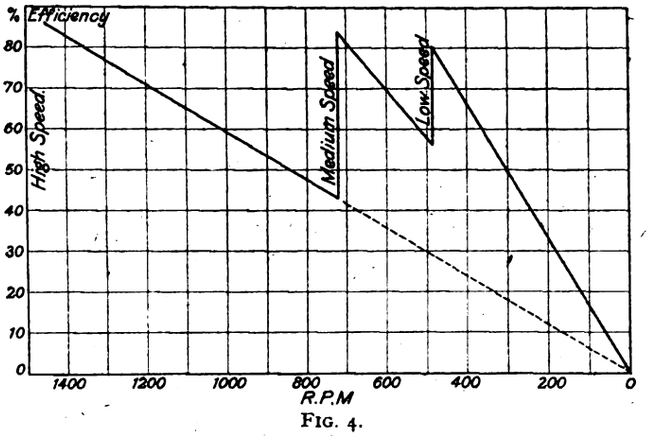

FIG. 4.

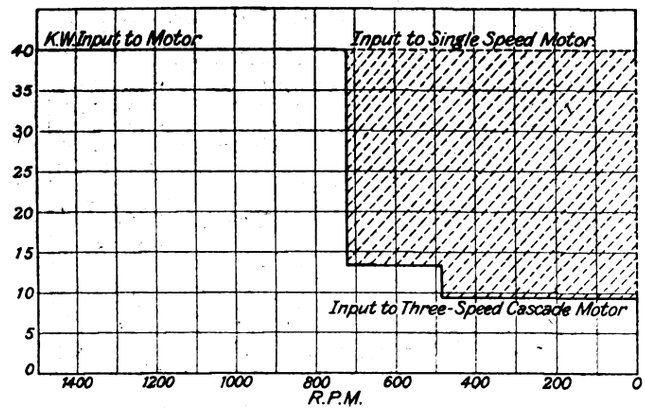

FIG. 5.

master controllers. The contactor panels are illustrated in Fig. 3. The efficiency of the motors is high at all speeds, and Figs. 4 and 5 indicate the saving in energy consumption as compared with an ordinary three-phase alternating current motor arranged for the same speed reduction by resistance.

Seven Years' Work of the Conjoint Board.

Activities Hampered by Lack of Funds.

A report dealing with the work of the CONJOINT BOARD of SCIENTIFIC SOCIETIES between 1916 and 1923 calls attention to the fact that, at the instance of a committee appointed by the Royal Society, a conjoint board for the purpose of promoting the co-operation of those interested in pure or applied science, supplying a means by which the scientific opinion of the country in all matters relating to science and industry might find expression, taking such action as might be necessary to promote the application of science to our industries and to the service of the nation and discussing scientific questions in which international co-operation seems advisable, was appointed. The work of the board has, on the whole, come within the lines thus laid down, but during the war a certain amount of research was undertaken. A list of scientific periodicals, with an indication of the libraries in which they can be consulted, is in process of compilation, and it is hoped the list may be published within a year.

A fortnightly bulletin of the meetings of scientific societies, with an indication of the papers to be read thereat, was published for two years and committees were instituted to consider the prevention of overlapping by various societies and to press the allocation of a Government site for the purpose of housing technological societies. Certain concessions with regard to paper supply and in the matter of censorship were secured during the war.

The Watching Committee on Education has done useful work, but probably the most important part of the work of the Board deals with the problem of the application of science to our industries. As a result of its representations a separate department of scientific and industrial research was established and research has been actually conducted by the Board into certain matters, including the water power resources of the Empire. The work of the Board, it has been pointed out, has been hampered by lack of sufficient funds, though the record of its work makes it plain that it has discharged its duties as fully as possible.

Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

THE E.P.E.A. AND THE EMPLOYERS.

To the Editor of THE ELECTRICIAN.

SIR,—I have read with grave concern the letter of Ald. Walker in last week's ELECTRICIAN, because there are statements in it which are calculated to mislead and entail further bitterness, and it looks as if there are those who still wish to prevent the National Joint Board from working, in spite of the efforts of the moderate men on both sides.

In the new salaries schedule put forward by the employers last autumn there was a clause under the heading "Settlement of Differences," which read as follows:—"In the default of agreement by the National Joint Board, the matter shall be referred to the Industrial Courts for determination." It was one of the best clauses put forward by the employers, and was welcomed by the E.P.E.A., but the joint sub-committee which was dealing with the revision of the schedule and conditions of employment had not yet reached that section when the employers' side, contrary to the spirit of their own proposals, withdrew from the Board.

On such slender foundation Ald. Walker makes the amazing statement that THE ELECTRICIAN had been hiding the fact that "for months the employers' have been urging the E.P.E.A. to agree to submit to arbitration matters which the National Joint Board failed to settle, and that it was only at the last hour that the E.P.E.A. could be got to accept this reasonable proposal."

We have always welcomed arbitration, and we have never withdrawn from the Joint Board because we could not get our own way. The only sense in which the employers could be said to have been urging us for months past to adopt arbitration was by giving a working demonstration of the unsatisfactory nature of the opposite course which they, during these months, had been pursuing.

Ald. Walker says "the E.P.E.A. admitted that the employers' interpretation of the agreement was correct." That is not true. The E.P.E.A. published the agreement, they have been commented on by the electrical Press, and only the employers will not admit the weight of the following words which occur in Clause 16 of these agreements: "A dispute is an officially recognised dispute *when it is in accordance with the constitution of the Union concerned.*" Clause 2: "In the event of a difference or dispute officially recognised *by both parties to this agreement* in accordance with Clause 1a and 1b, etc."

Ald. Walker says further: "No crisis would have arisen if the E.P.E.A. had not abandoned the path of friendly negotiation." But he does not add that it was the employers' side which presented an ultimatum to the E.P.E.A. in the midst of friendly negotiation on a schedule which included an arbitration clause.

Ald. Walker's statement "that the E.P.E.A. sought to establish the policy of striking against electricity undertakers who were observing every condition of the National Joint Board" is in keeping with the other statements in his letter.

The constitutional E.P.E.A. permits the executive to take national action only in such a grave crisis that an overwhelming majority of the members believe it is the only course left open to them. That situation has arisen twice only—once when the salaries schedule agreed to by the employers' representatives was not fully honoured by more than one per cent. of the undertakings. The second time was when the elected representatives of all these undertakings which Ald. Walker says "were observing every condition of the Joint Board" were refusing to function and thereby jeopardising all that the E.P.E.A. had gained by negotation. If the undertakings were observing the conditions, their elected representatives with whom we had to deal were not, and we took the only course possible to bring things to a head. It is very distasteful to me personally to revive all these old squabbles, but Ald. Walker's statements cannot be allowed to go unchallenged.

He has signed his letter as "Employers' Chairman," and presumably he has their sanction of his statements; but he must remember that he is also Chairman of the Joint Board, and his letter will raise such resentment on our side because of the misrepresentations he has made that he has jeopardised the smooth working of that Board when it is most needed—when the revised schedule comes to be adopted and when goodwill, if ever it was needed, will be required.

If the spirit shown in that letter is to be revived *after* our

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differences have been composed, I would suggest to both the employers and the E.P.E.A. to elect a completely new set of representatives to the Joint Board, and see if it is possible for a new set of men to start work with the intention of serving the best interests of the industry, rather than that of scoring points off each other.—I am, etc.,

JOHN H. PARKER.

Croydon,
April 16th.

To the Editor of THE ELECTRICIAN.

SIR,—It is a matter of great regret that Ald. Walker, as Employers' Chairman of the National Joint Board, should, directly after the termination of the recent dispute, endeavour to revive the matters in dispute as he does in his letter published in your issue of the 13th inst. So far as the E.P.E.A. is concerned, the recent crisis has now ended, and with the refunctioning of the Board and also with a view to giving the settlement arrived at a chance of successful operation, we were careful to avoid raising any issue which would tend to prejudice the continued functioning of the Board. Ald. Walker's letter, however, is of such a character and its tone so acrimonious, that in justice to ourselves we are compelled to take cognisance of some of the mis-statements made therein. In particular I would refer to the statement " that for months the employers have been urging the E.P.E.A. to submit to arbitration matters which the National Joint Board fail to settle, and that it was only at the last hour that the E.P.E.A. could be got to accept this reasonable proposal."

It is very significant that at the breakdown in December last there was no suggestion whatever of arbitration. The Employer Representatives stated their decision and as the E.P.E.A. could not accept this decision, the employers withdrew their membership of the Board. Certainly, in the proposals from the employers for the revision of the Schedule, there was at the end a clause which provided " that in default of an agreement upon the National Joint Board in the event of a difference arising in reference to the conditions and Schedule, the matter should be referred to the Industrial Court for arbitration." When, however, the deadlock occurred in December last, this clause had not received consideration by the Negotiating Committee of the Board, and it was not until the meeting held on the 6th inst., that there was any discussion or consideration between the employers and ourselves upon this particular proposal. It is absurd, therefore, for Ald. Walker to argue that the employers have been urging us for months to agree to arbitration and that we would only agree at the last hour.

Throughout our existence it has been the fundamental principle with the Association that, whatever the dispute, we should utilise all the available constitutional machinery before proceeding to take extreme measures. Apropos of of this, we should have secured from our point of view a better result at Halifax had we not adhered to our principle of adopting constitutional methods. I note, however, that Ald. Walker wishes that all matters upon which the National Joint Board fail to agree should be referred to arbitration. Perhaps the Employer Representatives in the future will adopt this method instead of withdrawing their membership as they did in December last.

Although much could be said from the E.P.E.A. point of view upon the other matters referred to in the letter from Ald. Walker, we think that to refrain from so doing will meet with the approval of both sides of the Board and of the industry generally.—I am, etc.,

W. ARTHUR JONES,
General Secretary,
Electrical Power Engineers' Association.

MODERN BOILER HOUSE PRACTICE.

To the Editor of THE ELECTRICIAN.

SIR,—I have read Mr. David Brownlie's article in your issue of March 16th with great interest, and have derived equal pleasure from the very instructive correspondence that has been published in the subsequent numbers.

Your space I know is limited, but my boiler experience, ashore and afloat, under all conditions imaginable, prompts me to ask the question: What is the use of boilers capable of such fine performances when there are few men, if there are any, who can *keep them running* at the efficiency mentioned? That the boiler can and will fulfil the contract conditions I do not doubt, and in any case the makers would hardly sign the agreement if they were doubtful about it. I am equally convinced, however, that when Babcock and Wilcox's staff leave the boiler, men who have devoted their lives to this special type, the test efficiency will never again be obtained by the owners for any length of time.

The design of a boiler is naturally affected in trying to meet such requirements, and as there are no men attached to any power station who can run the boiler at 88·5 per cent. efficiency, or anything like it, for, say, even a fortnight, I fail to see the value of the whole scheme. It would be far better to install a boiler which has proved its value by actual performance and educate a staff to run it at 75 per cent. efficiency year in year out, than get enthusiastic about some ideal scheme.

The matter, however, has one redeeming feature: it will be very interesting to try and find out in 1928 how often and for how long the boiler efficiency was above 80 per cent. That is something to look forward to.—I am, etc.,

CHARLES A. SUCKAN.

London, N.W.3.
April 16th.

To the Editor of THE ELECTRICIAN.

SIR,—I have read Mr. Brownlie's article on " Modern Boiler House Practice," and the subsequent correspondence on the subject with great interest.

From the correspondence which the article has brought forth, it would seem that the keen interest of engineers has been aroused, and if only on this account I think Mr. Brownlie's article has served a very useful purpose.

Plant efficiency guarantees are given by the manufacturers on the assumption that the apparatus guaranteed will be kept in proper condition. In the case of boiler plant I do not see how the efficiency guaranteed by a manufacturer can be attained other than when the boiler is new, and this condition can only be fulfilled when the boiler is started up for the first time, as no amount of cleaning will ever leave the tube surfaces in condition equal to new.

In the case under review in the article the efficiency of 85 per cent. seems at first sight to be to the high side, but this figure should not be so difficult of attainment when it is considered that efficiencies of 80 per cent. have been guaranteed and easily obtained in recent years for boiler, economiser and superheater, and this with a stack temperature of 400 deg. F.

In this case the stack losses would be about 14 per cent., and if the addition of an air-heater is going to reduce the stack temperature to about 250 deg. F., the efficiency would be raised to about 85 per cent.

In support of this statement I attach copy of a test taken on a boiler which has been steaming for about 18 months.

HEAT BALANCE.

(INDUCED DRAUGHT.)

Test on Boiler No. 1, December 12th, 1922.

	B.Th.U.	Per cent.
To Calorific Value of Coal (as fired)	10 630	100
By Heat Transfer in Boiler	6 370	59·9
Heat Transfer in Superheater ..	1 180	11·1
Heat Transfer in Economiser ..	960	9·03
Heat Transfer in Combined Plant	8 510	80·03
Loss in Flue Gases	1 385	13·03
Loss in Radiation	531	5·0
Loss in Combustible in Ash	204	1·92
Heat in Ashes, Moisture and Losses unaccounted for..	—	—
	10 630	99·98

Stoker and Fan Power = 0·91 per cent.

I do not see why Mr. Brownlie should wish to include in his calculations the steam or power used in driving the feed-pumps, coal and ash conveyors, soot blowers, etc., as these auxiliaries are outwith the boiler makers' province, his guarantee covering each individual boiler only, and not the boiler-house output.

Regarding the radiation losses, I may say that recently a number of tests were taken at Dalmarnock on a 50 000 lb. Babcock and Wilcox C.T.M. steel-cased boiler, to ascertain the quantity of banking coal per hour, and the result gave an average of about 270 lb. Assuming that the radiation losses were constant at all loads, this would give a figure of 3·9 per cent. at full load.—I am, etc.,

R. B. MITCHELL.

Glasgow,
April 11th.

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Merchandise to Sell and Profit By.

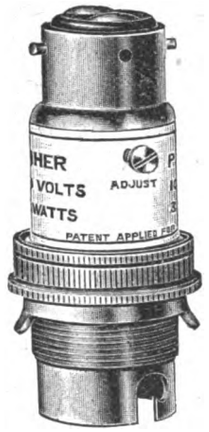
***In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of* THE ELECTRICIAN.**

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

The Flash-o-Lite Lampholder Adaptor.

The use of flashing signs for shop window and other display services is now general, but it is a pity that many otherwise well-designed signs should have their effect ruined by the use of unreliable flashers. The chief failing in this class of apparatus is that the "off" period is usually far too long, the action is sluggish and irregular, and is often accompanied by an irritating flicker. A wide field exists for a flasher free from these defects, and the



FLASH-O-LITE LAMPHOLDER ADAPTOR.

Flash-o-Lite adaptor recently put upon the market by the GENERAL ELECTRIC Co., it is claimed, meets this demand.

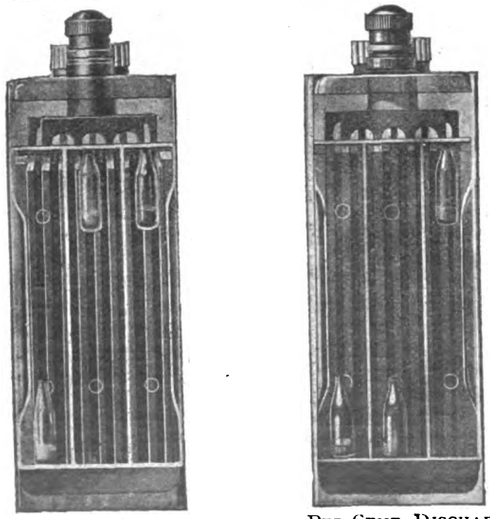
The Flash-o-Lite, as our illustration shows, is a simple device which can be fitted to any lampholder, thereby converting an ordinary lamp to a flashing lamp suitable for window or counter display. The period of the flash can be regulated by means of an adjusting screw at the side. Normally it is about 3 secs. "on" and 2 secs. "off."

Great care has been taken to ensure that the break and make shall be clean and decisive. The contacts are substantial and are made of platinum silver, which will stand any amount of hard work.

The interior of the Flash-o-Lite consists of a special thermal strip carefully wound with high grade wire.

Another "Service" Device for the Wireless Retailer.

In our comments under another heading we emphasise the importance of handling only the best accumulators. Among the multitude now tempting retailers to buy this apparatus there are a number who stand out from the others, and among them is PETO



50 PER CENT. DISCHARGE. 75 PER CENT. DISCHARGE.
IS YOUR BATTERY CHARGED? LOOK AND SEE.

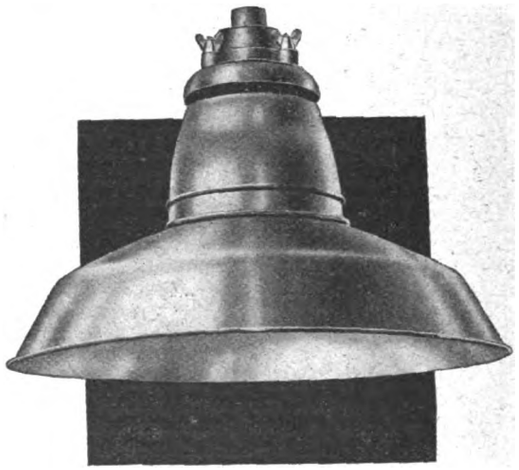
AND RADFORD. The reputation of this firm is so world-wide as to make this expression of thought commonplace, but the stress of the daily buying is such that the reminder will be useful. Our illustration is of the new accumulator which Peto and Radford have recently placed upon the market and which is known as the "Gravity Float" type.

By introducing this type of accumulator, Peto and Radford believe they are supplying a long-felt want. Everyone is aware of the disappointment caused to wireless amateurs by the "running out" "of the accumulator. This can now be avoided, because at a glance the amount of charge still in the battery can be visualised. Each cell, as will be seen in the illustration, is assembled with three "gravity floats" of distinctive colours—white, blue, and red. These floats are calibrated to sink as the density of the acid in the cell falls. For example, the white float will begin to sink when the cell is 50 per cent. discharged; the blue float will sink when the cell is 75 per cent. discharged; and the red and last float will do likewise when the cell is 95 per cent. discharged. As soon as the last float sinks the battery is practically discharged and must be charged at the earliest possible moment.

Full explanation of the action of these gravity floats is described on the instruction label which is affixed to every cell sent out.

The Simplex Dispersive Reflector.

From a study of a price list recently received from the SIMPLEX CONDUITS, LTD., we gather that they have placed upon the market a dispersive type metal reflector for gasfilled lamps. The specification indicates that the reflector is thoroughly well made. From our illustration it will be noted that the Simplex Co. have adopted



A NEW DISPERSIVE REFLECTOR.

the skirt or flounce shaped canopy which has proved in practice to be most efficient for a reflector intended to be "dispersive." The reflector is made in several sizes from 13½ in. to 24 in. in diameter. The range manufactured includes a concentrating pattern and an angle pattern reflector built on the same heavy weatherworthy lines as the dispersive pattern.

The Waller-Hardway Dry Cell.

We have recently had under observation the "Waller-Hardway" dry cell, a new design of primary battery which, it is claimed, is the outcome of experiments extending over twenty years. The great feature of this cell is stated to be that instead of depreciating by standing, it maintains and often increases in capacity before use up to six months and more. "Standing" is of course the usual obstacle to the sale of the everyday battery which has been in stock for any length of period.

The varying tests to which the cell has been subjected have been severe. One of these was short circuiting for 70 hours. This was found to bring the cell down to 0·7 V 3 A, but after 24 hours' rest the cell had recuperated to 1·55 V 14 A. Four cells working as a low tension battery on a wireless "two-valve set" constantly each night for 5 weeks, were returned as exhausted, but after 24 hours' rest were found to have recuperated to 1·5 V and an average output of 11 A. It may be stated that these four cells were without insulating covers and were returned joined up in series, thus being on short circuit. Three of these cells are still in use on a hand lamp for intermittent lighting for periods of 15 minutes at a time.

Another interesting point is that it is stated that the depolariser in these four cells was only half the ordinary amount usually employed

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and this it is claimed proves the highly recuperative power of the material.

The excitant in the Waller-Hardway cell is composed of a certain vegetable saturated with ammonium chloride, the depolariser contains the usual chlorides together with manganese dioxide packed in a bag.

The patentees maintain that these cells can be made as cheaply as other dry cells on the market and are therefore a good commercial proposition.

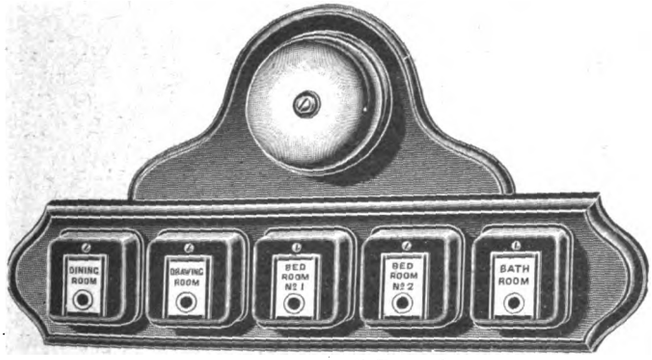
The "G.O.M." of Wiring Systems.

Historians of the future who attempt to present to their readers a word picture of our time will surely comment on the enthusiasm with which manufacturers set themselves to develop wiring systems which would solve the problem of "the cost per point." This is not the column to comment on their success, but certainly it is appropriate to show an installation carried out on the "Prescot" system, which is, of course, manufactured by the BRITISH INSULATED AND HELSBY CABLES, LTD. As a man is judged by the company he keeps, so it may be said that a contractor is judged by the wiring system he regularly uses. Therefore those who wish to build up profits and reputation and to receive the favourable judgment of both the men of their own time and posterity should see to it that they look into the "Prescot" system. If age is any merit—and who will deny respect to old age?—then the "Prescot" system has every merit because it is 25 years or more old and must surely, therefore, be the G.O.M. of wiring systems. Full information on the system is given in a publication recently issued by the manufacturers.

A STREET WHERE THE "PRESCOT" WIRING SYSTEM IS USED.

Something Better in Bell Indicators.

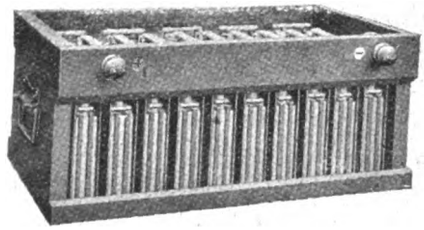
In the electrical field there are little by-ways or back-waters, in installation work particularly, where the standard quality and design has sunk so low that the device has almost ceased to merit the name electrical. What it should be called is difficult to say. Certainly it is not a "service" device. Particularly does this apply to bell indicators, of which we should do well to raise the standard. Among the several manufacturers who have a good device for the contractor to instal is the STERLING TELEPHONE AND ELECTRIC CO. Our illustration is from Cat. No. S. 6204. This equipment is built up on site if necessary with the "Unitype" pendulum indicator. Each "Unitype" is a complete unit, thus making it an easy matter to assemble an indicator with any number of holes.



THE LATEST "STERLING" BELL INDICATOR.

The "Exide" Battery.

It is not necessary to enlarge on the "Exide" Battery to those retailers who have determined that their policy shall be to market only batteries and accumulators of known worth. There are, however, a large number of retailers who are attempting to build their business on the quicksands of the false policy of handling apparatus which show (on paper) a large gross profit. This policy will not build up a reputation, and who can hope to survive in the retailing of electrical service devices without jealously guarding their reputation?



THE "EXIDE" HIGH TENSION BATTERY.

The "Exide" Battery, which, of course, is made by the CHLORIDE ELECTRICAL STORAGE CO., will show a reasonable and "profitable" profit and still more will add to the reputation of the retailer. Our illustration is of the Exide Co.'s A.Y.G. type, which is a high tension battery. It is made in two ratings, 32 V and 48 V. The plates are of standard Exide design; the boxes are of glass and the design of crate such that the outer rows of cells can be thoroughly inspected for acid levels, etc.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

Contractors and others who have to know the best ironclad switchgear to use, will be interested in a folder, No. 5B, published by J. H. TUCKER AND CO. A brief, but comprehensive, description, with prices, is given of new pattern iron switches with solid covers and earthed handles.

It is our pleasure to announce that the STERLING TELEPHONE AND ELECTRIC CO. have published two new catalogues on wireless apparatus. Catalogue No. 347 describes the "Sterling" unit system, and Catalogue No. 348 the "Sterling" new design of loud-speaker and power amplifiers.

The BRITISH THOMSON-HOUSTON CO. continue to issue publicity matter in a form most profitable to retailers. The latest is a folder, No. L 269, which illustrates a range of beautiful "glass shades for electric lamps." These folders are available in quantities, overprinted.

SIEMENS BROS. AND CO. announce the publication of (*a*) pamphlet 860A describing "Siemens Optical Pyrometer," and (*b*) "Siemens electrical distance thermometers for cold storage chambers on ships," and (*c*) "Siemens electrical distance thermometers for temperatures for 200° up to 500° C."

From the BRITISH THOMSON-HOUSTON CO. we have received three new descriptive lists: (*a*) No. 4 161A on "Ironclad Oil Immersed Circuit Breakers," (*b*) No. 5 625 describing "Automatic Control Gear for Electric Capstans and Winches," (*c*) No. 5 031 describing "Mining Controllers and Resistances for a.c. and d.c. Circuits."

We have recently received from the ENGLISH ELECTRIC CO. another publication in the handsome style for which this company is becoming deservedly famous. This contains a list of rolling mill equipments with much interesting technical data. We are asked to state that a copy will be forwarded on application to all engineers interested.

We have previously commented on the wireless products of RADIO INSTRUMENTS. We now have to announce the issue of a new list, which covers a large selection of apparatus from a crystal set at £4 15s. complete to valve sets of 105 guineas. Truly a wonderful range of apparatus with which the retailer can make turnover and profits.

The SIMPLEX CONDUITS CO. have published another price list to prove their determination to keep abreast with the needs of the electrical industry, and particularly the lighting field for a higher standard of quality. This list is No. 961, and it describes, with prices, a wide range of "Industrial Lighting Fittings," comprising metal reflectors, well-glass fittings, outside lanterns and cargo clusters. We hope to deal at an early date and in specific detail with some of the outstanding features of several of the devices listed in our "Merchandise to sell and profit by" columns.

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The Woman's Exhibition.

A Disappointing Electrical Display.

The Woman's Exhibition, now in progress at Olympia, London, W., has evidently followed too closely on the heels of the recent Ideal Home Exhibition for the liking of the electrical industry. Practically no attempt has been made to demonstrate the very great importance of electricity to the modern woman, who has, after all, enough sense to be attracted by something less superficial than pretty lamp-shades. These articles are present in force, but electric cookers and heaters are conspicuous by their absence.

Credit must be given to one or two firms, however, for excellent displays. CHARLES FER AND CO. have a stand on which several electrical labour-saving devices are shown. Good as the stand is, we cannot help thinking that the practical advantages of electricity might have been more effectively demonstrated. Electro-medical appliances are shown by the STERLING CORPORATION (GREAT BRITAIN), LTD., and by ROGERS' ELECTRIC SALES CO. The first named firm make a speciality of high frequency violet ray generators in two types. Both stands contain several very useful appliances for the sick room, where the convenience and cleanliness of electricity are becoming more and more appreciated.

The Sheringham artificial daylight system is demonstrated by the PHILSON MANUFACTURING CO., and should make a strong appeal to women on account of its convenience for colour matching purposes. Another essentially feminine application of electricity is shown on the stand of the WEST ELECTRIC HAIR CURLER CO.

Labour-saving devices involving the use of electricity are shown and demonstrated on a few of the gallery stands. Vacuum cleaners include the "Nilfisk" of GILLESPIE AND BEALES, the "Eureka" of the ELECTRIC APPLIANCES CO., the "Hoover," which is, as usual, very ably demonstrated, and the "Apollo" of LEWIS AND SAWYER. Electric washers and ironers are shown by BEATTY BROS. and FRANK FEESEY AND CO., while COMMERCIAL MONOPOLIES, LTD., are showing a useful novelty in the "Goblin" electric night lamp.

The publicity given to the conference of the Women's Engineering Society should attract attention to the stand of ATALANTA, LTD., a London firm run by and for women engineers. Inquiries at the stand showed that wireless components are among the articles at present being manufactured.

The Women's Engineering Society.

Confidence in the Future.

Lady Parsons presided at the first international conference held under the auspices of the WOMEN'S ENGINEERING SOCIETY at Birmingham last week. An attendance of forty included delegates from all parts of the country, as well as from France and America. The annual report recorded that, despite unparalleled trade depression, women who had been able to retain posts had consolidated their position, and there had been a growing confidence on all hands in the ability of women to perform many useful functions in the engineering world. The hope was expressed that in the new industrial order emerging from the after-war chaos women engineers would prove their value to the community.

Commercial Electrical Design.

The Papers read included one by Miss M. Partridge on "Engineering Contracts in Country Districts," and one by Miss G. L. Entwistle on "Some Considerations of Commercial Electrical Design." Miss Entwistle, referring to the design of small d.c. motors, detailed the numerous regulations and conditions which had to be met. Where the motors were for export, weight was an important factor, and special insulation was often necessary for tropical climates. The lecturer also pointed out that motors for special purposes necessitated special features, for instance, motors for ship work must be suitable for working at a permanent tilt, and unless this was kept in mind in designing the bearings the oil rings would probably jamb. All these things made a due consideration of the possible market a first essential.

Electric Power Transmission for Ships.

Striking Reliability Statistics.

In the course of a paper on "Electric Transmission of Power for Propelling Machinery," which he read last week before the INSTITUTION OF ENGINEERS AND SHIPBUILDERS in SCOTLAND, Mr. W. J. Belsey stated that an electric equipment had been fitted into the merchant ship "San Benito," which had been in service now for fourteen months, and travelled upwards of 76 000 miles. During that time nothing had been spent on the upkeep of the propelling machinery, and the vessel had not lost a single hour's sailing due to any defect in that machinery. The United States naval collier "Jupiter" had been in commission for over eight years, and seen arduous service, and although many seas had been shipped in the engine room, a matter of a few pounds had covered the cost of upkeep since she was put into commission. As to economy, he claimed that electrical transmission of power for propelling purposes for 3 000 H.P. upwards per propeller was a little more economical than single reduction gearing, and was decidedly more economical than double reduction gearing, and also was more economical than the old-fashioned reciprocating machinery. Another point was that the electrical drive was noiseless in operation, which was a feature of great importance from the point of view of popularity with passengers. For the Diesel electric type he also claimed that economical running could be obtained over a wide range of power.

Municipal Finance.

Tramway and Electricity Department Figures.

The following details indicate briefly the position in which certain municipal electricity and tramway undertakings have found themselves as the result of the past financial year's working. It will be observed that in several cases results have considerably exceeded expectations, and the general tendency appears to be to appropriate any unexpected surplus for rate relief. The good results shown by some undertakings, both tramway and electricity, are the more gratifying inasmuch as they have come about in spite of, or possibly because of, reduced charges during the period under review.

Profits and Losses on Tramway Undertakings.

The past financial year has, on the whole, been a profitable one so far as concerns municipal tramway undertakings. There are some notable exceptions, however. The CROYDON Corporation's undertaking recorded a loss of over £13 000. It remains to be seen whether the reconstruction of the track and the inauguration of the through service to London termini (a start has just been made with these improvements) will rectify the position. An EAST HAM Corporation report shows a loss of £7 700 on the tramways for the last nine months, and MIDDLESBROUGH Finance Committee estimates that the probable loss on the municipally owned trams and omnibuses during the year will be from £15 000 to £25 000. The result of the year's working shows a loss on the DARLINGTON tramways of £2 500, against £2 000 in the previous year. An optimistic view of the future is taken by the joint Tramways Committee of STOCKTON and THORNABY Corporations, which is faced with a loss of £5 180 for the year just ended. They estimate a net loss of only £29 for the year ending March 31st, 1924, the estimated expenditure being £11 000 less than last year. The revenue is expected to yield £49 817.

As against these losses, however, other municipalities have an excellent record to show. At BLACKPOOL, a year ago, the Tramways Committee estimated the profit for 1922–23 at £6 000, whereas the actual surplus is £23 500. The estimated profit for the year ending March 31st next is £21 500. An argument for reduced fares is furnished by BRADFORD, where it is estimated that the profit for the financial year just closed will be greater than that for 1921–22 (£67 000). Some months ago the minimum fare was reduced from 2d. to 1½d., but a million extra passengers have been carried as the result. At LEEDS the profit for the past year amounted to no less than £87 170, against £8 630 estimated. It is proposed to devote £20 000 to rate relief. Here again fares have recently been reduced. At PLYMOUTH the income of the tramways undertaking for the year was £226 000, and a profit of £3 924 was shown.

Results and Estimates of Electricity Undertakings.

The information at present available shows that electricity undertakings have been generally successful. At BLACKPOOL the electricity department, like the tramways department, exceeded expectations, a record being created by the generation of over 9 000 000 kWh. The estimated profit for the past year was £13 000, and the actual profit was £24 000. The estimated profit for the year to March 31st, 1924, is £12 000. The rates will benefit as the result of last year's successful working. The PLYMOUTH undertaking, out of an income of £141 000, made a profit of £24 581. We note with pleasure that the lighting charge was reduced from 6½d. to 5½d. per kWh as from April 1st. This is undoubtedly the way in which profits should, if possible, be applied. It is a policy, however, which is by no means universally followed, especially where the profit on an undertaking exceeds expectations. At LEEDS, for example, the estimated profit on the electricity undertaking was £10 415. The actual profit was £33 660, and of this no less than £30 000 has been set aside for rate relief. Some municipalities seem to favour a division of the spoils. At COVENTRY the profit on the electricity undertaking has admitted a contribution of £10 000 for rate relief, but charges have been reduced as well.

A Good Year at Huddersfield.

Contrary to the usual practice, the financial year of the HUDDERSFIELD electricity undertaking ends on December 31st, and the 1922 figures are now available. The income reached a total of £191 869 as against £203 928 in 1921, but expenditure was greatly reduced, the fuel bill alone dropping from £89 580 to £56 490. There was a net surplus of £21 580 as against £412 in 1921. The surplus has been carried forward, and substantial reductions in charges have been made, the lighting charge being brought down to the low figure of 4½d. per kWh.

Further Results in Brief.

The EAST HAM electricity undertaking shows a profit of £9 000 for the last nine months, and that at DARLINGTON a profit of £6 000 for the past financial year. This is more than was expected, in spite of the fact that charges have been reduced. A similar result has been obtained at BATH, where, although charges have been reduced, a profit of £10 000 is shown after sinking fund and interest charges have been met. The TAUNTON undertaking, as the result of a good year's working, has been able to repay to the District Fund the sum of £863 contributed to meet a deficit in 1920. The estimated profit of the ST. PANCRAS (London) undertaking for the year to March 31st last was £40 487 and out of this the sum of £25 000 has been earmarked for rate relief. Another London borough, HAMMERSMITH, has allocated from the profits of the electricity undertaking a sum equal to a 4d. rate.

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The London Electricity Scheme.

High Court Discharges Rule of Prohibition.

The case of The King *v.* the Electricity Commissioners, *ex parte* London Electricity Joint Committee and Others, came on April 12th before a King's Bench Divisional Court consisting of the LORD CHIEF JUSTICE and, JUSTICES AVORY and ROCHE, the Crown appearing to show cause against two rules *nisi* which had been obtained against the Electricity Commissioners, one for a writ of prohibition and the other for a writ of *certiorari* in regard to their scheme for effecting an improvement of the existing organisation for the supply of electricity in the London and Home Counties Electricity District.

The ATTORNEY-GENERAL, for the Crown, said that the rules were granted on the following grounds :—

(*a*) That the provisions of the said scheme whereby it is made compulsory upon the Joint Electricity Authority at their first meeting to appoint and keep appointed two Committees of the Joint Electricity Authority are *ultra vires* the Electricity Commissioners and contrary to the Electricity (Supply) Acts, 1919 and 1922.

(*b*) That the provisions of the said scheme whereby it is rendered compulsory upon the Joint Electricity Authority to delegate to the aforesaid two Committees the powers and duties of the Joint Electricity Authority mentioned in the third annex to the said scheme, are *ultra vires* the Electricity Commissioners and contrary to the provisions of the Electricity (Supply) Acts, 1919 and 1922.

He contended (1) that the applicants for the rule had wholly misconceived the position of the Electricity Commissioners and that *certiorari* and prohibition would not lie ; and (2) upon the merits that the Acts of Parliament gave ample power to the Electricity Commissioners to do all that they were alleged to be proposing to do under the affidavits and the rule. Sections 2-4 of the Electricity (Supply) Act of 1919 gave certain general powers to the Commissioners, and sections 5-7 provided a system for reorganisation of the electricity supply.

The Disputed Scheme.

Sir DOUGLAS HOGG then outlined the whole course of procedure adopted by the Commissioners, from the first local inquiry down to the final confirmation of a scheme by Parliament. In Greater London, he said, the first two inquiries were held together. No objection was taken to that, and schemes were submitted. The public authorities desired a scheme constituting one joint electricity authority, and the L.C.C. were not prepared to transfer their powers—and they could not be compelled to do so—unless there was one, and only one, electricity authority for the district. The private companies desired two authorities, one for the public authorities' areas, and the other for the companies' areas. They would not transfer their power stations and plant unless the companies retained control. The Commissioners were in a dilemma, and they put forward a scheme which was now said by the companies to be *ultra vires*. The scheme provided for one joint electricity authority for the whole area, to whom the L.C.C. would transfer their powers ; this authority was to constitute two committees to control respectively the companies' area and the public authorities' area under the supervision of the one authority. The Electricity Commissioners were merely an advisory body ; they had no corporate existence ; their function was to advise the Minister of Transport, who might lay the scheme before Parliament.

Section 6 of the Act defined what the scheme might contain, and by subsection (2) the scheme might provide for enabling the joint electricity authority to delegate its powers to committees, and for payment to its members of reasonable compensation for loss of remunerative time.

The LORD CHIEF JUSTICE : What is unremunerative time ?

The ATTORNEY-GENERAL : Perhaps it is the time I spend in the House of Commons. (Laughter.)

The ATTORNEY-GENERAL, continuing, said that under section 8 the authority were to comply with any general directions given them by the Electricity Commissioners.

The LORD CHIEF JUSTICE : You say that the Electricity Commissioners may give the authority power to delegate under section 6 (2), and under section 8 may add a direction that the power shall be exercised.

The ATTORNEY-GENERAL : Yes.

Reason for Bringing the Action.

Mr. TYLDESLEY JONES, appearing in support of the rules, said that the Commissioners were bound to hold the inquiry, which was a very formal matter, on oath. They had power to compel attendance and the production of documents. Such an inquiry could only be held on a scheme within the Act ; the Commissioners could not approve a scheme outside the Act and compel attendance at an inquiry into it, and prohibition would lie. The point of *ultra vires* was taken before the inquiry and again at the opening of the inquiry, and the Commissioners said that they were going to proceed on the assumption that these provisions were *intra vires*. It put the companies in a difficult position as there was a doubt whether features in the scheme which they approved were *ultra vires*. Section 6 had a limiting as well as an enabling effect. His clients had spent £20 000 000 on their undertakings and the object was to see whether the scheme was watertight.

The LORD CHIEF JUSTICE : It seems a novel chapter in the history of *certiorari* and prohibition. Your argument seems to suffer from the fallacy of the undistributed middle. If the Court refuses the writ it does not follow that the scheme is within the Act. Other considerations may apply if and when the scheme is approved by the Minister and adopted by resolutions of both Houses. You appear to be asking us for a proleptic certificate of contingent validity.

Mr. TYLDESLEY JONES : Section 6 (2) is absolutely inconsistent with complete delegation. The powers of the joint authority would be exercised by sections.

The LORD CHIEF JUSTICE : I have heard of a man who *cunctando restituit rem*. This looks to me like cunctation.

Mr. TYLDESLEY JONES : If this goes through and is of doubtful validity, all the parties concerned will spend a great deal of public money, for no one will dare act on it.

The LORD CHIEF JUSTICE : Your position is : We like what is being attempted, but because we fear that it will not be attempted with success we wish to test the legality of it now, and ask the Court to quash or to prohibit it, though we do not desire that it should be either quashed or prohibited, and notwithstanding that there are several further stages.

Mr. JUSTICE AVORY : Has a court of law ever been asked to decide the legitimacy of a child in embryo ?

Mr. TYLDESLEY JONES : This child is born ; it has seen the light, though it has not yet become an order.

The LORD CHIEF JUSTICE : Out of a benevolent interest in the offspring you are asking for an order in bastardy against what has not yet even become an order.

Judgment.

The LORD CHIEF JUSTICE, in delivering judgment discharging the rule, reviewed the statutory provisions and the history of the scheme, and said that what was complained of—if it was complained of—was that powers were compulsorily delegated. It was to be observed that the scheme, even when it had gone much further, was still in the air. Even after approval by the Ministry it was still inchoate and did not come into effect until it was approved of by resolutions of both Houses. He had wondered whether Mr. Tyldesley Jones thought the scheme too mischievous to be tolerated or too good to be true. He had come to the conclusion that the latter was the case, and that the object with which these rules were sought was not to quash or prohibit the scheme, but to make sure that when that which was so much desired was passed no one else could question it.

It was not necessary to go into the general questions raised. They were dealing here with an inchoate and embryonic order, which had at least to run the gauntlet of the Minister of Transport and of both Houses of Parliament. The whole foundation of Mr. Tyldesley Jones's argument would have gone if the Commissioners substituted the word " may " for the word " shall." This case, at any rate at this stage, was not one in which there should be prohibition or *certiorari*, and both rules must be discharged.

The other Judges concurred and the rules were accordingly discharged, with costs.

The Budget.

Reductions in Postal and Telephone Charges.

Although the Chancellor of the Exchequer has not seen his way to restore the penny post, his Budget proposals have at least given a long-suffering community a little more for their money. As from May 14th, the inland letter rate is to be 1½d. up to 2 oz., and ½d. for every 2 oz. beyond, as against the present charge of 1½d. for 1 oz. and 2d. up to 3 oz. A smaller concession is made in the case of the rate for the Empire and U.S.A. The initial rate of 1½d. for 1 oz. remains, but each additional ounce is charged 1d. instead of 1½d. The foreign rate comes down from 3d. to 2½d. (up to 1 oz.). The minimum rate for inland parcels is lowered 50 per cent., the new charges varying from 6d. for parcels up to 9 lb. to 1s. 3d. for those up to 11 lb., as against the old scale of from 9d. to 1s. 6d. Inland printed papers are to pay ½d. up to 2 oz., as against the present rate of ½d. up to 1 oz. and 1d. up to 2 oz. It is to be regretted that no concession is granted on the rate for newspapers, which are not included under the above heading.

The new telephone rates will not come into operation until July 1st. The annual rental is reduced by 10s. (except at exchanges with less than 15 subscribers), and local messages at public call offices are down from 3d. to 2d. A lower charge is also to be made for extension instruments and certain short trunk calls are slightly reduced at certain hours.

E.D.A. Electrical Slogan Competition.

Three prizes of £10, £5 and £3 respectively are offered by the BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION for the three best electrical slogans or phrases sent in before June 30th next. The Association points out that the use of short phrases or slogans in advertising has proved extremely valuable where the writers have succeeded in crystallising their message to the public in a few simple words. Such slogans as exist at present do not, it is urged, satisfy the necessary requirements, hence the competition. Envelopes, marked " Slogan " on the outside, and containing only the slogans and the name and address of the competitor, should reach the Director and Secretary of the E.D.A., 15, Savoy Street, London, W.C 2, before 6 p.m. on June 30th.

The private fire brigade of the OSRAM G.E.C. LAMP WORKS, on Saturday last, won the competition for the Corporation of London's silver challenge shield and medals.

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Legal Intelligence.

British Thomson-Houston Patent Litigation.

On April 13th, Mr. TREVOR WATSON, appearing for the British Thomson-Houston Co. in an action against the Premier Electrical Stores, moved, before Mr. Justice Eve, in the Chancery Division, for an injunction restraining the defendants from infringing the plaintiffs' letters patent.

Mr. TANNER stated that he appeared for the defendants, who were innocent infringers and who were willing to treat the motion as the trial of the action and to submit to a perpetual injunction, with costs.

His Lordship made an order accordingly.

Disputed Contract for Electrical Goods.

A dispute over the sale of a quantity of electric insulating porcelains came before a King's Bench Divisional Court (Justices LUSH and SALTER) on Tuesday, when their lordships were asked to give further consideration to the case of the Electrical Apparatus Co. *v.* The Manufacturers' Export Association.

The matter first came before Judge Parry at the Lambeth County Court on December 20th, the plaintiffs claiming the return of £49 17s. 6d. paid to the defendants in respect of goods which they alleged had not been delivered. Defendants maintained that the goods had been delivered, and that under the circumstances they were at the purchaser's risk.

The judge decided in the plaintiffs' favour, and against his decision the defendants appealed on the ground that he was wrong in law in finding that the property did not pass.

Mr. REGINALD WHITE, for the appellants, said the dispute arose over the sale by the appellants to the respondents of some electric insulating porcelains. The Manufacturers' Export Association, which was the trading name of Mr. Cecil, the defendant, had a contract for the supply of these goods with a firm in Czecho-Slovakia. The latter, by the contract, were to supply the goods at a fixed price. There was an alteration in the rate of exchange, and the Czecho-Slovakian firm said they could not supply the goods without ruining themselves. Under the circumstances they maintained that they were entitled to cancel the contract. Mr. Cecil, however, had given contracts in England for the supply of the goods at fixed prices, and he said that if they were going to cancel the contract he would not pay them for goods then in transit and forming the basis of the present dispute. He did not, in fact, pay specifically for those goods which had been handed over to the carriers for delivery to Mr. Cecil's English customers. While they were on their way from Czecho-Slovakia to the English customers the Czecho-Slovakian firm purported to stop the goods in transit.

The defendants' contention in the Court below was that the firm had no right to stop the goods, and that the loss must fall upon the plaintiffs, since by the conditions of sale the property had passed.

After hearing legal argument, Mr. JUSTICE LUSH said there were two questions which would have been gone into if evidence had been called. The first fact which ought to be considered on evidence was "What was the contract between the parties? Was it the conditions of sale only, or was it those conditions plus certain letters passing between the parties?" That was an important question, because he did not think the conditions of sale were in all respects consistent with the letters in question.

The second question was "What did the parties both contemplate by the words 'shippers' receipt,' as used in the conditions of sale?" Light might be thrown upon that point by evidence as to the previous course of business between the parties.

The case was sent back for the judge to take and consider evidence on those two questions, the costs of the appeal to be costs in the case.

The Stock Exchange Year Book.

A gradual development of confidence during 1922 in the world of commerce and finance is recorded in the preface to the 1923 edition of "The Stock Exchange Year Book." (London: Thomas Skinner and Co., Gresham House, Old Broad Street, E.C.2. Price 50s. net). The book, which has now reached its forty-ninth year of publication, gives a careful digest of information relating to the origin, history and present position of each of the public securities and joint stock companies known to the markets of the United Kingdom. A separate section is devoted to gas, water and electric lighting and power companies. The present volume contains 300 pages more than last year's, consequent upon the increase in the number of companies. New companies registered in 1922 numbered approximately 8 640, with a nominal capital of about £133 500 000.

A deputation from the Central Chamber of Agriculture on the subject of parcel post and RURAL TELEPHONES was received by the Postmaster-General on Wednesday.

It is reported by the INTERNATIONAL INSTITUTE OF AGRICULTURE that lettuces and other vegetables have been successfully "forced" in Germany by the aid of electric light.

Aerial photography has been successfully employed for ascertaining the extent of the flooding on the shores of Lough Neagh (Ireland) in connection with the BANN HYDRO-ELECTRIC SCHEME. The survey, if carried out in the ordinary way, would have occupied some weeks.

Mr. S. Parker Smith.

To Succeed Prof. Magnus Maclean at Glasgow.

We learn that Mr. STANLEY PARKER SMITH has been appointed to succeed Prof. Magnus Maclean as Professor of Electrical Engineering at Glasgow Technical College. Born in 1884, Mr. Smith was educated at Armstrong College, Newcastle-on-Tyne, and in Germany, being later apprenticed with Scott and Mountain on the Sandwich system. From 1907 to 1909 he was an assistant in the technical department of Siemens Bros. dynamo works at Stafford, and in the latter year he was placed in charge of the General Electric Co.'s design office at Witton. Here, during the next three years, he was responsible for the design of some important machines, including 14 turbo-alternators of over 600 kVA.

In 1912 he became lecturer and later assistant professor in the electrical department at the City and Guilds (Engineering) College, where he has remained up to the present time, although during the war his services were called upon by the Royal Aircraft Establishment at Farnborough in connection with work on gyroscope motors. The war years also saw him at work in the transformer department of what was then the British Westinghouse Co., and from 1916-1920 he was retained as consulting engineer by Vickers, Ltd. For this firm he designed some very important machines, including 21 turbo-alternators up to 10 000 kW.

Mr. Smith is Chairman of the Board of Studies and the Board of Examiners, in Electrical Engineering at London University, and is External Examiner in electrical technology at Manchester University. His original publications are numerous, and he has been a contributor to THE ELECTRICIAN since 1905. He took his D.Sc. at Durham University in 1911, is a Member of the Institution of Electrical Engineers, and an Associate Member of the Institution of Civil Engineers.

Institution Notes.

On Saturday last Mr. E. Caudwell lectured at a meeting of the BIRMINGHAM AND DISTRICT ELECTRIC CLUB on "The Engine of the Small Generating Set." The difficulties of obtaining ideal efficiencies were dealt with at length.

The annual general meeting of the ASSOCIATION OF OFFICERS AND STAFF MEMBERS OF ELECTRICITY (POWER AND SUPPLY) COMPANIES OF GREAT BRITAIN will be held at Caxton Hall, Westminster, London, S.W.1, at 8 p.m. on April 23rd.

Mr. R. W. Dodson presided at the annual business meeting of the PAISLEY ASSOCIATION OF ELECTRICAL ENGINEERS last week. A satisfactory financial statement was presented by the hon. treasurer, Mr. J. M. Barbour. Mr. F. B. Humphries was elected president for the next session.

AN ASSOCIATION OF LARGE USERS OF BRASS AND COPPER (sheet and strip) has been formed to secure mutual co-operation and to promote the welfare and interests of members in relation to supplies of sheet and strip brass and copper. Manufacturers using 140 tons per annum, or more, are invited to write to the secretary, Percival P. Richards, F.C.A., Box 18, Chamber of Commerce Buildings, Birmingham.

At the annual meeting of the SCOTTISH CENTRE of the INSTITUTION OF ELECTRICAL ENGINEERS last week, Mr. R. B. Mitchell was appointed chairman; Messrs. Alexander Lindsay and F. H. Whysall, vice-presidents; Mr. Joseph Taylor, hon. secretary; and Mr. W. F. Mitchell, assistant hon. secretary. Mr. J. F. Nielson was appointed chairman of the Students' Section. Following the business meeting, Mr. R. B. Mitchell read the late Dr. Gisbert Kapp's Paper on "The Importance of Power Factor."

The following new members, representing the interests named, have been added to the Council of the BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION: Messrs. E. E. Sharp and F. Wallis (B.E.A.M.A.), R. B. Mitchell (I.M.E.A.), Major Richardson (London Companies), Messrs. E. Boys (Power Companies), H. Bentham (Provincial Companies), P. J. Brewer (Lamp Makers) and R. Smith (Electrical Wholesalers' Federation). Messrs. Mitchell and Brewer are also members of the Executive Committee.

Books Received.

"Costing and Price Fixing." By J. M. Scott-Maxwell. (London: Sir Isaac Pitman). Pp xi+211. 6s. net.

"Industrial Electric Heating." By J. W. Beauchamp. (London: Sir Isaac Pitman). Pp. 118. 2s. 6d. net.

"George Lavington." A Novel. By John Harlock. (London: Arthur H. Stockwell). Pp. 434. 7s. 6d. net.

"Electric Cranes and Hauling Machines." By F. E. Chilton. (London: Sir Isaac Pitman). Pp. 114. 2s. 6d. net.

"Practical Electric-Light Fitting." By F. C. Allsop. Ninth edition. (London: Sir Isaac Pitman). Pp. 288. 7s. 6d. net.

"The Journal of the Institution of Electrical Engineers." March, 1923. Vol. 61. No. 316. (London: E. and F. N. Spon). 10s. 6d.

"Electric Motors." Vol. I. Direct Current. By H. M. Hobart. Third Edition. (London: Sir Isaac Pitman). Pp. xvi+412. 15s. net.

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Parliamentary Intelligence.

Jordan Hydro-Electric Scheme.

Mr. BECKER asked the Under-Secretary of State for the Colonies, on April 16th, what progress had been made with the harnessing of water power for producing electrical energy from the River Jordan; and were contracts for plant and equipment being placed in this country?

Mr. ORMSBY-GORE: The actual work of equipping the station and plant for the Jordan hydro-electric scheme cannot be undertaken until the formation of the company which is to hold the concession has been completed; but I am informed that, concurrently with the legal procedure which this involves, good progress is being made with the preparation of plans and specifications which will enable tenders for plant and equipment to be called for.

National Physical Laboratory.

Sir P. NEWSON, on April 16th, asked the Chancellor of the Exchequer whether, having regard to the figures he recently supplied to the House concerning the cost of and the numbers employed at the Physical Laboratory at Teddington, which apparently had gradually become a State-supported institution, he would consider whether it should now resume its original position of being supported and run by those who profited by it?

Lord E. PERCY: I have been asked to reply to this question. Having regard to the fact that the work done at the National Physical Laboratory is mainly undertaken in the national interest, I do not consider that a change is desirable. As the figures already supplied to the hon. Member showed, work undertaken for outside bodies is paid for by them.

The Imperial Wireless Chain.

Sir H. BRITTAIN asked the Postmaster-General whether his attention had been called to the statements of the Marconi Co. as to the delay on the part of the Post Office in granting to the company licences for the erection of wireless stations; and what was the cause of such delay?

Sir W. JOYNSON-HICKS: The statements referred to in my hon. Friend's question are not correct. Immediately upon my appointment as Postmaster-General I reviewed the whole matter in consultation with the chairman of the Imperial Communications Committee, and I addressed a letter to the Marconi Co. on March 26th asking them to favour me with any proposals which they desired to make in connection with the recent decision of the Cabinet permitting private enterprise to take its full share of Imperial and international wireless work. On April 3rd a reply was received to this letter in which the Marconi Co. pointed out that their proposals must depend on a closer knowledge of the Government's policy than they at present possessed, and they asked that I should meet their representatives in conference. This I propose to do in order that they may put before me any schemes or any proposals for any licence which they desire to obtain.

New Pacific Cable.

On Tuesday, the POSTMASTER-GENERAL informed COMMANDER BELLAIRS that the Pacific Cable Board are now laying new cables between Suva (Fiji) and Auckland, and between Sydney and Southport (Queensland). No decision has yet been taken regarding the duplication of the cable north of Fiji. The POSTMASTER-GENERAL promised to see that representations were conveyed as to the desirability of making the route by Honolulu.

Grimsby Electrical Exhibition.

Successful Lectures and Demonstrations.

An Electrical Exhibition organised by the Electricity Committee of the GRIMSBY CORPORATION was held at the Town Hall last week. The Committee had asked the local contractors to take part in the exhibition, and eight contractors took stands and displayed apparatus.

The opening ceremony was performed by the Mayor, Councillor J. W. Womersley, who explained that the object of the Committee was to demonstrate to the public of Grimsby how labour in the home could be reduced by using electrical appliances, and more especially to demonstrate the value of electric cookers which the Corporation were now prepared to let on hire.

Demonstrations were given each afternoon and evening to large and interested audiences, preceded by lectures on the advantages to be obtained from the use of electricity for domestic purposes by Col. Vignoles, the borough electrical engineer, and Mr. Leak, of the British Electric Transformer Co., whose "Tricity" cookers are being hired out by the Corporation.

Reports show that the exhibition has proved a great success. Orders were placed for the hire of some 25 cookers, while the contractors effected sales of sweepers, radiators and other appliances. Inquiries were received for the supply of cookers and electric coppers in bungalows now being built near Grimsby, where it is proposed to omit and save the cost of the usual kitchen range and coal-fired copper with their flues and chimneys.

Employees in the Melbourne, Australia, electric tramway service have been on strike for some days as a protest against a new method of paying wages. It is now stated that a settlement is in sight.

Obituary.

William Chew.

Mr. WILLIAM CHEW, who died last week at the age of 67 years, had been manager of the Blackpool Corporation Gasworks since 1913, succeeding his father, the late Mr. John Chew. He was also Blackpool's first electrical engineer, and he introduced electric arc lights, regarded at the time as a novelty, on Blackpool Promenade.

Charles R Sproule.

We regret to record the death of Mr. CHAS. R. SPROULE, which took place on April 12th at Chester. Mr. Sproule, who was 48 years of age, was a well-known figure at Helsby, having filled the position of works manager to British Insulated and Helsby Cables, Ltd., for some 15 years. Thirty years ago he joined the company as a premium apprentice in the test department, and remained in that department until his promotion to works manager, in succession to Mr. Jos. Crosland. Six months ago he went to India to transact some business for the company, leaving England on October 21st last year. Nearly three weeks ago he returned, and went to the company's offices in London to complete the business of his Indian trip. On Monday, April 9th, he came to Chester with the intention of returning to the works, but he was suffering from the effects of a chill, and had to take to his bed. Pneumonia supervened, and he passed away on Thursday morning.

Personal Items.

SIR RICHARD GLAZEBROOK has been elected an honorary member of the Institution of Civil Engineers.

Captain the Right Hon. FREDERICK E. GUEST has joined the board of Telephone Accessories, Ltd.

Mr. R. J. H. RYALL has been compelled, owing to ill-health, to resign from the board of Todman, Ryall and Co.

Mr. H. S. ASPINALL, who recently resigned his appointment as sales manager and director of the Keighley Gas and Oil Engine Co., has been appointed general sales manager to Vickers Petters, Ltd., with his headquarters at the company's Ipswich works.

Mr. R. H. BARTLEY, engineer and manager of the New Plymouth (N.Z.) tramway and electricity supply undertakings, has been appointed assistant engineer to the Auckland (N.Z.) Electric Power Board, and Mr. E. HUTCHINSON has been appointed engineer salesman.

Mr. ANDREW WILSON, who recently retired from the position of Superintendent of Telegraphs at Edinburgh, has been presented with a gold watch by the staff of the Edinburgh Telegraph Office. A gold brooch for Mrs. Wilson was also presented on behalf of the ladies of the department.

FREDERICK RICHARD HAYWARD, aged 17, an apprentice at the Witton works of the General Electric Co., has been chosen to represent the electrical industry at the wedding of the Duke of York, who, as president of the Industrial Welfare Society, has invited twenty boys from various important industries.

Sir JOSEPH THOMSON has been awarded the John Scott Medal and a sum of one thousand dollars by the American Philosophical Society. He has also been awarded the Franklin Medal, the highest award of the Franklin Institute. Sir Joseph is now in the United States and has delivered a course of lectures before the Franklin Institute and other bodies.

Mr. GEORGE W. HOLFORD has resigned from the general managership of the Salford Corporation Tramways. Mr. Holford, who has been in the service of the Corporation for 40 years, started as a boy in the Town Clerk's Department, and, after serving as clerk to the old Tramways Committee, took full charge of the department. He is a past president of the Municipal Tramways Association.

Wills.

The late Mr. WILLIAM BATES, formerly electrical engineer to Birkenhead Corporation, left £12 290 (net personalty £11 531).

The late Mr. THOMAS WILLIAM STRATFORD ANDREWS, managing director of the Indo-European Telegraph Co., and chairman of the Radio Communication Co., who died on February 17th, left £24 004 (net personalty £4 272).

I.E.E. North Midlands Centre.

Major H. Bell Elected Chairman.

The annual meeting of the North Midlands Centre of the INSTITUTION OF ELECTRICAL ENGINEERS was held at the Hotel Metropole, Leeds, on April 10th, the Chairman, Mr. W. B. Woodhouse, presiding.

The annual report, including a financial statement, was presented by the hon. secretary, Mr. J. D. Bailie, and a balance in hand was shown of £54, a slight increase over the previous year's figure. The report was adopted, and Mr. W. M. Selvey and Mr. Carter were nominated as scrutineers for the checking of the ballot for the Committee.

The following officials were elected:—Chairman, Major H. Bell; vice-chairmen, Major E. A. Barker, Mr. W. Howard Brown and Mr. S. Derwin Jones; hon. secretary, Mr. J. D. Bailie; committee, Messrs. James, Longman, Ripley, Roberts, Redman and Townley.

The meeting closed with a smoking concert which was much enjoyed.

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Foreign Notes.

AFRICA.

Proposed Railway Electrification in the Belgian Congo.

The Belgian Colonial Government is to place a sum of 100 000 000 francs at the disposal of the Congo Railway Co. for the reconstruction of the line between Leopoldville and Matadi. The execution of this programme will enable the capacity of the line to be increased to 1 000 000 tons instead of 250 000 tons as at present. A plan is under consideration for the electrification of this line.

EUROPE.

New Roumanian Power Station in Operation.

The Steaua Romana (British) states that the new electrical power station which the Steaua Romana Co., Bucharest, has constructed conjointly with the local power company is now in full working order, and is supplying current to the fields.

Belgian Electric Porcelain Manufacture.

According to a report by H.M. Commercial Secretary at Brussels, a steady improvement has been noticeable in the Belgian porcelain and earthenware industry since August last. Good orders, it is stated, have recently been placed for specialities for the electrical industry.

Employment in the Swedish Electrical Industry.

Statistics published in the "Swedish Economic Review" show clearly how the country's electrical industry has fluctuated in the post-war years. In the autumn of 1920 the industry found employment for 7 500 workers. By July, 1921, this figure had dropped to 5 000, and it continued falling until it reached 3 600 a year ago. Since then a continuous improvement has taken place, the number of workers employed rising to 3 700 in July, 1922, to 4 200 in October, and to 4 400 in January of this year, at which time wages were roughly 40 per cent. below the highest level reached in 1920.

The "Review" also gives figures concerning Swedish water-power development in recent years. The total power harnessed in 1913 was 650 000 H.P., and rose to 1 300 000 H.P. in 1922. It is estimated that the total water power resources of the country amount to about 7 750 000 H.P.

Proposed Revival of Norwegian Electric Smelting Company.

H.M. Commercial Secretary at Christiania reports that efforts are being made to float a new company to take over the plant and activities of the A/S Norsk Elektrodeverker, whose object was the smelting of pig iron by electricity, but which went into bankruptcy in May last year. In this connection a continuation of the State guarantee of the loan of 300 000 kr., given on July 15th, 1920, in exchange for a first priority mortgage in the company's property, has also been sought and obtained.

Application has also been made to the State to resign its first priority mortgage in respect of one-half of the guaranteed loan in favour of a private loan of 150 000 kr., for which a second priority mortgage is held, and to accept, instead, a third priority mortgage for 150 000 kr. to rank after the above-mentioned second mortgage. This arrangement has received the support of the Ministry of Commerce, and a proposal for its adoption is already before the Storting.

LATIN-AMERICA.

Buenos Aires Telephone Service.

In the course of a discussion in the Buenos Aires City Council on the subject of telephony in the city area, the Secretary of Public Works stated that the United River Plate Telephone Co. was working as the result of a fusion of two other companies having a special permit for the city and its vicinity. The Co-operative Co. also had a decree of the executive power of the nation, and Law 4 408 now required both companies to conform to the conditions of the National Telegraph Law. It was resolved to ask the National Congress to give the municipality jurisdiction in regard to telephone services.

The Buenos Aires Tram Fare Problem.

Reference has already been made in THE ELECTRICIAN to the large extensions proposed in Buenos Aires by the Anglo-Argentine Tramway Co. It will be remembered that the company applied to the Municipality for power to raise its fares on condition that the extensions, which would greatly benefit the city, were carried out. The Municipality has, however, claimed that fares should not be raised but lowered, in which case the company may find it difficult to maintain the present efficient service. Interviewed by the "Financial Times," the Secretary of the London agents for various Buenos Aires tramway and railway companies said: "Until we know exactly what the Municipality is going to do, of course, no definite steps can be taken, but it is clear enough that the company cannot carry on at a loss. If the fare is to be cut, then costs, including wages, will have to be brought down, and everybody who knows the labour conditions in Buenos Aires can understand what a row that will involve. The proposal of the Municipality is bound to do capital and credit in South America a lot of harm."

U.S.A.

Hydro-Electric Power in California.

The San Francisco correspondent of the "Manchester Guardian Commercial" states that in hydro-electric light and power facilities California is now ahead even of New York. This State possesses over 10 per cent. of the total available electrical energy of the Union. In hydro-electric energy it produces 21 per cent. of the total, 3 770 376 000 kWh having been produced in California during 1922. When the stupendous dams, now either actually being built or soon to be begun are completed, the lead of this State will be still greater, and the result must be an immense impetus to industrial enterprises of all sorts.

Imperial Notes.

AUSTRALIA.

The Nymboida Hydro-Electric Scheme.

The municipalities and shire councils in the Clarence River (N.S.W.) and contiguous districts formed themselves some time ago into a county council for the purpose of carrying out the Nymboida hydro-electric scheme. The Government approved the scheme, arrangements were made for borrowing £100 000, and a provisional contract for plant was placed with Armstrong, Whitworth and Co. It is stated that departmental red tape is now preventing further progress. The departments concerned are the Local Government Department, the Department of Public Works and the Irrigation Commission.

CANADA.

English Electric Co.'s Optimism.

Although the first combined annual report of the English Electric Co. of Canada and its subsidiary, the Canadian Crocker-Wheeler Co., does not contain a profit and loss account, it shows that the surplus at December 31st last amounted to $351 044, to which was added the profits for the year, amounting to only $2 452. Dividends have been paid on the preferred stock to September 30th last, and there is a surplus of $229 092. In their report the directors refer to the great depression in the electrical industry last year, which was, unfortunately, the initial year of the company's operations, but they report a great increase in sales during the first quarter of 1923, and it is anticipated that the plant will presently be running to full capacity.

Canadian General Electric Co.'s Reduced Profit.

There is also a note of optimism, though of a more subdued tone, in the report of the Canadian General Electric Co. for 1922. The year was a bad one for the company, whose net profit declined from $706 100 to $104 600, nothing being reserved for depreciation on this occasion, whereas before arriving at the former figure $401 800 was deducted. The directors decided after the first quarter of the year (for which the distribution was at the rate of 8 per cent. per annum) to make a reduction only to a 6 per cent. basis, so that the total return for the twelve months is 6½ per cent. To enable this payment to be made $179 600 had to be withdrawn from reserve, which still amounts to $6 820 400. The outlook for the current year appears to be rather more promising, for an improvement which set in towards the end of 1922 has been still more marked since. It is stated that the company has secured important contracts for electrical apparatus and hydraulic machinery.

INDIA.

Electricity Extension at Bombay.

Steps are at last being taken, writes a correspondent, to make available a supply of electric current for household and industrial purposes in the suburban areas of Bombay. The project is being undertaken jointly by Killick, Nixon and Co., a well-known Bombay firm, and Callender's Cable and Construction Co. The area of supply includes the municipalities of Bandra, Kurla, Ghatkopar and Juhu, the notified areas of Santa Cruz, Ville Parle, Andheri and Virkhuli, the military cantonment of Wakola and the area under the administration of the Collector and District Magistrate of Bombay Suburban District. The desire of the Government to make electric supply available at the lowest possible rates is evidenced in the following clause imposed by them in the draft licence: "Although in the first instance it may be necessary for the licencees to lay down their own plant, the general lay-out should be so arranged that it may be possible in five years' time to purchase energy in bulk from the Tata Power Co. at 22 000 V without changing the system of distribution, if, in the opinion of the Government, this will result in a cheaper supply, without reducing the licencees' profits unreasonably."

Imperial Wireless Chain Developments.

In reply to an interpellation, Sir Sydney Crookshank, on behalf of the Government, said that the long distance station in connection with the Imperial Wireless Chain would probably be handed over to be constructed and worked by private enterprise, the Government retaining a certain control through the possible possession of shares or reversion. According to him the probable cost of the main station would be half a million sterling and would cost £50 000 a year to run. This station would consist of three establishments, one for transmitting with two for receiving, the latter being some forty miles from the former. With reference to the main station, the Government was in communication with two Indian firms and the agents of the Marconi Co. With regard to the eight coastal and 12 inland existing stations, these would all remain under the control of the State. As regards the proposed broadcasting scheme, Sir Sydney assured the Assembly that all possible publicity would be given to this matter before any contract or agreement was made by the Government. He said that the Government was anxious for a rupee company with Indian directors.

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Electricity Supply.

Extensions and Developments.

FULHAM Borough Council is to carry out extensions of mains and sub-stations at a cost of £5 108.

BRISTOL is to apply to the Commissioners for sanction to borrow £120 000 for electricity purposes to be raised as and when required.

TAUNTON Town Council is to apply to the Commissioners for sanction to a loan of £2 250 for a new boiler at the electricity works.

The Commissioners have given formal sanction to the borrowing by MARYLEBONE Borough Council of £195 500 for electricity plant extensions.

EDINBURGH Town Council has approved considerable improvements in the electric lighting of certain streets at an estimated annual expenditure of £2 710.

OLDHAM Town Council has received the sanction of the Commissioners to a loan of £4 534 in connection with the purchase of the cables to the Lilac and Gorse Mills.

LOWESTOFT Town Council is to apply to the Commissioners for sanction to a loan of £3 500 for the extension of the distributive system of the electricity undertaking.

The CITY OF LONDON Electric Lighting Co., has given notice of its intention to apply to the City Corporation for its consent to the alteration of the periodicity of the company's a.c. supply from 100 cycles to 50 cycles.

CARDIFF Electricity and Housing Committees have agreed that it is desirable to extend the mains to the Ely housing site, both for public lighting and illumination of the houses, and that all houses erected in the future should be wired.

ECCLES Town Council has applied to the Commissioners for a loan of £7 000 for transforming and converting plant with a view to utilising the present three-phase bulk supply, taken from the Lancashire Electric Power Co., during such hours as the station is shut down.

The Brush-Ljungström turbine which has been installed at the WARRINGTON Electricity Works, was started on Friday last by Alderman Sir Peter Peacock, Chairman of the Electricity and Tramways Committee of the Corporation. It is the latest addition to the plant at the station, and has a capacity of 6 000 kW.

WATFORD Town Council has received sanction to a loan of £25 000 for electricity purposes. The total applied for was £39 000, and the Commissioners have intimated that they will be prepared to consider sanctioning the borrowing of any further sum required when the actual total expenditure has been approximately ascertained and details furnished.

The Southern Railway Co. has accepted the offer of SOUTHAMPTON Corporation to supply the whole of the electric power required at the company's Southampton docks. The supply is to be available by the end of July. The Corporation is to apply to the Commissioners for sanction to a loan of £8 365 for initial expenses, sub-station equipment, etc.

Alterations in Charges, Proposed and Actual.

Another price revision, which will mean a further slight reduction is in prospect at BIRMINGHAM.

Though the Committee appointed to consider reductions in electricity charges in BURNLEY have not reported, an all-round decrease is predicted.

AN INCREASE.—It has been decided by DUMFRIES Town Council to increase the charges for electricity from 7d. to 8d. per kWh for lighting, and from 4d. to 4½d. per kWh for power.

Presiding at the annual meeting of the SCARBOROUGH Electric Supply Co., last week, Mr. A. C. Swinton said that there was no intention at present of reducing the charge of 11d. per kWh.

MIDDLETON Town Council has reduced the charge for electricity for lighting to 6½d. per kWh, and for domestic purposes to 2d. per kWh. The minimum charge has also been lowered from £2 to 30s.

An all-round revision of electricity charges is announced by BELFAST Corporation. Flat rates for power vary from 5½d. to 2d. per kWh, according to the quantity consumed, and the ordinary lighting rate is to be 7d. per kWh.

At the last meeting of the YARMOUTH Town Council, the chairman of the Electricity Committee stated, in reply to a question, that when the price of beer went down he believed the price of light could be brought down. So Yarmouth consumers known what to expect in view of the Budget statement.

HIGH WYCOMBE Electric Light and Power Co. has reduced the price of electricity for power on the lowest charge, namely, over 3 100 kWh per quarter from 2½d. to 2d.; the other charges are first 100 kWh, 6d.; next 3 000, 3½d. per kWh. A reduction in the lighting charge will be announced in the near future.

The charge for the lighting of advertisement signs in LIVERPOOL at night time is 1¼d. per kWh, while the ordinary consumer is charged 5½d. per kWh. The Committee is now considering the lowering of the charges for electric light, and at the May meeting the Council will be asked to sanction a reduction of not less than 15 per cent.

WREXHAM Town Council has adopted the following revised scale of charges: Lighting, 7½d. for the first 1 000 kWh per quarter, and 6½d. beyond; lighting, heating and cooking in private houses, 20 per cent. on the rateable value and 1½d. per kWh; power and heating, 3d. per kWh up to 1 000 kWh per quarter, 1 000 to 2 500, abatement of 2½ per cent., 2 500 to 5 000, abatement of 5 per cent., 5 000 to 10 000, abatement of 10 per cent., 10 000 to 15 000, abatement of 20 per cent., beyond, abatement of 33⅓ per cent.

SOUTHPORT Town Council has made the following reductions in charges: Lighting business premises, on the maximum demand, from 8d., 6d., and 4d., per kWh to 8d., 5d., and 2d. per kWh; lighting for domestic purposes from 7d. per kWh flat rate to 6½d.; industrial power rate, 2d. per kWh flat rate. Long hour consumers are to be given the alternative of a maximum demand rate on the basis of £8 per kVA of the maximum demand per annum, plus ¾d. per kWh used, conditional that this charge shall not exceed 2d. per kWh on the average. Domestic power and heating rate to be reduced from 2d. per kWh flat rate to 1½d. per kWh (summer) and 1¾d. per kWh (winter).

Tapping New Areas.

The Galashiels and District Electric Supply Co. proposes to extend its mains in order to supply SELKIRK.

DARFIELD Council is to ask the Yorkshire Electric Power Co. for an estimate of the cost of lighting the district with electricity.

The Shropshire, Worcestershire and Staffordshire Electric Power Co. is to give an immediate supply of electricity to DROITWICH, from Redditch, via Bromsgrove.

STIRLING Town Council has refused permission to the Scottish Central Electric Power Co. to lay cables through the borough in order to supply Bridge of Allan.

TENBY Town Council has decided to engage an expert to advise on the questions arising on the renewal of the lease of the gasworks, and the provision of an electricity supply.

As the outcome of a deputation of tradesmen who desire a supply of electricity, TREDEGAR Urban Council has decided to ask the South Wales Electrical Power Distribution Co. for their terms for a supply in bulk.

SWANSEA Electricity Committee has conditionally arranged for the purchase of the Glais electric lighting supply. Steps have been taken for giving bulk supplies to the Samlet and Brynamman Collieries.

EASTHAMPSTEAD Rural Council has been informed that the York Town and Blackwater Gas Co. is making a canvass of the residents of Crowthorne and Sandhurst, with the object of ascertaining the probable number of consumers of electricity.

ULVERSTON Urban Council has decided, if a canvass of the residents is considered favourable, to take a bulk supply of electricity from Barrow-in-Furness Corporation. The Council desire that the probable number of consumers should take altogether 110 000 kWh per annum.

MANSFIELD Town Council has sealed an application for a Special Order authorising the supply of electricity to Sutton-in-Ashfield, Kirkby-in-Ashfield, Huthwaite, and Skegby. The estimated expenditure of the scheme is £30 000. The Council will oppose an application for an order by the Derbyshire and Nottinghamshire Electric Power Co., to supply electricity in certain districts, including Sutton-in-Ashfield.

Inquiries and Orders.

CALNE Town Council has decided to oppose the application of the promoters of the West Wilts Electric Supply Order, and to have its own order prepared and deposited forthwith.

HORWICH Chamber of Trade is supporting the Horwich District Council against Lancashire Electric Power Co. for an order to supply and distribute electricity within the urban district.

WALTHAMSTOW Urban District Council is applying to the Electricity Commissioners for a Special Order to supply electricity in Woodford, Wanstead, Buckhurst Hill, and Loughton urban districts, and the parish of Chigwell in Epping rural district. Objections to the Secretary, Electricity Commission, Whitehall, London, by May 7th.

The WESTERN ELECTRIC DISTRIBUTING CORPORATION, LTD., have applied to the Electricity Commissioners for a Special Order to supply electricity in the boroughs of Calne, Chippenham and Devizes, the urban districts of Bradford-on-Avon, Melksham, Trowbridge and Westbury, and the rural districts of Bradford-on-Avon, Calne, Chippenham, Devizes, Melksham, Westbury, and Whorwells Down. Objections to the Secretary, Electricity Commission, Whitehall, London, by May 1st.

The Minister of Transport proposes to confirm the Special Orders applied for by the LEES URBAN DISTRICT COUNCIL for the supply of electricity in Lees (Lancs), by ROYTON URBAN DISTRICT COUNCIL for the supply of electricity in Royton (Lancs), by CROMPTON URBAN DISTRICT COUNCIL for the supply of electricity in Crompton (Lancs), and by the NORTHAMPTON ELECTRIC LIGHT AND POWER CO., LTD., for the supply of electricity in Wellingborough and Brixworth rural districts. Objections to the Secretary, Ministry of Transport, Whitehall, London, by April 21st.

Miscellaneous Supply Items.

An application has been granted staying further proceedings in the winding-up of the WAREHAM Electric Supply Co., in consequence of an offer having been made for the land, works and plant of the company.

DALKEITH Town Council has approached the Electric Supply Corporation, Ltd., with a view to purchasing a bulk supply from the Corporation at one of the local sub-stations in place of being supplied throughout by the Corportaion.

It is stated that WALLASEY will not be included in the Mersey and West Lancs Electricity District, now being constituted, it being claimed that the existing generating station is capable of giving a full supply of electric current to the Wirral Peninsula.

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Tenders Invited and Accepted.

UNITED KINGDOM.

HULL CORPORATION.—Table telephone instruments, rubber covered wires and dry cells. Particulars from the Manager, Telephone Department, Mytongate, Hull.

FIFE AND KINROSS JOINT SANATORIUM BOARD, April 21st.—(1) Replacing accumulators at Glenlomond Sanatorium, (2) supply of electrical plant for driving threshing mill at Glenlomond farm and lighting steading; (3) X-ray apparatus. Specification from Mr. J. M. Mitchell, Joint Clerk to the Board, County Buildings, Cupar.

EDINBURGH CORPORATION, April 23rd.—(*a*) One 250 kVA three-phase transformer, (*b*) 6 600 V switchgear. Specifications from the Engineer and Manager, Electricity Department, Dewar Place, Edinburgh.

HALIFAX CORPORATION, April 23rd.—Steelwork in boiler foundations and battery room floor. Particulars from the Borough Engineer.

METROPOLITAN ASYLUMS BOARD, April 25th.—Electric wiring and fitting of staff blocks at the Grove Fever Hospital, Tooting. Specifications from the Board's Offices, Victoria Embankment, London, E.C.4.

LYTHAM ST. ANNES CORPORATION, April 26th.—E.H.T. cables (section B). Particulars from the Borough Electrical Engineer.

TAUNTON CORPORATION, April 26th.—Water-tube boiler. Specification from the Borough Electrical Engineer.

WEST RIDING STANDING JOINT COMMITTEE, April 26th.—Electric light wiring and fitting at Selby West Riding Lock-up. Specifications from the West Riding Architect, County Hall, Wakefield.

GRIMSBY CORPORATION, April 28th.—Sub-station 6 000 to 6 600 V switchgear and five transformers of capacities up to 100 kVA. Specification (171) from the Borough Electrical Engineer.

CARDIFF CORPORATION, April 30th.—About 275 tons of steel tramway rails (B.S.S. No. 7). Specification from the City Engineer. Only firms on the King's Roll are invited to tender.

DUBLIN ELECTRICITY AND PUBLIC LIGHTING COMMITTEE, April 30th.—One year's supply of single phase and three-phase meters and slot meters. Specification from the City Electrical Engineer, Fleet Street, Dublin.

GLASGOW CORPORATION, April 30th.—Twelve months' supply of (1) cables, including small i.r. cables and flexibles, (2) meters, (3) carbons. Specifications from Mr. R. B. Mitchell, Engineer, Electricity Department, 75, Waterloo Street, Glasgow.

MACCLESFIELD CORPORATION, April 30th.—(*a*) Two 15 kW d.c. dynamos, (*b*) switchboard, (*c*) battery, (*d*) motor-generator. Particulars from the Sewage Manager, Prestbury, near Macclesfield.

AMBLE URBAN DISTRICT COUNCIL, May 1st.—(1) Pole line, (2) transformers and switchgear. Specification from Mr. E. Corse, Clerk to the Council.

KIRKCALDY CORPORATION, May 1st.—High and low tension feeder cables (specification 16), and cooling tower (specification 18). Specifications from Kennedy and Donkin, 8, Broadway, Westminster, S.W.1.

COMMISSIONERS OF H.M. WORKS, ETC., May 11th.—Erection of central telephone exchange, Sheffield. Forms of tender from Contracts Branch, King Charles Street, London. S.W.1.

ARGENTINA.

DEPARTMENT OF NAVIGATION AND PORTS, BUENOS AIRES, June 4th.*—Machine tools, small tools, electric motors, centrifugal pumps, feed pumps, and general machine shop equipment, electric battery trucks, steam winches and ceiling, wall and table fans, etc.

AUSTRALIA.

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, June 12th.—Power plant for the Malvern and Brighton telephone exchanges.

VICTORIAN ELECTRICITY COMMISSION, July 31st.—Electrically-operated power shovel. Specification (23/63) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2.

N.S.W. GOVERNMENT, November 30th (*Extension of time*).—Construction of Sydney Harbour Bridge. Specifications from the Agent-General for New South Wales, Australia House, Strand, London, W.C.2.

NEW ZEALAND.

NAPIER BOROUGH COUNCIL, June 18th.*—One 500 kVA a.c. generator and exciter. Tenders are to be sent to Hay, Vickerman and Lancaster, Ltd., Wellington, N.Z.

NEWPORT (MON.) CORPORATION have decided to duplicate the Spearing boilers recently ordered for their generating station.

FOLKESTONE CORPORATION have accepted the tender of Walter Macfarlane and Co., for electric lamp columns at £36 17s. 6d. each.

Erina Shire Council have accepted the tender of Ramsay, Sharp and Co. for generating plant for the supply of electricity in the town of GOSFORD (N.S.W.).

WOLVERHAMPTON CORPORATION have accepted the tender of the British Thomson-Houston Co. for a 7 500 kW turbo-alternator, with air and oil-cooling plant, at £19 565.

The METROPOLITAN WATER BOARD have accepted tenders from British Insulated and Helsby Cables, Ltd., and the General Electric Co. for supply of electric lamps for twelve months.

Contracts have been placed with Gibson, Battle and Co. for coal transporters, £63 274, and Ferrier and Dickinson for boiler-feed pumps, £5 500, for the VICTORIAN ELECTRICITY COMMISSION.

The LONDON ELECTRIC RAILWAY COMPANY have placed contracts for escalators at Moorgate Street with the Foundation Company, £42 574, and at Shepherd's Bush with J. Cochrane and Sons, £21 700.

The tender of the Metropolitan-Vickers Electrical Co. has been accepted by the UNDERGROUND ELECTRIC RAILWAYS CO. OF LONDON for a 15 000 kW turbo-alternator for Lots Road power station.

The tender of the Enfield Ediswan Cable Works has been accepted by WORTHING CORPORATION for the supply of cables, at £3 482. Seventeen tenders were received, varying from £3 315 8s. 6d. to £4 179.

The Electricity Committee recommend LANCASTER CORPORATION to accept the tender of the Metropolitan-Vickers Electrical Co. for rewinding three alternators and supplying switchgear and protective gear, at £4 862.

YORK ELECTRICITY AND TRAMWAYS COMMITTEE recommend the acceptance of the tender of Callender's Cable and Construction Co. for feeder cables, in connection with the hydro-electric works at Linton Locks at £4 661 9s.

The tender of A. and C. Bridgland (lowest tender received) for wiring EAST GRINSTEAD URBAN COUNCIL'S generating station, at £75, is recommended for acceptance. Three tenders were received, the highest being £83 18s.

The following tenders have been accepted by WINCHESTER CORPORATION: Tudor Accumulator Co., battery; Electric Construction Co., booster; Mather and Platt, boiler feed pump; Enfield-Ediswan Cable Works, cables.

LONDON COUNTY COUNCIL have accepted the tender of the Enfield Edison Cable Works for supply and laying of l.t. cables in connection with tramways at Amhurst Park, at £3 758 2s. 2d. Fifteen tenders were received ranging from £3 687 19s. 6d. to £5 469.

PARANA (ARGENTINA) TRAMWAY COMPANY have placed an order with the J. G. Brill Company for two further Birney one-man safety cars. The Parana company already have seven of these cars in service, and it is stated that about 4 000 are in use in various parts of the world.

The following tenders have been accepted by WALLASEY CORPORATION:—Edison Accumulators, Ltd., 2½-ton electric vehicle, £1 430 10s.; Stewarts and Lloyds, piping and valves, £595; Brush Electrical Engineering Co., 5 000 kW Brush-Ljungström turbo-alternator, etc., £23 380.

SYDNEY (N.S.W.) CORPORATION have placed a contract with Siemens Bros. and Co. for transformers amounting to £14 118. The quotation of the English Electric Co. of Australia was £17 228, and the majority of the Council considered the difference between the offers too great to show preference for Australian manufacture.

The following tenders are recommended for acceptance by ST. HELENS CORPORATION in connection with the reconstruction of the tramway track from the borough boundary at Eccleston Hill to Higher Parr Street: Thomas Coates for reconstruction of track, and Edgar Allen and Co. and Titan Trackwork Co. for special track work.

For the construction of a turntable for the central tramcar repair depot of the LONDON COUNTY COUNCIL, the tender of P. and W. Maclellan, at £547 10s., has been accepted, and that of T. Summerson and Sons, at £36 5s., has been accepted for a turnout at the same place. The four tenders received for the turntable varied from £453 to £590.

The following tenders have been accepted by BRADFORD CORPORATION:—National Railway and Tramway Appliances Co., 30 tons of Peckham hand-brake shoes, £362; Cole, Marchent and Morley, 20 tons track-brake shoes, £220; Steel, Peech and Tozer, 50 Siemens open-hearth steel axles, £5 17s. each; Hadfields, Ltd., manganese steel crossings, £673; Equipment and Engineering Co., rail file, £250.

SALFORD CORPORATION are recommended to accept the following tenders: Brush Electrical Engineering Co., five low-type tramcars, £9 200; Hadfields, Ltd., special tramway track, £1 875; E. Green and Son, renewals to economiser at Electricity station, £1 488 13s.; Babcock and Wilcox, six water-tube boilers with pipes, etc., £3 154; W. T. Glover and Co., l.t. mains, £4 045 15s. 9d.; County Electrical Co., wiring Grecian Street Boys' School, £240 5s.

Amongst tenders recently accepted by ISLINGTON (London) Borough Council for the supply of various materials and stores for one year are the following:—British Insulated and Helsby Cables, h.t. and l.t. paper-insulated cables, compounds, tapes, c.f. and m.f. lamps, etc.; Enfield Ediswan Cable Works, h.t. and l.t., rubber-insulated cables; Chamberlain and Hookham, meters; J. Gibb and Co., castings; Edison Swan Electric Co., electrical sundries; Swedish General Electric, transformers; General Electric Co., carbons.

CARDIFF ELECTRICITY COMMITTEE have accepted the following tenders: British Insulated and Helsby Cables, 10 500 yards of 0·25 sq. in. e.h.t. cable, £8 295 (tenders received varied from £8 106 to £10 472), and 12 months' supply of cables, £7 919 (other tenders ranged from £8 046 to £10 022); Ferguson, Pailin Ltd. (lowest tender received) e.h.t. switchgear, £1 081 (highest tender £2 350); E. Green and Son (lowest), two economisers, £3 236 (highest tender £4 225); Rees Roturbo Manufacturing Co. (lowest) 5 750 gallons per min. pump, £398 (highest tender £539); Sir Wm. Arrol and Co. (lowest) steel bunkers and boiler-house roof, £3 000 (highest tender £3 875).

* Particulars from the Department of Overseas Trade.

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Electric Traction.

Tramway Extensions and Developments.

ROTHESAY Town Council has again decided against the running of tramcars on Sundays.

NEWCASTLE-ON-TYNE City Council is to purchase 25 new cars at £2 000 each. Application is to be made to the Ministry of Transport for sanction to the necessary loan.

In the event of GLASGOW Corporation taking over the Glasgow Subway Railway, it is their intention to incorporate it in the tramway undertaking and to have it converted from cable haulage to electricity.

Speaking at the annual meeting of the SWANSEA Improvements and Tramways Co., Mr. C. G. Tegetmeier, the chairman, remarked that there was an extensive programme in contemplation for renewals of permanent way and rolling stock.

ABERDEEN Town Council has decided to take no further steps in connection with the proposed Provisional Order for acquiring the Suburban Tramway Co.'s undertaking, for which £30 000 had just been offered, and subsequently £33 000. The negotiations had, however, broken down, the company refusing to sell under £43 000.

Fares, Receipts and Passengers.

GLASGOW Tramways Committee is to consider the advisability or otherwise of increasing the number of tokens obtainable by the public for one shilling.

The number of passengers carried on the PLYMOUTH tramways up to March 10th for the year was 28 898 290, and receipts amounted to £188 354, giving an average of 20·49d. per car mile.

In connection with the proposed introduction of reduced return fares on the SOUTHPORT trams, it is also proposed to issue pre-paid books of eight tickets at the rate of 1½d. for a 2d. stage.

During the week ending April 7th, the receipts of LONDON tramways under "Underground" control amounted to £46 730, as compared with £40 599 in the corresponding week of last year.

The receipts from the READING Corporation tramways from April 1st, 1922, to March 1st, were £72 499 16s. 8d., compared with £75 049 4s. 4d. for the corresponding period of the previous year.

Electric Railway Items.

Receipts on the MERSEY RAILWAY for the week ending April 7th were £5 207. For the first 13 weeks of the current year the total was £58 790.

Considerable improvements have been made on the METROPOLITAN RAILWAY between Baker Street and Wembley Park in anticipation of the heavy traffic to be carried on April 28th, the day of the Football Cup final tie. At Wembley, the latest all-electric signalling is being installed, and this, coupled with an ingenious track lay-out, will facilitate the handling of abnormal traffic.

The new automatic booking office at VICTORIA UNDERGROUND STATION has proved a great success, 50 000 tickets being delivered from the machines last week. The Underground Co. are so satisfied with the experiment that it is proposed to introduce a similar arrangement at Waterloo Station. A device has been fitted which enables a warning bell to be rung in the station booking office when the stock of tickets in the machines is running low. All the machines are electrically operated, and a device permits of their refusing money if the machine is out of order or the stock of tickets is exhausted.

Forty Years Ago.

"The Electrician," April 21st, 1883.

HONOURS FOR AN ELECTRICIAN.—Her Majesty has been pleased to confer the honour of knighthood upon Dr. C. W. Siemens, F.R.S.

ELECTRIC LIGHT LEADS.—With our next week's issue we shall publish No. 3 of our Supplements, which will be in the form of a table giving the loss of potential in volts, in 100 yds. of outgoing and returning lead.

ELECTRIC LIGHTING AT KIMBERLEY, SOUTH AFRICA.—We have received the following description of the installation, on the Brush system, which has been working for some time past at Kimberley, in South Africa, from a correspondent. He writes:—"The installation consists of 32 Brush arc lamps, supplied by two 16-light machines driven from a countershaft by a Robey engine of 20 nominal horse-power, which makes 130 revolutions per minute, the machines going at 800 per minute. One circuit, three and a-half miles in length, extends round the Kimberley mine, the other circuit, four miles in length, to De Beer's mine, down Du Toit's Pan and Victoria Roads. The wires are carried partly on the roofs of the houses, partly on iron poles. The light is at present giving great satisfaction. The work has been carried out under the superintendence of Mr. R. L. Cousens, A.S.T.E. and E., electrician to the South African Brush Electric Light and Power Company."

On Wednesday a deputation from Hull Corporation interviewed Mr. J. B. HAMILTON, who combines the positions of tramways manager and commercial manager to Leeds Corporation, with the object of ascertaining whether the appointment of a commercial manager at Hull was likely to result in more economical administration.

Wireless News.

The Third Licence Problem.

In a written reply to Col. MOORE-BRABAZON on Tuesday, the POSTMASTER-GENERAL stated that no proceedings would be taken against amateur constructors of wireless sets until he had made an announcement as to the conditions under which they could obtain licences. He added that he hoped to make such an announcement at a very early date. The position is thus as indefinite as ever. Statements have been made to the effect that the British Broadcasting Co. has suggested that the licence fee should be £1, of which 15s. should go to the company, but that the Postmaster-General is unlikely to exceed 10s., of which the company would get half. It is further stated that such an arrangement might be acceptable to the B.B.C. provided that amateur sets were constructed of British manufactured parts only.

The final outcome will depend on the Postmaster-General's decision, and the "Evening Standard" states that he is consulting the Crown lawyers as to the intentions he has in view.

Further Facilities for Broadcasting in America.

A conference on radio matters which has recently been held in Washington suggested that the interference experienced by broadcasters and listeners could be relieved by the opening up of a NEW WIDE BAND OF WAVES by the Government and a new assignment of individual wave-lengths to broadcasting stations. Up to now all broadcasting has been concentrated on three wave-lengths—360, 400 and 485 m.—but a new field extending from 222 to 545 m. could be created. This band would be divided into two parts, the higher power stations using wave-lengths between 288 and 545 m., and the lower power stations using waves from 222 to 286 m. This would enable the fifty higher power stations now in operation to be within reach of every listener in the United States. It is suggested that a band extending from 150 m. to 222 m. should be placed at the disposal of amateurs, and that a band from 200 to 222 m. should be reserved for high-grade continuous wave telegraphy, transmitting stations operating under special licence, and technical training school licensees. Ships using a 250 m. wave should keep silence between 7 and 11 p.m., and as soon as possible readjust their equipment for transmission at wave-lengths about 600 m.

Imperial and Foreign Developments.

A commercial wireless service has been started between Great Britain and the South American Republic of COLOMBIA.

Following the arrangements made for broadcasting the debates in the Argentine Chamber of Deputies, to which we referred some weeks ago, the Minister of Agriculture is to BROADCAST DAILY INFORMATION AND ADVICE TO AGRICULTURISTS. We retain our opinion that the former is a horrible idea, but there seems to be the germ of a really sound scheme in the latter plan.

The "Electrical World" (New York) states that the THIRD AVENUE RAILWAY Co. is using its feeders and control wires as a means of communication between points on the system by means of wired wireless. Transmitters and receivers similar in many respects to those used in radio broadcasting have been employed, and satisfactory communication has been established.

The DANISH GOVERNMENT, says the "European Commercial," is said to be contemplating a wireless telephone connection between Lyngby Radio Station, near Copenhagen, and the island of Bornholm in the Baltic, to be opened in the near future. At each end the wireless will be linked up with the existing line systems. The radio distance will be 150 km., or about 93 English miles, and will thus be the longest distance of any such regular connection in the world. The system to be employed is the Valdemar-Poulsen, with a wave-length of about 2 000 m., operated by power stations of one and two kW respectively.

Miscellaneous Wireless Items.

It is understood that the British Broadcasting Co. have plans well advanced for the ESTABLISHMENT OF A FURTHER BROADCASTING STATION either at Inverness or Aberdeen.

A number of British steam trawlers have now been fitted with wireless apparatus by the MARCONI INTERNATIONAL MARINE COMMUNICATION Co. It is claimed that a £12 000 haul of fish was made through the agency of one wireless communication.

Following complaints of difficulties in wireless reception at SHEFFIELD, Captain P. P. Eckersley conducted last week a special investigation, a test transmission from London being arranged. It is possible that a relay station may be erected for transmitting the London programme over the Sheffield area with greater strength.

Dr. Erich F. Huth, G.m.b.H., and Dr. Siegmund Loewe have applied for the RESTORATION OF PATENT NO. 149 213 (20 960/20), dated July 4th, 1917, for "Improvements in and relating to thermionic valve amplifiers and generators," which has expired owing to non-payment of renewal fee.

The postal authorities have obtained permission from Liverpool Health Committee to erect, as an experiment, several KIOSKS AS PUBLIC TELEPHONE CALL OFFICES. Three points in the centre of the city are spoken of as sites. Should the experiment attract sufficient public patronage other kiosks will be constructed at suitable places.

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Companies' Reports, Dividends, etc.

DICKSON AND MANN, LTD.—Final dividends declared of 3½ per cent. on the preference shares, making 6½ per cent. for the year, and of 7½ per cent. on the ordinary shares, making 12½ per cent. No dividend was paid on the ordinary shares last year.

BRITISH L. M. ERICSSON MANUFACTURING CO.—Dividend recommended of 8 per cent., tax free, on the ordinary shares, carrying forward £43 913, subject to corporation profits tax. The net profit was £10 681 plus £47 232 brought in, making £57 913.

HADFIELDS, LTD.—As intimated last week, the dividend recommended for 1922 is at the rate of 5 per cent. The report shows that by redeeming £1 000 000 7½ per cent. mortgage debenture stock and making a new issue at 5½ per cent., an annual saving of £17 800 has been effected. For writing down investments to present-day values, £137 000 has been taken from the special reserve account. The profit for 1922 was £187 250, and £128 418 is carried forward, against £122 657 brought in.

Supply and Lighting.

WYCOMBE (BOROUGH) ELECTRIC LIGHT AND POWER CO.—Final dividend declared of 6 per cent., tax free, making 10 per cent., tax free, for the year, placing £5 000 to general reserve and carrying forward £650. The gross profit for 1922 was £22 185, against £17 004 in 1921.

Traction Companies' Results.

BRAZILIAN TRACTION LIGHT AND POWER CO.—Quarterly dividend declared of 1 per cent. on the ordinary shares.

TILLING-STEVENS MOTORS, LTD.—The profit for 1922 was £22 860, against a loss of £148 212 in 1921. The directors propose to transfer £15 000 to depreciation reserve, and deduct the balance of £7 860 from the debit of £166 382 brought forward, carrying forward an adverse balance of £158 522.

Cable and Telegraph Companies.

ANGLO-AMERICAN TELEGRAPH CO.—Dividends declared for the quarter ended March 31st of 15s. per cent. on the ordinary stock and of 30s. per cent. on the preferred stock.

INDO-EUROPEAN TELEGRAPH CO.—The report states that owing to causes beyond their control, the directors will not be able to present to the annual meeting the accounts for 1922. They recommend a final dividend of 22s. 6d. per share, tax free, making 7 per cent. for the year.

WESTERN UNION TELEGRAPH CO.—The gross operating revenue for 1922 totalled $105 447 748, less operating expenses, leaving $13 796 473, plus dividends and interest $1 668 557, making $15 465 030. Interest on bonds absorbs $2 306 850, appropriation for development of ocean cables $2 000 000, leaving transferred to surplus account $11 158 180, making a surplus of $54 221 872. Dividends required $6 982 694 and adjustments of surplus (net) $384 641, leaving a surplus of $46 854 537.

CUBA SUBMARINE TELEGRAPH CO.—The receipts for 1922 totalled £55 899, while expenses amounted to £26 561. After providing £4 759 for cable repairs, £4 331 for income tax, £3 147 for balance of excess profits duty, and £2 217 for two years' corporation tax, there remains £14 881, plus difference in exchange £2 415, and £16 532 brought forward, making £33 829. A sum of £10 000 has been added to general reserve. The directors recommend a dividend of 5 per cent. for the year and a bonus of 4s. per share on the ordinary shares, free of tax, carrying £6 629 forward, subject to corporation tax.

English Electric Co.'s Reduced Profit.

The accounts of the English Electric Co. for 1922 show a profit of £262 665, compared with £317 423 for the previous year. After providing for debenture interest, trustees' fees and interest on 8 per cent. notes, and including £55 599 brought in, there is available £167 002, against £210 765 for 1921, when £46 236 was brought forward. A dividend of 5 per cent., less tax, on the ordinary shares is proposed, the same as for 1921, and compared with 8 per cent. for the years 1919 and 1920, carrying forward £68 982. On this occasion nothing is placed to reserve, compared with £60 000 placed to contingencies at December 31st, 1921. The directors in their report state that they have pursued an active policy abroad, taking special measures for the representation of the company in countries offering business which it was in a position profitably to undertake. The directors have persevered in their policy of reducing the stocks of material on hand to the lowest workable margin. This accounts to a considerable extent for the figure in the balance sheet which gives the value of the stocks and work in progress, and which is less by approximately £366 000 than the corresponding figure for the previous year.

New Issue.

YORKSHIRE ELECTRIC POWER CO.—A further issue of 250 000 ordinary shares of £1 each at 23s. per share is being made to the holders of ordinary and preference shares in the company. The shares may be renounced, if desired, in favour of an allottee.

New Companies.

FIVEMILETOWN ELECTRIC SUPPLY, LTD.—Private. Reg. in Belfast April 3rd. Cap., £1 900 in £1 shares. To carry on the business of electricians, engineers, etc. Reg. office: Fivemiletown.

WIRELESS ACCESSORIES STORES, LTD.—Private. Reg. April 13th. Cap., £500 in £1 shares. Manufacturers of all kinds of electrical appliances and wireless accessories, warehousemen, shipping agents, etc. Reg. office: 664, Old Kent Road, London, S.E.

EAGLE WIRELESS SUPPLY CO., LTD.—Private. Reg. April 6th. Cap., £2,000 in £1 shares. To act as selling agents for the manufactured articles of the Eagle Egineering Co., and, in particular, in regard to its wireless receiving sets and component parts in connection therewith. Reg. office: Eagle Works, Warwick.

"B.D.S." WIRELESS, LTD.—Private. Reg. April 6th. Cap., £1,500 in £1 shares. Manufacturers of wireless telegraph and telephone instruments, equipment, and material, including crystal and valve receiving sets, and parts, factors of, agents for and dealers in electrical and other equipment and accessories, particularly relating to wireless broadcasting, receiving and analogous instruments, etc. Reg. office: 124, Devonshire Street, Birmingham.

A Reyrolle Showcard.

The accompanying illustration is of a showcard recently issued by A. REYROLLE AND CO., to demonstrate the advantages of their switch plugs. The firm are conducting a campaign for the recognition of the fact that the plug may be used as a switch plug. They claim that when comparison is made with the usual arrangement

of interlocked switch and plug, it is evident that the standard metal-clad apparatus is cheaper and more serviceable. The plugs are manufactured on a mass production basis, and the special terms offered make them an attractive proposition for wholesalers and retailers.

Business Items.

HOLLINGS AND GUEST, LTD., inform us that they are supplying five hydraulic presses to A. T. and F. E. Birkby for use in the manufacture of insulating materials.

MAWDSLEY'S, LTD., Dursley, Glos, have opened a branch office at 41, Arcade Chambers, St. Mary's Gate, Manchester, under the management of Mr. G. B. Lowe, who has represented them in Lancashire and Yorkshire for the past 14 years.

JAMES GORDON AND CO. have recently acquired the licence for the manufacture and sale in Great Britain of the duplex mono recorder, the flue gas analysis apparatus, which automatically records on one chart both CO_2 and combustible gases. A pamphlet dealing with the apparatus is in course of preparation, and will shortly be available.

W. H. DORMAN AND CO. inform us that practical demonstrations of their wave power tools will be given at the following Exhibitions: International Mining, Agricultural Hall, London, June 1st to 14th; Engineering, Shipping and Machinery, Olympia, London, August 31st to September 22nd; Public Works, Road and Transport, Agricultural Hall, London, November 22nd to 29th.

A commission agent in Vancouver, British Columbia, who is at present representing a Canadian firm which manufactures electric lamps and flexible conduit, desires to secure the representation, on a commission basis, for Western Canada (Port Arthur, Ontario to Victoria, British Columbia), or alternatively the Provinces of British Columbia and Alberta, of BRITISH MANUFACTURERS OF ELECTRIC MOTORS AND TRANSFORMERS, iron telephone wire, standard tools and appliances for the automobile trade. Particulars from the Department of Overseas Trade, quoting reference number 452.

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Commercial Intelligence.

County Court Judgments.

[Note.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

EVANS, George, 3, Macdonald Road, Bargoed, electrical contractor. £10 1s. February 21st.

FARRAR, Mr. J. H., 2, Belden Place, Idle Road, Undercliffe, Bradford, master electrician. £10 16s. 10d. March 6th.

FROGGATT AND MIDDLETON, 15, Sheaf Street, Sheffield, electrical engineers. £40 5s. 9d. February 22nd.

HICKS AND CO., 44, King George Street, South Shields, electricians. £16 13s. 10d. February 14th.

HILLER BROS., 111, Whitechapel Road, E., electrical engineers. £14 8s. February 23rd.

HOLLINGS, (CLIFFORD) AND CO., 1, Market Place, Pontefract, electrical contractors. £11 4s. 4d. February 19th.

HUTCHINSON AND CO., 101, Dartmouth Road, Forest Hill, electricians. £17 12s. 5d. February 15th.

ROSEN AND CO., 4, Woburn Buildings, Upper Woburn Place, electrical engineers. £33 17s. 4d. February 6th.

THOMAS, Mr. J. E., 49, King Street, Carmarthen, electrical engineer. £26 10s. 4d. February 8th.

TWIST, Thomas, 20, Carnegie Street, Sutton, near St. Helens, master electrician. £11 0s. 4d. March 3rd.

WARD AND CO., 15, Northgate, Dewsbury, electrical engineers. £16 2s. 4d. January 3rd.

Receivership.

BRITISH POWER CO., LTD. T. W. Holland, of 9, Bedford Row, W.C.1., ceased to act as Receiver for the debenture stock holders on April 3rd, 1923.

Mortgages and Charges on Limited Companies.

[Note.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

FLACTEM WIRELESS, LTD., Leeds.—Registered April 4th, £1 000 debentures secured by trust deed dated March 16th, 1923: general charge. *£1 000 now being registered. March 16th, 1923.

Satisfactions.

ELECTRIC CONSTRUCTION CO., LTD., London, W.C.—Satisfaction registered April 6th, £9 130, part of amount outstanding July 1, 1908.

FERRANTI, LTD., Hollinwood, electrical engineers.—Satisfaction registered March 23rd, £50 000, registered November 26th, 1912.

Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

BARLOW, Alfred James, electrical engineer, trading as BARLOW BROS. AND CO.; 9, Brunswick Place, City Road, London, E.C. Creditors were called together on Monday, when the representative of Clark, Hunt and Co. was elected to the chair. An approximate statement of affairs was presented by the debtor's solicitor, which showed liabilities to the trade of £1 659, and preferential claims of £75. Assets amounted to £2,631, or a surplus of assets over liabilities of £897. It was stated that the meeting had been called as a creditor for more than £100 had obtained judgment. Debtor commenced trading about twelve years ago, and for a long time was successful. Lately he had been pressed by creditors, and he attributed his position to bad debts, losses on contracts and the slump in trade. A balance sheet was prepared at the end of December last, and it showed that there had been a slight loss on the trading during the preceding six months. In the absence of any offer of composition it was decided that the debtor should be requested to execute a deed of assignment in favour of Mr. A. Wilmott (Francis, Nicholls, White and Co., C.A., 14, Old Jewry Chambers, E.C.), while a committee was nominated consisting of the representatives of the Sloan Electric Co., Ltd., Metal and Hardware Products, Ltd., Metacon Patent Glazing Bar Co., C. J. Ferguson and Sons, and Holme and Roland.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Bankruptcy Information.

CARTWRIGHT, Thomas Stanfield, 90, Wellington Street, Stockport, Chester, carrying on business under the style of T. S. CARTWRIGHT AND CO., electrical contractor. First meeting, April 18th, 3.30 p.m., Official Receiver's Offices, Byrom Street, Manchester. Public examination, May 8th, 10.30 a.m., Court House, Vernon Street, Stockport.

Notices of Intended Dividends.

HAXBY, Charles Johnson, and BRADY, Edward, carrying on business at 1A, East Parade, Harrogate, under the style of HAXBY AND BRADY, electrical engineers. Last day for receiving proofs, April 28th. Trustee, D. S. Mackay, Red House, Duncombe Place, York.

INCE, Arthur Courtenay, electrical contractor, 21, Fenkle Street, Newcastle-upon-Tyne, formerly under the style of THE NEWCASTLE ELECTRICAL ENGINEERING CO., now with a partner under the style of THE TYNE ELECTRICAL INDUSTRIES. Last day for receiving proofs, April 30th. Trustee, C. Woollett, Official Receiver, Pearl Buildings, 4, Northumberland Street, Newcastle-upon-Tyne.

Order made on Application for Debtor's Discharge.

SOUTH, Harry, 43, Rathbone Place, Oxford Street, and late of 10-12, Garrick Street, Covent Garden, electrical engineer. Bankrupt discharged February 13th subject to judgment for £5 (paid).

Partnerships Dissolved.

COMPACTUM RADIO CO. (HAGUE, James, and CLARK, John Alfred) wireless manufacturers, 44, Station Road, Wood Green, Middlesex, by mutual consent as from April 10th, 1923.

Edinburgh Gazette.

MENZIES, John, electrical engineer, 208, Quarry Street, Hamilton. The examination of the bankrupt will take place in the Sheriff Court House, Hamilton, on Tuesday, April 24th, at 3 p.m. Creditors will meet in the chambers of Walter and W. B. Galbraith, chartered accountants, 87, St. Vincent Street, Glasgow, on Friday, May 4th, 1923, at 3 p.m.

Bankruptcy Proceedings.

GREATHEAD, Walter, and GREATHEAD, Oswald, lately carrying on business at Burnley as electrical engineers and contractors. At Burnley County Court, on April 12th, the Judge made an order for the annulment of bankruptcy of these debtors. The creditors had accepted a composition of 6s. 6d. in the £, which His Honour approved of, the Official Receiver stating that the proposal was reasonable and for the benefit of the estate. The liabilities were £224.

Prices of Metals, Chemicals, etc.

TUESDAY, April 17.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£77 0 0	—	£1 10 0
Electro Wirebars ..	,,	£81 5 0	—	£1 5 0
H.C. Wire, basis ..	per lb.	11 5/16d.	—	1/8d.
Sheet	,,	11 1/8d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 3 5/16d.	—	1/8d.
Brass 60/40—				
Rod, basis	,,	7 1/2d.	—	—
Sheet, basis ..	,,	10 1/2d.	—	—
Wire, basis	,,	11d.	—	—
Pig Iron—				
Cleveland Warrants No. 3	per ton	£6 12 6	5s.	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 10 0	—	—
Lead Pig—				
English	,,	£28 10 0	—	10s.
Foreign or Colonial	,,	£27 7 6	—	10s.
Tin—				
Ingot	,,	£214 5 0	5s.	—
Wire, basis	per lb.	2s. 9 3/8d.	1/8d.	—
Aluminium Ingots ..	per ton	£110 0 0	—	—
Spelter	,,	£35 0 0	—	2s. 6d.
Mercury	per bottle	£10 5 0	—	£1 5 0

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2 1/2d.
,, (Roll-Brimstone)—,, £8 5s. *Sulphuric Acid* (Pyrites, 168°) per ton. £7 10s.
Copper Sulphate.— ,, £26
Boric Acid (Crystals). ,, £55 *Sodium Bichromate*.—Per lb. 4 1/2d.

Rubber.—Para fine, 1s. 3 1/2d.; plantation 1st latex, 1s. 4 3/8d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.; and the rubber prices by W. T Henley's Telegraph Works Company.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

191 485 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Radio-receiving systems. (14/10/21.)
191 488 EVER-READY CO. (GREAT BRITAIN) and C. S. MUMMERY. Inert batteries. (14/10/21.)
170 306 W. ZEHNDER. Electro-magnetic chucks. (16/10/20.)
191 513 CALLENDER'S CABLE AND CONSTRUCTION CO. and J. F. WATSON. Bonding devices for electrical junction boxes. (28/10/21.)
191 515 R. MACLAREN. Automatic regulator for electric, steam or hot water radiators, etc. (26/11/21.)
191 525 E. A. GRAHAM. Means for supporting telephone transmitters. (4/11/21.)
171 683 P. O. PEDERSEN. Wireless transmitting systems. (18/11/20.)
171 995 AUTOMATIC TELEPHONE MANUFACTURING CO. Automatic switches for telephone systems, etc. (23/11/20.)
191 550 W. W. BURNHAM. Electric coils. (18/11/21.)
191 560 F. MULLER. Excess current cut-out. (21/11/21.)
191 566 JENSEN TRADING CO., LTD., and K. V. I. JENSEN. Multi-wire safety fuse. (29/11/21.)
174 323 L. BERTRAN. Electric fuses. (19/1/21.)
172 959 A. DELLA RICCIA. Auto-transformers. (13/12/20.)
173 238 WESTINGHOUSE LAMP CO. X-ray tubes. (21/12/20.)
191 596 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Switch-operating mechanism. (23/12/21.)
191 618 V. J. HINKLEY. Variable electric condensers. (17/1/22.)
191 636 BERRY'S ELECTRIC, LTD., and H. H. BERRY. Electric switches. (8/2/22.)
191 638 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Circuit controllers. (15/2/22.)
178 421 SOC. ANON. DES ATELIERS DE SECHERON and C. J. BELLI. Couplings for high voltage series machines. (15/4/21.)
177 533 Dr. J. ENGL, H. VOGT and J. MASSOLLE. Cathode-ray tube for recording frequencies free from inertia. (24/3/21.)
180 639 F. KRUPP AKT.-GES. Time switches. (23/5/21.)
179 960 GES. FUR DRAHTLOSE TELEGRAPHIE. Wired wireless telephone systems. (14/5/21.)
191 670 W. S. G. BAKER and J. Y. FLETCHER. Holders for electric lamps. (25/5/22.)
180 683 BRITISH THOMSON-HOUSTON CO. Wireless signalling systems. (21/5/21.)
182 458 SULLIVAN MACHINERY CO. Electrically propelled mining machines. (30/6/21.)
191 767 MULLARD RADIO VALVE CO. and S. R. MULLARD. Thermionic valves. (16/7/21.)
191 769 A. H. MIDGLEY. Electric starters for engines. (12/8/21.)
191 772 CREED AND CO. and F. G. CREED. Transmitters for automatic telegraphy. (16/8/21.)
191 773 J. FIRTH and S. COHEN. Connections between conductors. (17/8/21.)
191 777 RADIO COMMUNICATION CO. and J. SCOTT-TAGGART. Signalling systems. (12/9/21.)
191 778 A. J. H. HADDAN (AUTOMATIC TEMPERATURE CONTROL CO.). Electrically operated automatic valve regulators. (13/9/21.)
191 782 W. J. NICHOLAS and P. J. W. ROBERTS. Generators, switches, batteries and wiring systems for motor vehicles. (16/9/21.)
191 784 SUNDERLAND FORGE AND ENGINEERING CO., H. D. WIGHT and W. PARK. Electric signalling. (20/9/21.)
183 414 UNION BAG AND PAPER CORP. Switches. (22/7/21.)
191 788 J. H. MOSS. Bell pushes. (17/3/22.).
191 795 G. AUSTIN and J. C. and W. A. MACFARLANE. Driving machines on constant current series system. (12/10/21.)
191 801 E. A. GRAHAM. Mouthpieces or trumpets for telephones. (13/10/21.)
191 804 A. H. HUNT. Holders for incandescent lamps. (14/10/21.)
191 810 R. R. SPROSEN and S. WISEMAN. Electric lamps for vehicles. (15/10/21.)
191 825 A. CRANKSHAW and T. MARKLAND. Electro-magnetic lock for carriage doors. (18/10/21.)
191 827 S. R. ILLINGWORTH. Electrodes. (18/10/21.)
190 831 T. S. ROGERS. Electric horns. (20/10/21.)
191 849 EVERSHED AND VIGNOLES and J. C. NEEDHAM. Electrical transmissions for direction purposes. (25/10/21.)
191 850 P. BRINDLE. Commutators or distributors for ignition systems. (8/6/22.)
191 852 SIEMENS BROS. AND CO. and W. E. GOODWIN. Protective devices for electric circuits. (25/10/21.)
191 861 A. J. Q. SMITH (ATLAS RAILWAY SIGNAL CO.). Bond wires for joints of railway track. (26/10/21.)
191 866 H. MARRYAT and M. D. SCOTT. Lamps operating by electric discharge. (28/10/21.)
191 869 W. B. MORRIS. Combined ammeters and volt meters. (31/10/21.)
183 416 NATIONAL PNEUMATIC CO. Radio signalling. (16/7/21.)
171 090 J. B. ENTZ. Electric power transmission for vehicles. (5/11/20.)
191 878 J. E. POLLAK (SIEMENS AND HALSKE A.-G.). Telephone systems. (2/11/21.)
191 879 E. A. GRAHAM. Adjustable resistance devices. (4/11/21.)
191 880 MACINTOSH CABLE CO. and D. D. WATSON. House service cut-out combined with sealing chamber. (4/11/21.)

APPLICATIONS FOR PATENTS.

April 3.

9 042 J. ROBERTS. Connections for electric circuits.
9 053 R. H. BARTON and L. C. MUNN. Utilising force of attraction between two plates of condenser.
9 056 W. MAVITTA. Earth clip.
9 073 A. LOW AND SONS and W. E. MILLER. Electric heating plates.
9 098 BRITISH INSULATED AND HELSBY CABLES and E. A. BAYLES. Cables.
9 111 J. H. WILKINS. Aerials for wireless telegraphy.
9 121 A. REYROLLE AND CO., H. W. CLOTHIER and B. H. LEESON. Circuit breakers.
9 127 L. ROSENGART. Driving phonographs by electric motor.
9 130 G. W. HARRIS and C. SEYMOUR. Resistances or rheostats.
9 137 L. D. G. MORRISON. Secret intercommunication by oscillatory discharges.
9 148 S. J. ANDERSON. Intervalve transformer for wireless signalling.
9 153 WIRELESS AGENCIES, LTD., and S. L. FORBES. Device for use with wireless receivers.
9 167 G. E. MORLEY. Mounting coils for wireless telegraphy.
9 168 G. E. MORLEY. Apparatus for wireless telephony.
9 172 V. CRABB. Variable inductance for wireless receivers.
9 179 V. TRICERRI. Contact shoes for electric traction.
9 186 W. TORRANCE and J. H. RUNBAKEN. Hydrometers for testing accumulators.
9 187 J. JUNKER. Three-valve receiving apparatus.
9 188 J. JUNKER. Combined high and low frequency amplifying device
9 194 CONTINUOUS TRANSIT CO. Electric transportation apparatus. (15/5/22, U.S.)

April 4.

9 219 J. F. BENNETT. Inductance coils.
9 223 F. C. CLARK. Crystal detector holder.
9 227 T. F. WALL. Squirrel-cage induction motors.
9 247 J. S. ROWE. Basket coils for radio telephony.
9 267 M. A. E. SPLINDEN. Trumpets for wireless telephony.
9 281 F. O. MONKHOUSE and G. E. TATE. Electric lamps.

April 5.

9 314 D. W. REES. Generating electro-magnetic waves.
9 318 BRITISH L. M. ERICSSON MANUFACTURING CO. and A. G. ROGERS. Telephone receivers.
9 326 H. P. REES. Wireless receiving instruments.
9 328 H. E. WALKER. Electrically conductive clips.
9 335 C. C. GARRARD. Sound magnifiers for wireless receiving sets.
9 344 J. SOWERBY. Electric locks.
9 353 A. H. MIDGLEY. Coil windings for wireless reception.
9 356 FERRANTI, LTD., and S. Z. de FERRANTI. Direct current mercury motormeters.
9 358 W. E. MOORE. Machines for insulating armature windings.
9 361 N. MAGELSSEN. Electric cooking plates. (6/4/22, Norway.)
9 367 & 9 402 W. J. MELLERSH-JACKSON (INDEPENDENT RADIO MNFRS., INC.). Neutralising capacity coupling between circuits.
9 375 F. POOLEY, F. C. AUSTIN and W. L. WREFORD. Electrically driven freezers, etc.
9 397 F. BATEMAN. Securing tram rails.
9 400 AKTIEBOLAGET BIRKA REGULATOR. Electrically controlled apparatus. (6/4/22, Sweden.)
9 401 MARCONI'S WIRELESS TELEGRAPH CO. Signalling systems. (17/4/22, U.S.)
9 410 S. L. PRICE. Crystal detectors.
9 413 SKINNER ORGAN CO. Wireless broadcasting. (8/2/23, U.S.)

April 6.

9 419 A. J. KEMP. Valves for wireless telegraphy.
9 424 W. HOWLETT. Crystal detectors.
9 427 H. E. NEWSTEAD. Generating power by means of water currents.
9 431 & 9 434 ABBEY INDUSTRIES, LTD., H. MELVILLE-SMITH and S. J. TYRRELL Wireless receiving sets.
9 432 ABBEY INDUSTRIES, LTD., H. MELVILLE-SMITH and S. J. TYRRELL. Crystal receivers.
9 433 ABBEY INDUSTRIES, LTD., H. MELVILLE-SMITH and S. J. TYRRELL. Wireless aerials.
9 435 H. WOOD and C. T. RHODES. Valves for wireless apparatus, etc.
9 445 F. HARRINGTON. Earphone holder.
9 451 R. M. ABRAHAM. Wireless receivers.
9 486 A. S. BARNES. Switchboards for charging accumulators.
9 492 W. E. HACKETT. Crystal detectors.
9 489 H. A. SUTTLE. Mounting electric lamps on vehicles.
9 490 V. H. G. MARTIN and A. H. MAITRE. Damping device for switch contacts for electro-magnetic vibrating members. (12/4/22, France.)
9 501 WESTERN ELECTRIC CO. (RUTTER). Slow-acting relays.
9 502 WESTERN ELECTRIC CO. Loaded transmission systems.
9 503 WESTERN ELECTRIC CO. Telephone exchange systems.
9 508 C. CHILOWSKY and J. SAPHORES. Rupture of currents. (12/2/22, France.)
9 527 L. BARBER and J. PARKINSON. Aerials for wireless telegraphy.
9 534 HART MANUFACTURING CO. Switches. (24/2/22, U.S.)

April 7.

9 536 W. BERESFORD. Frame wireless aerials.
9 545 INTERNATIONAL RADIOTELEGRAF & COMPAGNI WAHNOE and PETERS. Arrangement for taking bearings. (10/4/22. Denmark.)
9 551 R. S. and G. F. WOODS. Receptors and inductance coils for wireless telegraphy.
9 564 F. L. L. CALVERT and C. F. LINTON. Electric fires.
9 568 R. G. VANNECK. Telephone systems.
9 579 F. C. REILLY. Moving electric sign.
9 584 G. E. MARBAIX. Crystal detector.
9 589 A. BROWN. Electric leading elements.
9 596 RELAY AUTOMATIC TELEPHONE CO. and W. D. EDWARDS. Telephone systems.
9 597 C. K. CHANDLER. Wireless aerials.
9 600 A. D. COWPER. Variable inductance devices.

Arrangements for the Week.

FRIDAY, APRIL 20th. (To-day.)

INSTITUTION OF MECHANICAL ENGINEERS.

6 *p.m.* At the Institution, Storey's Gate, St. James's Park, London. General Meeting.

INSTITUTION OF ENGINEERING INSPECTION.

7.30 *p.m.* At the Royal Society of Arts, John Street, Adelphi, London. Paper on "The Inspection of Ball Bearings," by Mr. C. H. Richardson.

JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette entitled "The Business of Engineering," by Mr. H. N. Munro.

SATURDAY, APRIL 21st.

EDINBURGH ELECTRICAL SOCIETY.

Visit to Rosyth. Train to Rosyth Halt 2.30.

MONDAY, APRIL 23rd.

INSTITUTION OF ELECTRICAL ENGINEERS.

7 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London. Informal Meeting. Discussion on "Practical Broadcasting," opened by Mr. E. H. Shaughnessy.

WEDNESDAY, APRIL 25th.

LIVERPOOL ENGINEERING SOCIETY.

At the Royal Institution, Colquitt Street, Liverpool. Annual General Meeting

THURSDAY, APRIL 26th.

ROYAL INSTITUTION OF GREAT BRITAIN.

3 *p.m.* At the Institution, 21, Albemarle Street, Piccadilly, London. Lecture on "Modern Electric Lamps," by Prof. J. T. MacGregor-Morris.

INSTITUTION OF ELECTRICAL ENGINEERS.

6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London. Lecture on "The Drive of Power Station Auxiliaries," by Mr. L. Breach and Mr. H. Midgley.

FRIDAY, APRIL 27th.

PHYSICAL SOCIETY OF LONDON.

5 *p.m.* At the Imperial College of Science, South Kensington, London.

1. "The Analysis of Bubbles in Glass," by the Research Staff of the General Electric Co., London.
2. "A Simple Regenerative Vacuum Device and Some of its Applications," by Mr. H. P. Waran.
3. "Application of the Eötvös Torsion Balance to the Investigation of Local Gravitational Fields," by Capt. H. Shaw and Mr. E. Lancaster-Jones.
4. Demonstration of an Electromagnetic Inductor, by Mr. L. F. Richardson.
5. Demonstration of an Experiment Illustrating Time-Lag in Vision, by Dr. F. Ll. Hopwood.

INSTITUTION OF ELECTRICAL ENGINEERS. (SOUTH MIDLAND CENTRE.) (STUDENTS' SECTION.)

Annual General Meeting. Lecture on "Mining Switchgear," by Mr. F. H. Beacon.

JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette entitled "Stock Control," by Mr. J. Fearn.

INSTITUTION OF ELECTRICAL ENGINEERS. (SCOTTISH CENTRE.)

7.30 *p.m.* At University College, Dundee. Meeting of Centre.

ROYAL INSTITUTION OF GREAT BRITAIN.

9 *p.m.* At the Institution, 21, Albemarle Street, Piccadilly, London. Lecture on "Measurement of the Heating Value of Gas," by Mr. C. V. Boys.

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THE ELECTRICIAN

ESTABLISHED 1861.

THE OLDEST WEEKLY ILLUSTRATED JOURNAL OF

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CONTENTS.

Notes of the Week	441
Boiler House Practice	443
"The Electrician" "All-Electric" House. Prize Winning Solution	444
Conditions for the Second "Electrician" Competition	446
"The Electrician" "All-Electric" House Competition. The Judges' Comments on the Entries	447
Automatic Sub-Stations. By L. C. Grant. Illustrated	448
Electric Welding in Cast Iron	450
The Control of the Speed and Power Factor of Induction Motors. Illustrated	451
Mr. Beauchamp on Electric Heating	453
Recent Advances in Applied Electro-Chemistry. By M. De Kay Thompson, Ph.D.	454
Longest Submarine Power Cable in the World. Illustrated	455
Correspondence	456
Electromagnetic Motions in Electric Furnaces. By Carl Hering	459
Merchandise to Sell and Profit By. Illustrated	460
Catalogues, Price Lists, etc.	461
The Electrical Contractors' Dinner	462
Books Received	462
An "All-Electric" Ship	462
Rural Telephones	462
Private Bills	463
Legal Intelligence	463
Electricul Trades' Benevolent Institution	464
N.A.S.E. Prize Competition	464
Mersey and West Lancs Electricity District	464
Electrical Progress Illustrated	464
Parliamentary Intelligence	465
Institution Notes	465
Electrical Imports and Exports	465
Light Without Heat	465
The Bann Hydro-Electric Scheme	465
Foreign Notes	466
Imperial Notes	466
Textile Mill Output	466
Electricity Supply	467
Personal Items	467
Tenders Invited and Accepted	468
Electric Traction	469
Wireless News	469
Companies' Reports, Dividends, etc.	470
Commercial Intelligence	471
Prices of Metals, Chemicals, etc.	471
Patent Record	472
Arrangements for the Week	472

Notes of the Week.

Result of "The Electrician" House Competition.

As announced in last week's issue to-day's Electrician contains the results of our first prize competition—a scheme for an "All-Electric House." On other pages will be found the names of the three prize winners, the detailed scheme to which the judges have awarded the first prize and the judges' report on the competition generally and on the prize winning scheme in particular. Before making any further comments we should like to congratulate the prize winners on their success. The scheme abounded in pitfalls into one or more of which every competitor fell, but it is evident even from a cursory glance over the schemes submitted that a great deal of work, sometimes unnecessary work, was expended in their preparation, and that much interest was taken in what we consider a most important question. Secondly, we should like to thank the judges for acting and for taking such pains in the examination of the competitors' work. The task, as we have had every means of knowing, was more than usually difficult and all competitors, both successful and unsuccessful, may rest assured that their claims to reward were adequately sifted. For that the judges are responsible.

What the Judges Think.

The judges in their frank comments "nothing extenuate nor set down aught in malice." It was what we asked them to do, for we felt that the competitors would learn more from their own and other people's shortcomings than from any amount of well meant but meaningless congratulation. The judges say: the competitors failed to grasp the essentials of the competition, an all-electric house is not a house filled with electrical apparatus (that is, a showroom) and in a servantless house it is not necessary to have extensive bell installation. By forgetting these things many competitors spoilt their chances. The important factor of cost was often neglected. The house we chose for the competition might be called a £1 500 house. Three per cent. of the cost of the structure is the inadequate figure sometimes laid down as usual for the electrical installation. None of the competitors' figures are, of course, anywhere as low as this. But the prize winner's costs work out at about 7·5 per cent.; and his economy was one of the factors which led the judges to award him the prize. Some of the competitors dealt with the installation with a lavishness reminiscent of the Coalition government in the heyday of its power. But we want to make electricity in the home popular and not the preserve of the ultra-rich. Though, therefore, a good deal more money must be spent than is spent at present, spending for spending's sake is to be avoided. Moreover, a great deal of this money was badly laid out, one competitor going so far as to design a special type of push-button switch in the laudable desire to keep the 240 V circuits quite of the way of any householder.

Some Notable Faults.

Now about all these matters there may be legitimate differences of opinion. We have simply recorded our views on what all agree is an important question. There can, however, be no difference of opinion on the futility of sending in schemes which do not comply with the conditions of the competition. Several competitors gave no indication on their plans and schemes as to their identity—not even a pseudonym. Others neglected the hints given in the conditions as to the system of supply and worked out elaborate schemes for the use of alternating current and others again modified the plans of the house to suit their own views. We always thought that electric engineers were poor at literary efforts. This competition confirms our views. Even the prize winning scheme leaves

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much to be desired from that point of view, but it at least has the merit of being practical, which is after all the main thing. We suggest that these criticisms should be noted by those who are entering for our second competition. The subject of that is more straightforward and more technical. But all the same, certain elementary factors must not be forgotten. Good engineering practice is the first essential, but for prize-winning purposes an easily intelligible explanation does not leave it far behind.

Broadcasting Politics.

SINCE we wrote upon the subject last week settlement of the rival interests in the broadcasting controversy has approached little nearer solution. In the House of Commons on Friday Sir WILLIAM JOYNSON-HICKS gave the Post Office's view on the question, the most important point in which was that he was not sure that the agreement with the Broadcasting Company gave them a monopoly, and that it might be open to him to grant a licence to somebody else. This was not, he said, a threat but a warning. He reviewed the negotiations with the Broadcasting Company, and remarked that he would be no party to extending their monopoly. He stated that 33 000 applications for experimental licences were being held up, and that these applications were being investigated as to their *bona fides* in accordance with the advice of the Law Officers. He proposed to set up a Committee to investigate the whole position. We give the composition of this Committee on another page of this issue. Its chairman is Sir F. SYKES; there are three other members of Parliament, including Sir HENRY NORMAN; the Post Office is represented by Mr. F. J. BROWN and Sir HENRY BUNBURY, the Broadcasting Co. by Mr. J. C. W. REITH, the Radio Society by Dr. W. H. ECCLES, newspaper interests by Lord BUNHAM, and the Army by Sir WILLIAM ROBERTSON, while according to Sir WM. JOYNSON-HICKS, everybody on the Committee more or less represents the listeners-in. The Committee is both strong and representative, and we earnestly hope it will evolve some order out of the present chaos.

Problems for the Committee.

THIS they should be able to do as the terms of reference include a consideration of broadcasting in all its aspects, present contract conditions and licences, the action to be taken on the determination of the present licence with the Broadcasting Co., the uses to which broadcasting may be put, and the restrictions which should be placed on the user or development. It might also include, as Mr. HINDERLICH suggests in our correspondence columns, a consideration of the reaction problem and how best to secure that experimenters' sets comply with this important provision. The Committee will have to consider the claims of three parties—the genuine experimenter, the broadcasting public, and the concerns engaged in providing the broadcasting. The claims of these three sections are to some extent conflicting, and, in the case of the first of the three classes, difficult to allow without interfering with those of the others. But we feel that the claims of the genuine experimenter ought to be given full weight, as the work of this body may well have a profound effect on wireless progress.

The Broadcasting Company's Case.

WE have not yet been able to obtain from the Broadcasting Company a reply to the case put forward by Mr. CHALLIS in last week's ELECTRICIAN, but we hope to be able to publish this in our next issue. During the past few days, however, the company has put forward two official statements, in one of which they take up the position that recognition of the home-made set constructor on any terms other than those acceptable to themselves would constitute a serious breach of faith. In this we are disposed to agree with them on the grounds that an agreement is an agreement, and should be treated as such. That such an agreement should not have been entered into is no argument for now disregarding it except by mutual consent. In another statement they deny that the Company is a monopoly, but that it was simply formed to protect British industry, and without it there could have been no broadcasting. With that also, with certain reservations, which we do not propose to discuss at the moment, we are also disposed to agree. Neither do we propose to discuss the domestic question as to which Postmaster-General is responsible for the agreement, except to express our view that it is a pity that no wireless progress can for long be kept separate from political activities of a kind we all deplore.

Routine Cable Testing.

THE routine testing of cables and the way in which this can best be carried out is a subject which has received a good deal of consideration. In the current issue of the "Journal" of the American Institute of Electrical Engineers Messrs. H. S. PHELPS and E. D. TANZER suggest the use of the kenotron as a source of high tension current. They have devised a routine method which will enable an impending fault to be detected to be employed. By this means a large volume of data concerning the input current as a function of the time after complete electrification has been secured and the curves indicate by their shape the condition of the cable. For instance, curves showing a sharp increase in the magnitude of the input current during the first minute and a gradual but persistent rate of decay for the next six or seven minutes indicate that the state of the insulation is satisfactory. Curves showing little or no decrease, or an increase, indicate that early failure is likely and the degree of deterioration is marked first by the time which has elapsed since complete electrification before this increase occurs, and secondly by the sharpness of the upward trend of the curve. In practice the method is said to have proved extremely valuable and we hope it will be investigated in this country.

Are Tramways Obsolescent.

IN a recent debate in the House of Lords the Earl of CRAWFORD remarked that "Tramways were an obsolescent method of traffic in such a place [Croydon] and were bound to disappear in course of time." In transport matters Lord CRAWFORD is not what may be termed an ordinary lord and his statement is therefore worth a moment's philosophical reflection. If when tramways were first introduced in this country the volume of other traffic had been so great as it is now we think public opinion would have been strong enough to prevent what are virtually railways being laid through streets of towns. Had the motor omnibus or even the electric vehicle reached its present standard of perfection twenty-five years ago the history of tramway development would probably have been very different. Had a Road Board been in being twenty years ago tramways would never have been allowed through narrow, crowded streets, and a means of helping to pay for street widenings would have been lost to certain local authorities. Instead we should, it is to be hoped, have had boulevards with the trams running on their own rights of way. Even now that is an ideal for which it is not too late to work; trams, as Mr. JOHN BRODIE showed some time ago, still have their uses, but they also have their limitations.

Books and Bibliography.

IN his review of Mr. H. H. HARRISON's new book on "Printing Telegraph Systems and Mechanisms," which we published in last week's ELECTRICIAN, Mr. DONALD MURRAY complained that authorities are not quoted. We are not in favour of Government control of human endeavour, but if any Government insisted that every book published should bear the date of publication, and, where appropriate, a

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competent index and bibliography, we should heartily support them. Authors, no doubt, like to suppose that they are "the first who ever burst into that silent sea," but that is a piece of egotism which should be sternly checked. The most that any author can be said to have done is to have added one more brick to a structure, and the least he can do is to give some indication of those who have laid the other bricks. In replying to a discussion on an Institution Paper a little while ago Mr. SYDNEY EVERSHED pointed out that the phrase "the author" included justly not only himself but all other works in that field. This is an important fact which other "authors" would do well to note.

Boiler House Practice.

The discussion that has taken place in THE ELECTRICIAN during the last few weeks on Mr. BROWNLIE'S article on "Modern Boiler House Practice" is a gratifying proof of the growing interest in a subject whose importance cannot be overstressed. It is not so many years ago that a boiler plant efficiency of 80 per cent. was considered a good figure even on test, but it is obvious from the progress which is being made that we are now within measurable distance of the 90 per cent. line. The fact that 85 per cent. efficiency on the gross heating value of the fuel—representing about 88 per cent. on the net value according to the Institution of Civil Engineers' formula—has actually been guaranteed by steam-raising plant manufacturers of the highest repute is sufficient proof that that figure is possible of attainment; and we need not therefore debate further that particular aspect of the problem.

A Tendency to Confusion.

The discussion has, however, disclosed several other questions of absorbing interest to engineers engaged in steam production. There appears to be some tendency to confuse two essentially different phases connected with steam plant efficiency, the one relating to purely technical maximum possibilities, and the other to what may be termed commercial actualities.

In our search for the former we have successively added to our original boiler: economisers, superheaters, mechanical stokers, mechanical draught and finally air heaters, together with numerous minor auxiliaries and refinements in order to extract the last possible percentage of heat units from the fuel consumed. With all these additions, it is obvious that a certain amount of the power produced by the complete unit will be absorbed by the auxiliaries serving it, and that to obtain the maximum possible efficiencies a high degree of operating skill, together with careful "tuning up," will be necessary. It may be fairly argued that, so far as ascertaining the maximum technical possibilities of a plant are concerned, all these additions are perfectly legitimate and should not detract from the results obtained.

Tempering Technical Enthusiasm.

The power production engineer of to-day, however, has to temper his technical enthusiasm with commercial discretion, and in discussing this problem of high efficiencies must of necessity, consider how far their attainment is a commercial proposition. Mr. BROWNLIE, as well as other contributors, obviously have this distinction in mind, and it is a point which deserves, and will undoubtedly receive, the closest scrutiny.

Test Figures *versus* Working Results.

A second point of the utmost importance, brought out by more than one contributor to the discussion, is the discrepancy which exists between test figures and actual working results over extended periods. It appears to us that the existence of this discrepancy is ample vindication of the comparatively short test taken under conditions when the whole plant is perfectly clean and "tuned up" to the high state of perfection, to which some objection has been raised. To the designer the conditions of running a plant not clean and not tuned up are liable to so many variations and are so entirely outside his control that it would be utterly impossible for him to provide for them. What he can do, however, is to demonstrate the *possibilities* of his plant, so that in general operation a correct comparison between possible and actual results can be determined. To this end the "taking over" test under skilled supervision, with all the refinements indicated by Mr. BROWNLIE, including a thorough warming up, clean tubes, clean flues, and concentrated operation, obviously serves a most useful purpose.

The Human Factor Important.

The real crux of the matter as regards continuous working undoubtedly depends, like so many other things, on the human factor. This point has not received the consideration it deserves, and on the operating side of the discussion the view of those practical engineers who are now actually obtaining continuously high efficiencies would be of the greatest possible value.

The Commissioners' Figures as a Working Guide.

We have had an excellent guide recently in this direction from the statistics relating to electric power stations and published by the Electricity Commissioners. From these it can be seen that quite a number of power stations (some with a relatively low output) were working for a complete year (ending March 31st, 1922) at thermal efficiencies of over 15 per cent. This means that, taking a fair average power station coal value of 10 800 B.Th.U.'s, the consumption of coal per kilowatt hour generated was just over 2·1 lbs. A fair overall water consumption figure for such a station would be 14·5 lb. per kilowatt hour, so that these boiler plants were almost certainly working continuously for a whole year at only just under 80 per cent. efficiency. There is one station recorded as obtaining a thermal efficiency of 17·2 per cent., and working on the same basis, but allowing a lower water consumption of 13·5 lb. per kilowatt-hour, this would indicate a continuous average boiler house efficiency of nearly 85 per cent.

Figures Show 85 per cent. Possible.

In the foregoing examples naturally we can only deal with "units generated," as these are the only figures available, so that no account can be taken of units used by auxiliaries, but on broad lines they afford ample support of the contentions of Mr. SELVEY, "Vivat Veritas," Mr. HALLS and other contributors that an efficiency of 85 per cent. and over is well within the range of possibility.

The controversy with regard to standardising the form in which boiler tests should be recorded has been well sustained, and all steam-raising engineers will be in agreement that some definite regulations are desirable.

For commercial results it would appear that the calorific value of the fuel "as fired" is the more satisfactory, in the same way that "actual" evaporations are in many respects preferable to the once popular "from and at," and no doubt the Committee set up by the Institution of Civil Engineers to consider this matter will be able to make suitable modifications in their existing regulations in order that a definite standard of calorific value may be adopted.

Coal Sampling Important.

One particularly important point relating to the determination of fuel values should be emphasised. It is with regard to the taking of the actual coal samples. The chemical or combustion engineer of to-day can quite accurately determine the heating value of any coal sample submitted to him, but in too many cases the sample is not really representative of the bulk. It is obvious that big errors in declared results can readily occur from this cause.

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"THE ELECTRICIAN" "ALL-ELECTRIC" HOUSE.

The Prize Winning Solution in Full.

First and Second Prizes go to London Men, and the Third to Scotland.

We give below the plans, bill of quantities and other details of the scheme for THE ELECTRICIAN *"All Electric" House to which the judges have awarded the first prize of 25 guineas. These were submitted by Mr. Perronne, of 141, Camden Street, London, N.W., under the pseudonym of "Perrard." The solutions to which the second and third prizes have been given will appear in subsequent issues. The judges' comments on the competition, together with the full names and addresses of the three prize winners, are published on p. 447. The titles and sub-headings have been inserted by us. Mr. Perronne writes as follows :*

Description of the Installation.

Rigid Economy and Pleasant Construction.

On careful examination of the plans it appears that the house has been designed with a rigid eye to economy, even whilst everything has been done to maintain a pleasant and convenient aspect and construction. It has therefore been thought desirable to keep the same view in mind when designing the corresponding electrical installation.

For example, there are a multitude of luxurious devices which also no doubt save work (say even the cigar lighter), but which are certainly not required at the commencement by the modest householder.

It is considered that the housewife will at very crowded seasons, say, as at Christmas, have to manipulate the oven a little ; it is expected that a certain amount of manipulation will have to take place with regard to the number of radiators ; that the small "Sun" radiators supplied will occasionally have to warm water in the spare bedrooms, and so on.

In the manner of wiring, nothing but two-core cable is used, all connections being made by the loop-in method and three-plate ceiling roses. In the class of house under discussion this makes the cheapest and soundest job, especially when, as in the present case, by the judicious use of 3/0·036 in. cable, heating and lighting circuits have been conveniently incorporated.

Water Warming a Difficulty.

The greatest difficulty was with the water warming, since it is felt that an adequate supply of hot water is of primary importance. The housewife will have it in her power to economise in this direction by means of the control board supplied.

In the case of the fittings rigid economy has been observed and only glassware has been supplied upstairs. It is believed that this arrangement frequently gives the greatest satisfaction. If expensive fittings are installed in the first place the consumer frequently wishes to change his mind at a later date when he has had experience of the electric light, but he then does not feel inclined to scrap a valuable fitting.

In conclusion, then, the estimate is put forward as a practical proposal to solve in a practical way the problem of providing an "All-Electric" House for the average man at an average price. Of providing one that will be a comfort to him and an incentive to him to extend in the course of time and to advertise his comfort to his friends.

Specifications of Materials Used.

The wiring to be carried out in St. Helen's Cable and Rubber Co.'s flat cab tyre sheathed cables, 600 megohm grade, concealed above ceiling or chased in the walls, including all making good for this work ; the cables to be held in position by lead strips $\frac{3}{8}$ in. wide by 1/16 in. thick.

Two ironclad main switch fuses to be erected in the scullery of 50 A capacity, manufactured by Messrs. Sanders and Co., controlling each a D.P. Teak 25 A H.O. type distribution board, three way, the switches and fuses being double pole.

The circuits would be as nearly balanced as possible ; one distribution board would supply to the stove and the other to the water heater, the lighting and heating load being as nearly as possible balanced between the two.

Wiring to the stove and water heater would also be in St. Helen's cable, cab tyre, and of size 7/0·044 in., whilst the lighting cable would be 3/0·036 in.

The specification includes for the supply of a Jackson No. 20 Cooker, complete with boiler plates, grill and oven, having a total installed wattage of 5 750 W. Also for a "Highlow" 4 kW 43 gallon galvanised iron electric hot water tank.

Further the following radiators are included :—
One No. 985 Belling "Imitation coal fire" ;
One No. 989 Belling "Derby" 2 kW ;
One Belling "Sunflower," No. 200 ;
Three "Highlow" Premier, 1 kW, No. 162 ;
Two Sun Electrical Co. "Premiers," 600 W.

The following fittings have been allowed for :—
One pendant porch fitting, No. 53 826.
1 pendant fitting for hall, with opal shade, No. 55 731.
2 living room pendant fittings, with petticoat silk shades, No. 58 298.
1 loggia pendant fitting, No. 52 521.
1 dining room fitting, with silk petticoat shade, No. 58 313.
Five bedroom and one staircase shade, etched white glass, No. 33 648.
(The numbers refer to Messrs. Falk, Stadelmann's catalogue.)

In addition one table lamp with rose silk shade and tilting carrier is included.

All fittings to be of British manufacture and of approved quality erected in a workmanlike manner.

Schedule of Circuits.

CIRCUIT I.—Porch light ; hall light and plug ; living room (front side), light and two plugs ; bedroom No. 1, one light, one plug.

CIRCUIT II.—Bedroom No. 2, two plugs and one light ; living room (rear side), two plugs and one light ; loggia, one light.

The above two circuits and the water heater are on the same distribution board.

CIRCUIT III.—Dining room, two plugs and one light ; bedroom No. 4, one plug, one light.

CIRCUIT IV.—Scullery, one plug and one light ; bedroom No. 3, one plug and one light ; china cupboard, one light ; tile, one light ; w.c., one light ; coal hole, one light, one plug ; bedroom No. 5, one light, one plug ; bathroom, one light ; staircase, one light.

The above two circuits and the stove are on the same distribution board.

The Bill of Quantities.

Cost Price Based upon Quotation from Lists

		£ s. d.	£ s. d.
1 Jackson Cooker, No. 20			18 5 0
RADIATORS—	£ s. d.		
1 2 kW Belling, No. 985	6 5 0		
1 2 kW Belling, No. 989	3 5 0		
1 Belling "Sunflower"	2 15 0		
3 Highlow Premier, No. 162	3 15 0		
2 Sun Electrical Co. Premiers	2 10 0		
	£18 10 0 List		18 10 0
1 "Highlow" No. 92 Heater	List		14 10 0
300 yds. flat twin cab-tyre	St. Helens	14 5 0	
15 5 A switch plugs	G.E.C.	2 2 1	
12 3 plate ceiling roses	G.E.C.	1 1 8	
6 2 plate ceiling roses	G.E.C.	3 3	
5 Blocks, 6 in. by 3 in.		3 9	
42 Blocks round, $3\frac{1}{2}$ in.		10 6	
18 Lampholders		9 0	
18 Tumbler switches		15 0	
Clips for cable with pins		6 0	
Lamp flexibles, 18 yds.		3 0	
6 Shades, white conical, opal, 10 in.		5 3	
5 Lamps, Osram, 60 W, $\frac{1}{2}$ W	4s.		1 0 0
11 Lamps, Osram, 40 W, $\frac{1}{2}$ W	3s. 6d.		1 18 6
2 Lamps, Osram, 20 W, $\frac{1}{2}$ W	2s. 2d.		4 4
1 Falk Stadelman, hall fitting, No. 53 828, 33s.		16 6	
1 Falk Stadelman, porch fitting, No. 55 731, 15s.		7 6	
2 Living room fittings, No. 58 298 at 19s. each		19 0	
1 Loggia fitting, No. 52 521, 15s.		7 6	
1 Dining room fitting, No. 58 313		1 3 3	
5 Bedroom shades and 1 stair, No. 33 648		11 6	
1 Table lamp, No. 52 637, with fitting 56 001, complete		10 0	
2 Distribution boards, 4 way, 25 A, teak	Sanders	4 8 6	
2 Switch fuses, D.P. Ironclad, 50 A	Sanders		4 15 0
12 yds. twin 7/0·044 cab tyre cable	St. Helens	1 1 0	
Miscellaneous material, etc.		2 10 0	
Labour, including making good		12 10 0	
Flexible for radiators		1 0 0	
		£46 9 3	£59 2 10
Plus 25 per cent.		11 12 3	
		£57 1 6	£58 1 6
			£117 4 4

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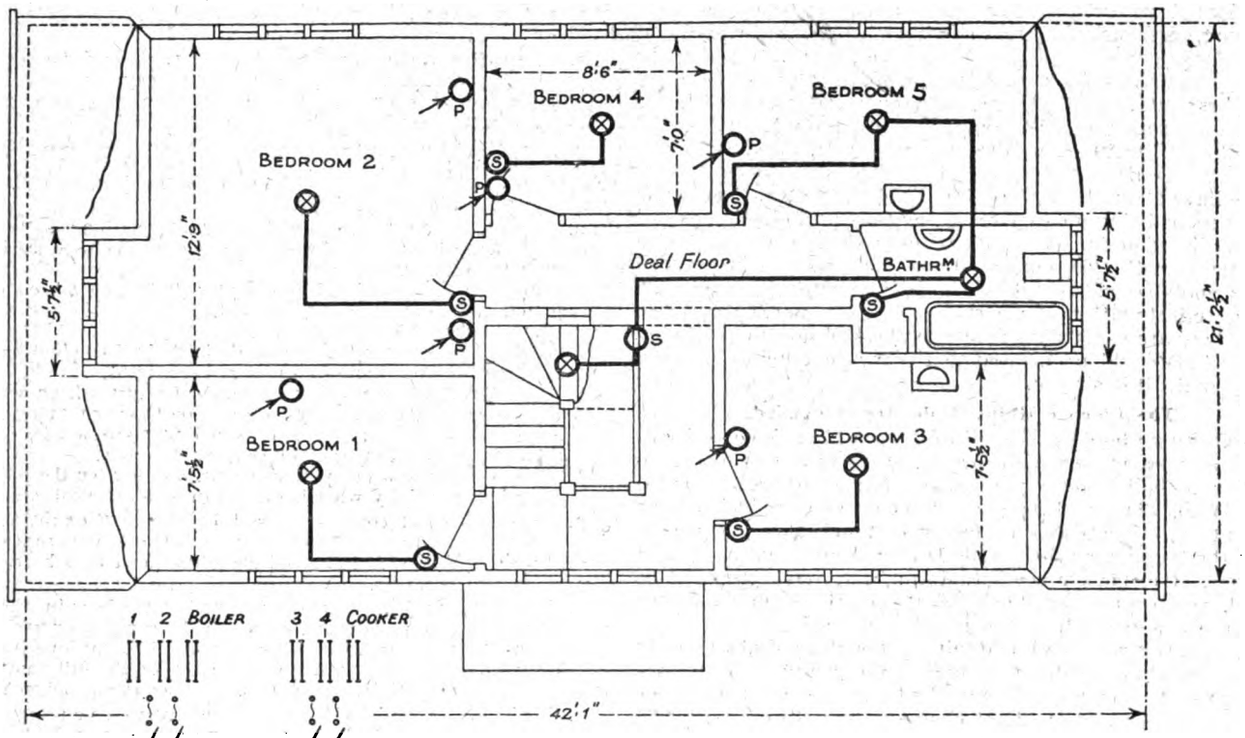
Wiring Plans for "The Electrician" "All-Electric" House.

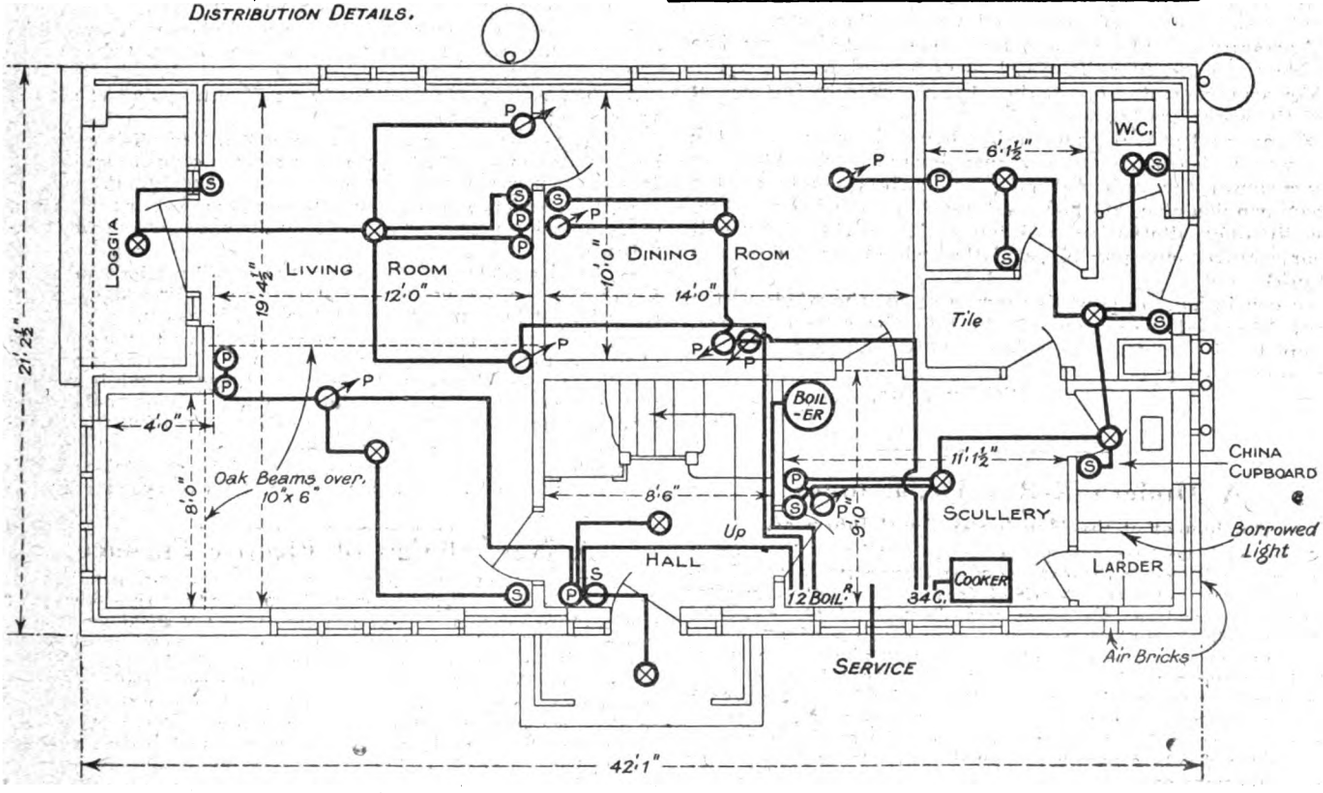
Prize Winner's Circuits and Arrangement of Apparatus.



FIRST FLOOR.

DISTRIBUTION DETAILS.

Scale of Feet.
0 1 2 3 4 5 10 15 20



GROUND FLOOR.

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The Letter to the Client.

March 28th, 1923.

SIR,—We were exceedingly obliged by your request for a price to wire your house so that it might be well equipped with electricity for domestic purposes. We regret that we have not had the opportunity of going over your new residence nor of ascertaining what the habitual number of residents it is anticipated will be. We have felt this disadvantage the less, however, as electrical power is flexible in the extreme and can be modified in its use to suit frequent variations.

We have allowed for an adequate number of power plugs and these can not only be used for the radiators, but also for vacuum cleaning or as, say, in the drawing room for the temporary fitment of kettles, toasters, etc., as convenience and occasion arise.

We have allowed for a fire in each of the rooms, that in the living room being an especially handsome "imitation coal" fire, whilst that in the dining room is of a large size. The remainder of the heaters are of varying sizes and in practice you would no doubt find it convenient to modify arrangements as to the installation of a particular fire in a particular room. Also there are extra plug points in the hall and in the living room which could be utilised in this conjunction as occasion would make it desirable.

The Electric Home Scale Recommended.

We have proposed half-watt lamps in all but three positions since, as you are probably aware, these only consume proportionally half the current compared to the ordinary vacuum-type lamp. This will have a further effect in reducing your current charges in that we suggest you should take your current from the borough at their Scale D (the electric home scale) of charges. Considering the actual lamps we have proposed to instal, your payments will only be at the rate of the fixed sum of 15s. per quarter plus 1d. per unit consumed.

At the latter rate of 1d. per unit we should say that a 60 watt lamp would burn nearly 17 hours for the penny, or your fires from 1½ to ½ hour in the case of the largest fires. The cooker and the heater costs will, of course, vary entirely with the extent to which they are used.

We should not omit that we have placed a plug point in the old coal hole, inasmuch as this would make an ideal place to instal an electric washing machine.

We have not allowed for an electric bell system, as we hardly think it called for considering the lay-out of the house.

As regards the fittings these might be inspected at any time at Messrs. Falk, Stadelman's showrooms and we could also make arrangements at any time to demonstrate the cooker and the water heating boiler.

We are perfectly at your service should there be any detail you would wish altered or any amendment made. Whilst we have shown the proposed plug and switch points on the accompanying plan, to which we draw your attention, we could usually offer alternative positions which might better suit your arrangements possibly, and that without any alteration of price.

In conclusion, we now give our price for the whole of the work discussed above and specified in the attached sheet, complete with lamps, and excluding only plumbing work, for the sum of £117.

Faithfully yours,

PERRARD.

A Modern X-Ray Department.

Equipment at the Manchester Royal Infirmary.

A pamphlet we have recently received describes and illustrates the X-ray equipment in the RADIOLOGICAL DEPARTMENT at the Manchester Royal Infirmary. A gift of £5 000 was recently given for this purpose, and the work was carried out by Watson & Sons (Electro-Medical), Ltd. The department consists of a demonstration room, a radioscopic room, two radiographic rooms (one of which contains a 2 kW high tension Coolidge tube for dental and stereoscopic work, and the other a Potter-Bucky diaphragm, a dark room, a treatment room, and a deep therapy room. A useful feature is the workshop where repairs can be quickly executed. Manchester is to be congratulated on this, its latest addition to its electrical equipment.

As a result of the entrance scholarship examination held at FARADAY HOUSE ELECTRICAL ENGINEERING COLLEGE the "Faraday" scholarship has been awarded to B. K. Watts, the "Maxwell" scholarship to J. B. Browning, exhibitions to S. Anderson and L. B. Law, and an entrance prize to J. Chavooshian.

Hot Water Supply for an "All-Electric" House.

Conditions for the Second "Electrician" Competition.

As a reminder to our readers that our second competition is now in being we repeat the conditions which were published in our issue of April 6th. The plans of the house for which a hot water supply is to be provided also appeared in that issue.

1. Competitors are required to submit suggestions for an electric hot water supply scheme and the cold water supply service necessary in connection with it for the house illustrated on pp. 372 and 373 of THE ELECTRICIAN for April 6th. Provision should be made for hot water service to an electric hot water boiler and/or washing machine not shown on the plan. The house is assumed to be in Hackney. The plans and elevations should be re-drawn on ¼ in. = 1 ft. scale on tracing cloth in black ink.

2. Competitors must give the following information:—

(*a*) A specification of the materials to be used and the method of fixing.

(*b*) A schedule of all hot water "draw-offs," controls, fittings and apparatus to be erected.

(*c*) A priced bill of quantities.

(*d*) Plans showing the runs and sizes of all conductors and pipes and the position of all materials installed.

(*e*) Wiring diagrams (if necessary) of any work or connections that cannot be clearly indicated on the wiring plans.

(*f*) A brief description, not exceeding 1 500 words, of the methods proposed to be employed, with reasons.

(*g*) A letter to a prospective client, quoting for the job and describing concisely what is offered in non-technical language.

3. While technical correctness will be the first essential, the judges will take into account literary and artistic presentation in the competitors' work. Financial soundness will also be a very important consideration.

4. Drawings, specifiations and typescripts must bear in the top right-hand corner a pseudonym by which the competitor wishes to be known, and must be accompanied by a sealed envelope bearing on the outside the pseudonym and on the inside the full name and address of the competitor, and a certificate (see paragraph 10).

5. The typescripts, drawings and pseudonym envelope must be sent by registered post to the Editor, THE ELECTRICIAN, 8, Bouverie Street, London, E.C.4, and must reach him not later than first post on Friday, June 29th, 1923.

6. Typescripts, etc., bearing the pseudonyms will be sent to the judges, but the names and addresses of competitors will not be disclosed to them until the awards have been made.

7. The names and addresses of the successful competitors will be published in THE ELECTRICIAN as soon as possible after the close of the competition.

8. The following prizes will be given: First, 25 guineas; second, 15 guineas; third, £5.

9. The Editor of THE ELECTRICIAN will act *ex officio* as judge, and his decision on all matters relating to the competition is final. He can enter into no correspondence on the competitions.

10. Competitors will be required to submit with their typescripts, etc., a certificate agreeing to abide by the conditions of the competition.

11. The proprietors of THE ELECTRICIAN will not be responsible for the loss or damage to any typescripts or drawings. Every care of the matter submitted will, however, be taken.

12. Competitors must take their own steps to protect any patentable suggestions in the plans or essays sent in. The Editor reserves the right to publish any matter he receives, and will not be responsible if protective steps have not been taken before publication occurs. Solutions other than those of the prize winners, if published, will be paid for at £2 2s. each.

13. The Editor will not be responsible for any opinions which may be expressed about apparatus, methods or systems by the competitors.

A New Design of Electric Furnace.

BROWN, BOVERI and Co. are now manufacturing a metallurgical furnace which is designed for working on either three-phase or single phase circuits. There are two upper vertical electrodes, separately adjustable, and a fixed third electrode embedded in the hearth, all three in the same vertical plane. The furnace body is a horizontal cylinder of iron lined with refractory material and resting in trunnions in a semi-cylindrical cradle. The upper electrodes are fixed to two standards which are connected with the cradle in such a way that the electrodes need not be removed when the furnace is tilted; but the whole body can be taken out of the cradle when renewal becomes necessary. The electrodes are graphite rods, generally 4 in. or 5 in. in diameter; the fixed electrode only is water-cooled. The furnace is run with the aid of a transformer, which for furnaces of charges of 200 kg. or 300 kg. may have to supply up to 140 kVA. In order to reduce the heavy current fluctuations which the melting of cold charges involves, a three-phase choking coil is inserted in the circuit.

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The Judges' Comments on the Entries.

The Prize Winners Specified.

We give below the report of the judges, Messrs. Alan Kirk and L. L. Robinson, on the schemes submitted for THE ELECTRICIAN *"All-Electric" House Competition. It will be seen that these comments are highly critical, and we commend them not only to the attention of the competitors, successful and unsuccessful, but to the wider electrical public which is interested in the furtherance of the use of electricity in the home. It is obvious that much more has to be done before perfection is reached. Included in the judges' report is their unanimous decision as to the names of the three prize winners.*

Some General Views on the Competition.

The careful examination, analysis and judging of the many schemes submitted for the competition has been no light task, more particularly so on account of the fact that the competitors generally had apparently failed to grasp the essentials of the competition.

It is not necessary to fill a house with electrical apparatus —regardless of cost—to obtain an all-electric house, but it is essential to provide the means whereby any piece of electrical apparatus can be used when and where required. It is also necessary to consider carefully and adopt such a supply of electricity that the householder can economically and efficiently make use of any electrical accessory he may fancy.

Fundamental Considerations Missed.

Practically all the competitors missed these fundamental considerations in their endeavour to convert a domestic habitation into an electrical showroom, regardless of the first cost and the ultimate charges for current consumption.

It should also not have been necessary for us to call the attention of the competitors to the fact that when a three-wire system at a pressure of 480 V is balanced in a building it is of paramount importance that the two sides should not be brought into close association one with the other.

Some Detailed Criticisms.

Specifications should specify the material to be used and the method of using it, and should not be boiled down into a list of articles that it is proposed to fix.

Bills of quantities should be compiled, tabulated and priced in such a manner that they clearly show how the costs are made up, and, further, provide a complete schedule of rates usable in any variations to the contract, such rates being absolutely proportional to the estimated amount of the tender.

Wiring plans to be of any practical use must show the position of all materials to be used for the wiring of the building, and should also give the sizes and particulars of the conductors and their protective covering.

Results Obtained Disappointing.

Frankly, the results obtained were disappointing, and cannot be taken as representing the best brains of the electrical wiring industry.

Several competitors thought it necessary to have an electric bell-push in every conceivable place; the vision of an all-electric house being able to dispense with the domestic servant problem evidently had not penetrated their minds.

The attempts to produce bills of quantities were without exception poor; but too much stress has not been laid on this as it was recognised that this method applied to electrical wiring is of comparatively recent innovation and may not have had sufficient time to germinate and bear fruit.

First Cost of Prime Importance.

In all schemes for the internal wiring of buildings the first cost should be looked upon as one of prime importance, and therefore it is necessary when formulating a scheme that the cost of all materials and apparatus shall be carefully considered, not only at their purchased price, but also at their fixed price. It is interesting to note in this connection that, ignoring the cost of apparatus, the prize-winning scheme cost £60 19s. 4d. for 33 points. The second prize winner reached £100 5s. 5d. for 35 points, and the third prize winner £88 16s. 1d. for 45 points, altogether too large a number for so small a house.

There are many accessories and small articles sold for a few pence that more than double in cost by the time they are fixed, and it is for this reason that it is not always wise to adopt *en bloc* a complete so-called wiring system.

Some of the competitors' attempts to introduce special effects in switching and bell ringing were not only financially unsound but unworkable and imperfect.

Names and Addresses of the Prize Winners.

Having given all the schemes submitted a most scrupulous examination and analysis the judges unanimously decided to award the prizes as follows:

First Prize (25 guineas).

MR. PHILLIPE ERNEST PERONNE ("Perrard")
141, Camden Street,
London, N.W.1.

Second Prize (15 guineas).

MR. W. M. CRAUFURD ("Willett Wynne"),
205, Eglinton Road,
Plumstead, S.E.18.

Third Prize (£5).

MR. EDWIN WHYTOCK ("Northern Lights"),
10, York Terrace,
Shettleston, Glasgow.

The Prize Winning Schemes—Some Faults.

Perrard's faults are many and obvious, but his ideas show a greater understanding of the essence of the competition than that of his fellow-competitors.

He has chosen the positions for his wall plugs from a view-point of economy in wire, and has thereby entirely sacrificed all utility benefit obtainable from more appropriate positions. The amperage capacity of the wall plugs is obviously wrong, these should have been 10 A throughout.

His choice of tariff and his appreciation of the fact that the provision of wiring suitable for all ultimate requirement at a reasonable first cost are excellent.

He has provided in his scheme for what may be termed the first necessities, leaving the door open for the reception of little gifts from time to time of, say, electric irons, kettles, etc. We like the idea, it is human, and shows a knowledge and vision of greater value than a purely technically correct proposition.

The method of wiring specified is sound, and ensures economy in first cost and safety in manipulation.

The absence of all necessity for special bonding and earthing is of great importance in relation to the use of cab tyre sheathed wires.

A Financially Sound Scheme.

Cab tyre sheathed wires have been in use long enough, under the most trying conditions, to prove their value regarding their ability to withstand rough usage and other ills that conductors are heir to. "Perrard's" scheme has the merit of being the soundest from a true financial point of view; he has studied his client's pocket without depriving him of any electrical benefits in the immediate present and the distant future.

A Little Honey.

Having expended nearly a page of powder we may conclude with a few lines of honey. The schemes, as a whole, indicate a real desire to achieve two things: the maximum advantage for using electricity in the home and the greatest economy in bringing this desirable end about. We have shown that in doing this some competitors have exhibited the defects of their qualities. But a study of the schemes will not be a bad education for those whose duty it is to carry out work of this kind and for this reason some measure of gratitude is due to those who have submitted their ideas.

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Automatic Sub-Stations.

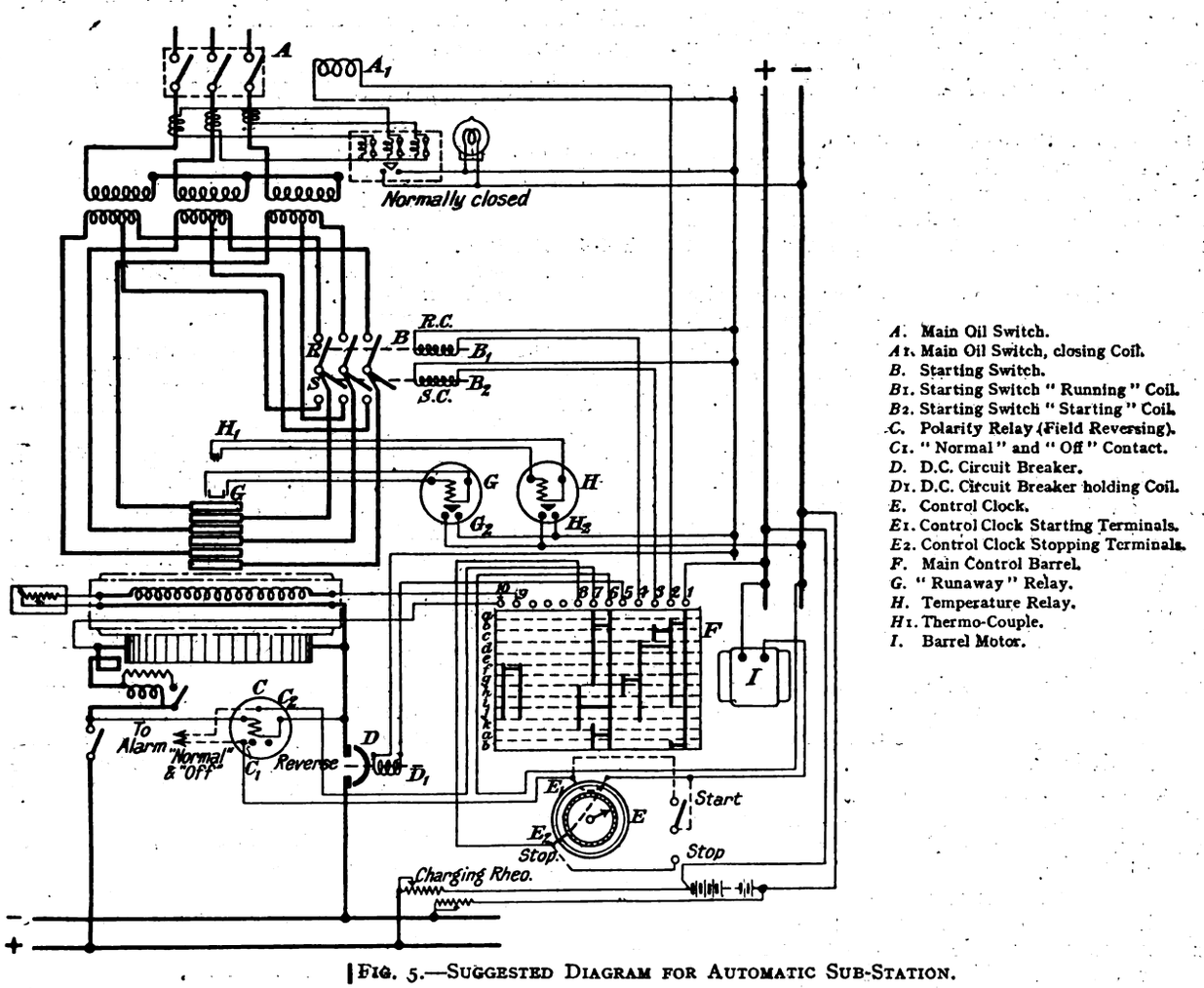
By L. C. GRANT.

In this, the concluding portion of his article, the author, after discussing certain matters of relay design, goes on to deal in detail with two schemes for large and small automatic sub-stations respectively. In these, simplification is the great factor. Some figures of cost are also given.

(*Concluded from page 417*).

Covering Relays.

Owing to the heavy duty which may be required of the relays and the difficulty of combining current carrying capacity and sensitivity, it may be necessary to add covering relays at certain points. For instance, should it be desired to use a voltmeter movement for the starting relay, then it is obviously impossible to add contacts large enough to carry the closing coil current and still retain anything approaching sensitivity. It is here that the covering relay becomes of use, and although it means the introduction of further contact points, the second relay can be so designed that little or nothing is lost in the way of reliability by its adoption.



A. Main Oil Switch.
*A*1. Main Oil Switch, closing Coil.
B. Starting Switch.
*B*1. Starting Switch "Running" Coil.
*B*2. Starting Switch "Starting" Coil.
C. Polarity Relay (Field Reversing).
*C*1. "Normal" and "Off" Contact.
D. D.C. Circuit Breaker.
*D*1. D.C. Circuit Breaker holding Coil.
E. Control Clock.
*E*1. Control Clock Starting Terminals.
*E*2. Control Clock Stopping Terminals.
F. Main Control Barrel.
G. "Runaway" Relay.
H. Temperature Relay.
*H*1. Thermo-Couple.
I. Barrel Motor.

FIG. 5.—SUGGESTED DIAGRAM FOR AUTOMATIC SUB-STATION.

Time Lags.

The requisite time lag between the various movements can be obtained in a number of ways. Whenever possible a positive form of interlock, by the use of auxiliary switches, should be adopted, but this is not always convenient. Other methods, such as the use of magnetic lockout and flux diversion contactors, dash pots, etc., we have not touched upon, as they are hardly ideal for the purpose under consideration.

A sound form of time delay device involves the use of a small motor-driven barrel switch through the contacts of which all essential circuits are led. The barrel is driven by means of worm or other gears and by the use of a brake, centrifugal regulator, or other device, is arranged to rotate once in (say) ten minutes. The starting relay sets the drum in motion and also closes the "closing" circuit of the first power switch to be operated. Until the barrel reaches the correct point, however, the closing circuit is not *completed*. When the closing circuit is bridged by the barrel, the interlocks on the power switch close up the next operating circuit (again *via* the barrel), so that there is once more a slight delay while the barrel runs up to the correct point and bridges the closing circuit. When this takes place the rotary converter starts, and upon reaching synchronism the synchronising relay operates and closes the induction motor short circuit switch. Again a delay takes place until the barrel catches up, when the short circuiting switch is closed by means of the barrel contact, and so on, the operation being repeated for every movement. Obviously, if a sufficiently long interval is allowed, nearly all the relays can be dispensed with and the equipment very much simplified and cheapened, although, strictly speaking, no positive interlock is introduced. The question naturally presents itself as to whether a point-to-point interlock is vital, and the answer can only be obtained by considering the characteristics of the rotary converter during the starting period. It is well known that only under extraordinary circumstances is any delay ever experienced in running up a machine of this type.

Design Without Interlocks.

We can then set out to design an automatic sub-station in which, with the exception of the starting, stopping and fault relays, no other device of this nature need be introduced. The suggested scheme is shown diagramatically in Fig. 5. In this no interlocks whatever are used. The starting is

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determined by a clock which controls the motor driving the barrel switch.

In this case the diagram has been laid out for a converter without a starting motor, the starting being effected by transformer taps. The starting switch is shown at *B*. *S* indicates the starting side and *R* the running side. *B2* is the holding coil for the starting contacts and *B1* performs the same function for the running contacts. It will be observed that in this diagram, trip coils have been dispensed with, holding coils being used which are always in circuit.

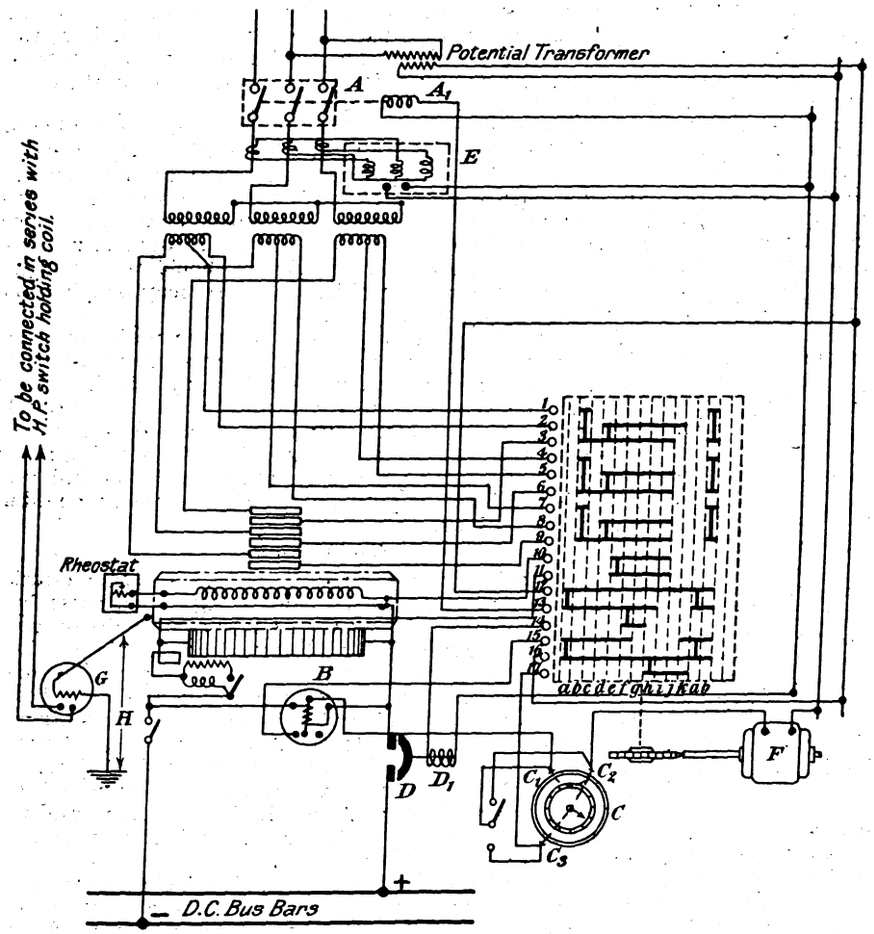
Starting Arrangements.

Starting is commenced by the clock closing up the control-battery circuit through the starting terminal *E1*, through contacts 6 and 7 in position (*a*) on the starting barrel, through contacts *C1* and *C2* on the synchronising relay *C*, thence to the motor. The function of relay *C* will be explained later. The motor *I* is geared up to the control barrel so that the latter rotates through the distance covering the starting operation in about fifteen minutes. In position *B*, the high-pressure switch closing coil circuit is made through battery contact 1 and contact 2. Note that the closing coil return is not taken directly back to the battery negative, but, together with other return wires, is taken to return busbar *J*.

The next movement of the barrel (position *C*) closes up starting contactor *S* through 1 and 3, when the rotary commences to run up to speed and in position *D*, running contactor *R* is closed up through 1 and 4, while contactor *S* is opened again. A blank position (*d*) is left on the barrel to allow the machine plenty of time to fall into synchronism.

The Reverse Polarity Relay.

The purpose of relay *C* can now be explained. Normally this relay lies over to the left, and it remains in this position while the polarity is correct or while the machine is standing. Should the polarity become reversed in the running-up operation, this relay moves over to the opposite side and interrupts the control barrel motor operating circuit, thus suspending the running-up operation. An indicator arrangement such as a lamp or bell can be connected directly across the relay contacts, giving an indication at a distant point, or, if required, it can be arranged to open up the high-pressure switch, thus closing down the machine again until the polarity can be rectified by an inspector. To render the machine capable of correcting its own polarity, the polarised relay change-over switch arrangement just outlined can be used, or the starting barrel can be arranged with a release and spring return to the starting position; the tripping being carried out by means of the relay *C* instead of, or in addition to, operating on the high-pressure holding circuit. By adopting this scheme, the machine will be sure to come up to correct polarity, for immediately the control barrel returns to position *A* the machine will slow down, the field will collapse, and relay *C* will again move over to the correct position, thus commencing the starting operation over again. Segments are also added on the barrel for making and breaking the field circuit at suitable intervals during the starting and stopping operation.



A. High Pressure Switch.
A1. High Pressure Switch holding Coil.
B. Synchronising Relay.
C. Control Clock.
C1. Control Clock Battery Contact.
C2. Control Clock Starting Contact.
C3. Control Clock Stopping Contact.
D. D.C. Circuit Breaker.
D1. D. C. Circuit Breaker holding Coil.
E. High Pressure A.C. Protective Relay.
F. Barrel Motor.
G. Earth Leakage Relay.
H. Machine Earth Connection.

FIG. 6.—DIAGRAM OF A SCHEME FOR SMALL SUB-STATIONS.

Shutting Down.

Closing down is carried out by the clock through contact *E2*. The circuit is then completed from the positive control bar through the barrel motor *J*, through the clock contact *E2*, thence to contact 8 on the starting barrel across to contact 6, which is the return wire to the battery negative. The barrel now commences to revolve, and on passing position *h* cuts out the d.c. circuit-breaker, next passing *i* and *j*, when it cuts out the high-pressure circuit-breaker and the running-contactor holding coils respectively. In the latter position (*j*) the field, if broken, which would be quite within the capacity of the starting barrel, as the machine will have slowed down by this time, and no appreciable inductive rise can take place.

Assuming the relay *C* to close in position *g*, the control barrel will bridge 1 and 5, thus closing the d.c. circuit-breaker by means of this holding coil *D1*. In position *g*, also, the control barrel motor circuit is interrupted across contacts 6 and 7. The clock "starting" and "stopping" contacts should break circuit an appreciable time after the starting barrel opens the motor circuit, so that the barrel motor is not switched out prematurely.

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At the next position (leaving *k*) the barrel motor circuit (opening) is interrupted, and the barrel motor stops, but not before closing up the starting circuit again ready for the next cycle of operations, which commences again at *a*, the next position on the barrel. The starting barrel is shown on the diagram as being duplicated over the first movements, but it will be understood that the second position (*a*) corresponds with the first.

A battery is shown for the operating circuits, and to make it as simple as possible and to obviate the danger of short circuits, charging resistances are provided on each pole. Obviously, no high voltage, short circuit or other fault can take place beyond these resistances.

A Much Simplified Scheme.

The scheme which is outlined represents a material simplification when compared with those at present in use, and should prove quite satisfactory for machines up to 1 000 kW at, say, 600 V. For greater outputs and higher voltages it will probably be necessary to add special safeguards.

Overload and earth leakage protection will be necessary on the high-pressure side of the machine, and overload and reverse power relays should be included for the protection of the d.c. side. A convenient way to fix up the high-pressure protective apparatus is that shown on the diagram. It will be noticed that the return from the various holding coils are not taken direct to the battery negative, but are grouped together on a common busbar, which is then coupled through the high-pressure relay contacts to the battery negative busbar. This contact is normally closed, thus completing the return for the holding coils, but open the relay operating, the holding circuit is interrupted, and the various switches are opened in consequence.

A good type of relay to use for this job is that manufactured by the B.T.-H. Co., Type S, Form H, slightly modified so that the circuits on the barrel are normally closed and upon the trip-coil operating the holding circuits are opened. The S.H. relay operates very quickly with a rotary movement, is capable of carrying an appreciable current, and can be obtained with anything up to four ways through it. Obviously, if holding coils are used on the power switches, they will be fitted with economy resistances, so that the current to be broken by the relay should be quite reasonable. Failing this, then the relay must be connected through a circuit-opening contactor or a standard air-break circuit-breaker. Connected across the relay contacts is a resistance to prevent arcing, and in this case it is used as a signal light to show that the relay has operated. If the signal light is not wanted, then it should be removed from the position shown and replaced by separate resistances for each coil and connected pirectly across their respective terminals. This relay should be of the non-resetting variety if the trip signal lamp is used.

A Scheme for Small Sub-Stations.

Fig. 6 shows a logical development of the previous scheme, Fig. 5, for small sub-stations. This is undoubtedly a good arrangement. The scheme can with confidence be used for machines up to 150 to 200 kW, and with care in the design of the control barrel could be used for greater outputs.

In this case the only devices necessary are :—

Motor-driven starting barrel, control clock, synchronising relay, protective relays, high-pressure overload and earth leakage, d.c. overload and reverse, overspeed, transformer and machine temperature relays.

The control barrel now bears the whole duty, carrying both control and power circuits. No interlocks are provided between movements as the barrel itself provides the most efficient safety device which could be used.

A synchronising relay is again provided as the alternative (i.e., its omission) means that some polarity controlling device —such as a separator exciter—would have to be provided as part of the converter.

Power Supply Simplified.

Another departure which makes for simplicity is the use of a potential transformer instead of a battery for providing the power for the control busbars. Starting is commenced when the clock closes up the control transformer circuit by bridging contacts *C*1 and *C*2. There is then a circuit available from the potential transformer auxiliary bars through barrel motor *E*, through *C*2 and *C*1, through relay *B* (which is normally in the closed position) thence to contact 15 on the control barrel which is bridged across to contact 16, and so back to the control bars. The motor commences to revolve the barrel, and in position *a* bridges the high-pressure switch holding coil circuit, thus closing this switch. In position *b* the low-pressure tapping from each transformer is connected up to the rotary converter slip rings, *via* the barrel, thus completing each transformer circuit and starting the machine.

Closing down commences by the clock closing up through C 1 and C_3, then through contact 17 on the barrel, thence to 16 and back to the control busbars. The barrel immediately commences to rotate, and on leaving position *g* switches out the d.c. circuit breaker. At *h* the high-pressure switch is opened and at *i* the low-pressure power circuit is interrupted and the field broken. If desired, the field-breaking operation can be delayed until the next position, thus ensuring that the field is not broken until well after power is cut off from the converter, thus saving flashing at the barrel contacts. After this, the barrel rotates through positions *j* and *k*, and in the latter closes up the barrel motor starting circuit and opens the "close-down" circuit contacts 15 and 17 respectively. The next position is *a*, the starting position, which is the waiting stage for the starting operation. Eventually this circuit is completed by the clock closing up across contacts *C*2 and *C*1.

In a system such as that just outlined, the starting barrel should, if possible, be arranged with a trip release feature, so that if the fault relays operate the barrel is immediately tripped back to the "off" position. This can be accomplished by arranging the motor to wind up a spring attached to the control barrel shaft; between the spring and motor a release detent or ratchet-wheel and pawl should be so arranged that no matter in what position the barrel may be lying, the release can always be effected.

Another attachment which may be very useful on some high-tension supply systems is a high-pressure under-voltage relay. Under normal conditions this relay will be in the "closed" position, but upon the pressure falling or supply failing entirely, the secondary contacts are open-circuited. These contacts are to be connected into the starting motor control circuit. The low-voltage relay can be worked very conveniently from the potential transformer used for feeding the control busbars.

Cost Factors.

The foregoing scheme is about as material a simplification as can be evolved. A sub-station designed on these lines would cost very much less than either a manually-operated plant or a fully automatic equipment. The cost of the switch-gear should be less even than a plain slate panel manually operated board. The cost of a suitable air-break heavy current motor operated barrel switch capable of dealing with a continuous load of 200 to 250 A at any voltage between 400 and 600 would be in the neighbourhood of £100. An oil-immersed controller of the same capacity would cost £160 to £200, while a 400 A switch of the oil immersed type would cost £200 to £250. The 400 A oil-immersed switch is essential if a sound job is wanted.

The foregoing remarks on automatic sub-stations are necessarily very sketchy, and have been confined to rotary converter equipments only. Their object was to place before the reader a number of possible lines upon which to develop, design, and in some cases to develop the said design, on (it is hoped) common-sense lines. The application of automatic operation to motor-generated plant has not been touched upon.

Electric Welding in Cast Iron.

In making an electric weld in commercial cast iron, says "The Engineer," the surfaces which are to be joined must, of course, be melted. When these surfaces, which consist of iron containing carbon in both the free and the combined states, are melted, several things happen. First, all the carbon goes into solution in the molten metal. Second, some of the carbon, silicon and manganese is burned out by the heat, while the sulphur and phosphorus are practically unaffected. The tendency, therefore, is to produce a cast iron in the weld that will be white when cold owing to its low content of silicon and carbon. Third, the surface of the molten metal oxidises, making a slag, which partly prevents further oxidation. As soon as the welding heat is removed, the melted iron hardens very quickly, giving up its heat to the neighbouring cold metal and to the air. The sudden cooling produces a chilled hard white metal in the weld, the hardness being due to the fact that much of the carbon remains in solution if the cooling is sudden. Of course, if the casting has been preheated before welding, the cooling of the added metal will not be so sudden, and a softer machinable weld may be secured.

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The Control of the Speed and Power Factor of Induction Motors.

In this portion of his fourth lecture Professor Miles Walker deals with the series wound unsaturated Le Blanc exciter and discusses Kapp's construction for the design of this machine. He also deals with methods of finding the locus of the stator current with the obtaining of speed below and above synchronism and with slip reversal.

Lecture IV.

Series Wound Unsaturated Le Blanc Exciter.

When the phase advancer is series wound it is possible, by arranging the series coils in suitable phases, to inject an e.m.f. having any required phase position with respect to the current. The connections are shown in Fig. 38. SF_1, SF_2 and SF_3 are the series coils. C_1, C_2 and C_3 are compensating coils which neutralise the armature ampere turns. The simplest

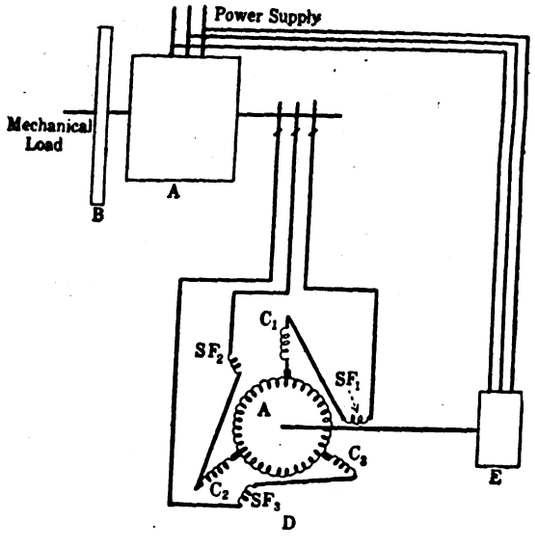

FIG. 38.—CONNECTIONS OF SERIES WOUND LE BLANC EXCITER.

case to consider is the one where the phase angle is a constant and the e is strictly proportional to I_2.

Applying these conditions to Fig. 39, we see that the ratio between RO, the ohmic drop, and E_2R, the injected e.m.f., remains constant.

Also the angle E_2RO remains constant. That is to say that the angle E_2OR is constant and also its complement ROp. But angle ROp = angle OpC. Therefore angle OpC is constant. Under the conditions assumed the reactance of the rotor circuit remains constant, therefore the length of OC is constant. The locus of p will be a circle of which OC cuts off a segment containing the constant angle OpC. To find the centre of the locus of p we may proceed as follows: Take any rotor current and, knowing r, lay out in any direction the line

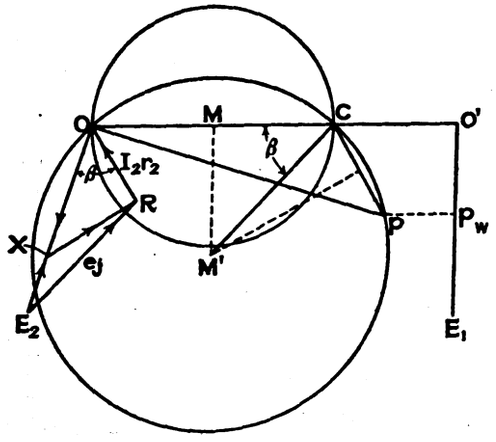

FIG. 39.

RO equal to the ohmic drop to the voltage scale. Now lay off E_2R from knowledge of the phase advancer adjustment. This gives us OE_2. Set off a line Op at right angle to E_2O. The position of p is determined because the length of pC and the angle Opc being known, the perpendicular distance of C from Op is known and also OC.

Kapp's Construction.

Another method due to the late Gisbert Kapp depends upon the following relations: Angle OpC at the circumference (subtended by OC) is equal to half the angle at the centre = MM'C. Break up the injected e_j into two components, one XR at right angles to the current and the other E_2X in line with OE_2. Then ORX is a right-angled triangle. The angle

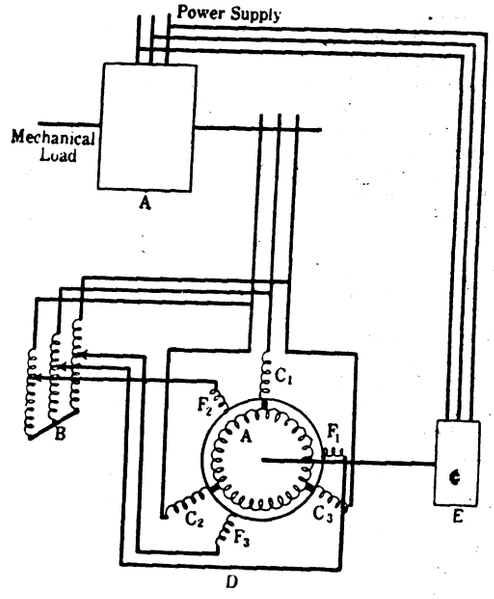

FIG. 40.—CONNECTIONS OF SHUNT WOUND LE BLANC AUXILIARY MACHINE.

OXR = the angle ROp = angle MM'C. Therefore angle XOR = angle MCM' = β. But tan β gives the ratio between the component of e_j which is at right angles to the rotor current and the ohmic drop. For a given arrangement of the coils of the phase advancer and assuming no saturation of the iron we get a constant angle β. We can therefore find the centre M' of the locus circle by setting off the line CM', making the angle β with OC and seeing where it cuts the perpendicular

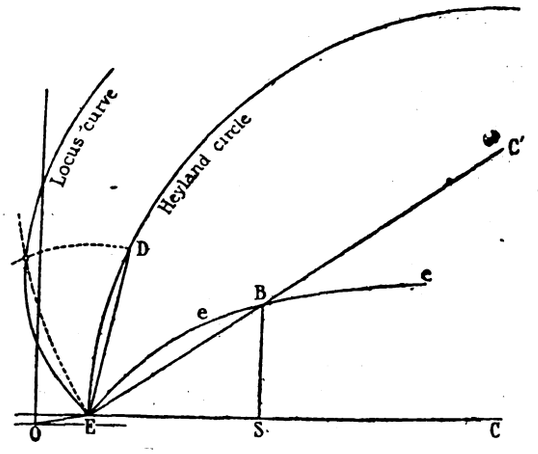

FIG. 41.—KAPP'S CONSTRUCTION TO TAKE ACCOUNT OF SATURATION.

from M. It should be pointed out that the series coils of the phase advancer add an appreciable amount of reactance to the rotor circuit and the same is true of the armature of winding of the advancer. We must (on laying out the scales to which OC and Cp are drawn) include in the value of v_2 an allowance for the extra leakage flux caused by these windings.

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This may be done as Mr. Hull does it, by decreasing the size of OC in proportion to Cp, or we may keep OC constant and change the scale of Cp so as to reduce the number of amperes represented by 1 cm. This is virtually to increase the length of p in relation to OC for a given load on the motor.

Effect of Saturation of Iron.

In practice the iron of the phase advancer approaches saturation at heavy loads. Gisbert Kapp proposed a neat construction for taking account of this. For every value of the current through the advancer there is an ascertainable value of injected e.m.f. at right angles to the current. In

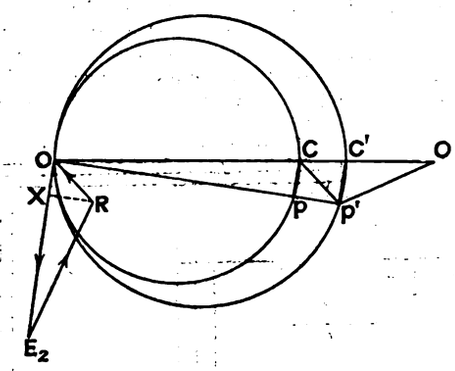

FIG. 42.

Fig. 41 Gisbert Kapp* sets off along the line EC a length ES to represent the ohmic drop for a particular current and a length SB to represent the injected e.m.f. at right angles to the current. Each value of SB gives a point on the curve *ee* which is nothing more than the saturation curve of the advancer plotted in the units above mentioned. A line EB drawn through B for any value of SB gives the angle BES = β in Fig. 39. If we continue EB to C′ where it cuts the perpendicular at C we get C′ the centre of the locus circle (M′ in Fig. 39) for that particular value of β. We can then plot the locus of the end of the rotor current vector point by point by striking a circle with C′ as centre and C′E as radius and finding the point where this cuts the circle with centre at E and having a radius equal to the rotor current vector.

Finding the Locus of the Stator Current.

Two methods of procedure are open for finding the locus of the stator current; either the method given by Hull, involving the constants v_1 and v_2 as given above, or the method which

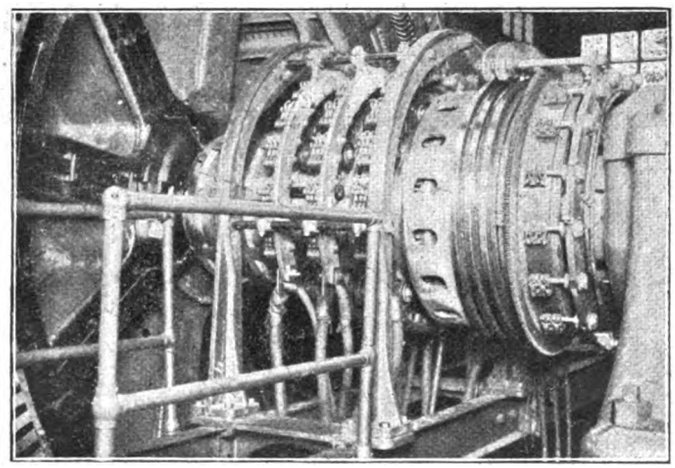

FIG. 43.—OHMIC-DROP EXCITER MOUNTED ON THE SHAFT OF A LARGE INDUCTION MOTOR. (GENERAL ELECTRIC CO. OF AMERICA.)

starts with the locus of the current in the rotor circuit as plotted by Kapp's method. The locus of the current is the locus of admittance to another scale. This gives the starting point for the method of inversion as described above.

Shunt-Wound Unsaturated Le Blanc Exciter.

For many classes of work it is desired that the induction motor shall not increase its slip very greatly with load but shall maintain as good a speed regulation as an ordinary induction motor and yet have the set speed adjustable. For this purpose it is necessary that the Le Blanc auxiliary machine should have the characteristics of a shunt motor; suitable connections are shown in Fig. 40. The Le Blanc exciter is shown at D. It will be seen that the field coils are fed from taps on an auto transformer B, whose terminals are across the slip rings. It can be shown that the flux in this auto transformer remains constant at all slips, because when the voltage across the rings increases the frequency in the rotor circuit increases at the same time. For a given setting of the tappings the flux in the field coils, F_1, F_2 and F_3, will for the same reason be constant and independent of the frequency. The amounts of flux, F_1, F_2 and F_3, can, however, be adjusted by altering the position of the tappings. We see, therefore, that almost independently of the load on the motor, the machine D will generate a constant voltage whose phase position can be adjusted by varying the position of the brushes with respect to the field coils.

The locus diagram of the apparatus is then given in Fig. 42. OE_2 represents the voltage generated in the rotor circuit. This balances E_2R, the e.m.f. of the exciter, and RO, the resistance drop. In this case it is supposed that E_2R has a slight leading component. Resolve RO into two components XO in line with E_2O and RX at right angles to it. Let the circle OCp be the locus of the rotor current when the exciter is not running. To find the locus of the point p′ when the

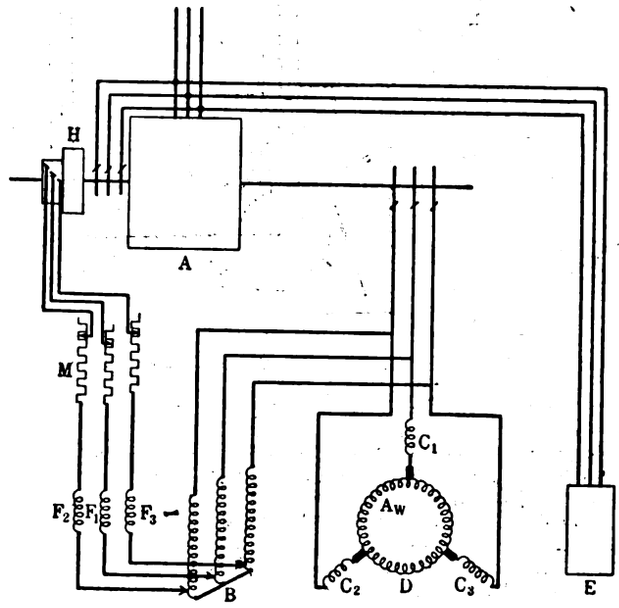

FIG. 44.—CONNECTIONS OF LE BLANC MACHINE TO GIVE SPEED RANGE ABOVE AND BELOW SYNCHRONOUS SPEED.

machine is in operation draw pp′ parallel to XR and Cp^1 parallel to OR. Cp^1 gives the rotor current under the new condition. As the triangle Cpp′ is similar to the triangle OXR, one being drawn to the current scale and the other to the IR drop scale, the circle OC′p′ is the locus of the point p′.

It will be seen that by altering the phase of E_2R the amount of leading component of the rotor current could be altered at will.

Variation of Speed Above and Below Synchronism.

Where a wide range of speed in the induction motor is required there is a great advantage in arranging the Le Blanc exciter so that the slip of the motor can be made both positive and negative. By so doing the kVA rating of the auxiliary machine is reduced to one-half because it can be designed for only one-half the voltage that would be required to give a full range of speed from synchronism downwards. In order that the voltage supplied by the auxiliary machine should be capable of carrying the rotor of the induction motor through synchronism an additional piece of apparatus, commonly known as the ohmic drop exciter, is required. This machine consists of a frequency changer having an armature like a rotary converter with a commutator at one end and slip rings at the other. It is wound for the same number of poles as the main induction motor on whose shaft it is mounted. A view of an ohmic drop exciter is given in Fig. 43. It consists of an armature like a rotary converter having a commutator and slip rings. The magnetic circuit of the armature is completed by rings of laminated steel placed over the slots

* "The Improvement of Power Factor," "Journ. I.E.E.," vol. 61, p. 102.

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and rotated with the armature. This laminated ring is not visible in the figure because it is under the slip rings.

As explained above in connection with the frequency changer, a machine of this kind will, if fed at the slip rings, with a frequency equal to the frequency of the supply mains yield at the brushes a constant voltage at the slip frequency. This voltage is employed to control the excitation of the Le Blanc auxiliary machine. The connections are shown in Fig. 44.

The field coils of the machine D are shown at F_1, F_2 and F_3. They are fed from tappings from an auto transformer

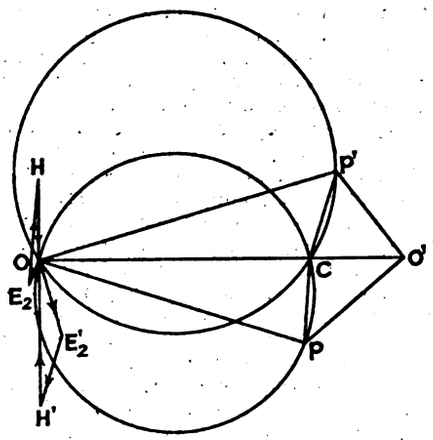

FIG. 45.

B, whose terminals are connected across the slip rings of the induction motor A, the tappings being taken off as in Fig. 40. Instead, however, of the inner ends of the field coils being connected to the star point they are connected, through the interposed rheostats M to the commutator brushes of the ohmic drop exciter H. If we leave out of account the action of H, the machine D operates as a shunt-wound motor having a constant flux per pole for a given setting of the tappings. When it is required to change the speed of the motor the tappings are altered and the flux is increased in proportion to the slip. The reactance drop component of the field coils F_1, F_2 and F_3 varies as the square of the slip. The current in the coils will vary directly as the slip. If we now superimpose the constant voltage of H, it is seen that we can make it compensate for the ohmic drop in the field coils and supply an exciting current which will keep a current flowing in the rotor circuit even when the slip is zero.

In order to get a suitable adjustment of the field current the rheostat M is added. When the slip is zero H operates as an ordinary rotary converter supplying d.c. to the field coils and making D operate as a d.c. generator feeding the rotor with direct current.

For great values of the slip the chief voltage is that yielded by the auto transformer, but as the motor approaches synchronism (the tappings being moved to the neutral point) this voltage is cut down and the pressure yielded by the ohmic drop exciter plays an important part. The phase of this pressure is adjusted so that the e.m.f. which it causes to be generated in the rotor circuit is in phase with the wattful current in the rotor. This e.m.f. assists the current to overcome the ohmic resistance and enables the slip to be reduced.

Reversal of Slip.

By cutting out resistance from rheostat M the e.m.f. driving the current can be so increased as to drive the wattful current through the rotor winding, although the slip is made negative. At the instant when the main motor is running at synchronous speed the Le Blanc machine acts as a d.c. exciter. As the direct current is increased the rotor changes its phase position with respect to the vector representing the supply voltage.

That has the effect of changing the relative values of the current in the various phases. This, again, produces a still further change in the phase position of the rotor, and the action is continued until the phase rotation of the voltage on the brushes of the ohmic drop exciter is reversed and the rotor is fed from the Le Blanc machine with currents that slowly alternate with reversed rotation and cause the slip to be negative. The e.m.f. generated by the negative slip is overcome by the e.m.f. generated by Le Blanc exciter, which in its turn is controlled by the ohmic drop exciter.

This reversal of the slip is shown by Hull in his diagrams in the manner indicated in Fig. 45. Consider first the condition when the slip is still positive but greatly reduced. The vector HO, at right angles to OC, represents the e.m.f. injected into the rotary circuit by D due to the excitation received from the ohmic drop exciter. OE_2 represents the small e.m.f. generated by the small slip, and these are sufficient to overcome E_2H, the ohmic drop parallel to pC. If, now, HO is increased to a point sufficient to drive the motor above synchronous speed, the direction of rotation of the vectors is reversed, and if the diagram relates to the rotor circuit and OC is taken as the datum line from which phase differences are measured, the quadrature components of all vectors must be reversed, as a vector which would not reach its maximum until 90 degrees after OC will in the reversed phase rotation reach its maximum 90 degrees ahead of OC. Therefore, viewed from the rotor H'O must be drawn on the opposite side of OC. OE_2 is drawn on the same side because, while it is generated by a negative slip which makes it opposite to OE physically, the reversal of the diagram brings it on the same side of OC. $E_2'H'$ gives the ohmic drop caused by the rotor current Cp', which is not reversed physically but only diagrammatically, owing to the reversed rotation of the vectors in the rotor. The reflection of Cp' in the stator is on the same side of OC as Cp, but the power factor is better because the reversed direction of rotation of the currents in the machine D makes the armature reaction give a leading component to the e.m.f. generated. Mr. Hull's article gives many other important diagrams dealing with the combined effect of shunt and series excitation of the Le Blanc machine.

The ohmic drop exciter consists of an armature like that of a rotary converter, having a commutator at one end and slip rings at the other. There is just sufficient iron to give a reactive drop of 20 V, sufficient to overcome the ohmic drop in the field circuit of the regulating motor.

Mr. Beauchamp on Electric Heating.*

When electric heating is mentioned the electrical engineer, and still more the layman, is prone to think of room heating alone and to forget the numerous industrial and domestic applications of electric heating which are possible in such equipment as ovens, welding machines, irons and various other kinds of tools. Mr. Beauchamp's primary object is to bring together information on these matters for the benefit of the engineer and the student and particularly to stimulate further inquiry on the part of manufacturers and others who could, with advantage, use electric heating in the wider sense. This is a laudable object. Electric heating for such purposes is no less convenient and flexible than it is for others in which it is increasingly being used. It has greater ease of control than any other method and its capacity for reproducing the same conditions over and over again in the easiest possible way is an advantage which must not be overlooked. Station engineers also would do well to consider this matter. Industrial heating is a load with a high load factor and, properly tackled, many millions of kilowatt hours could be sold at a remunerative price.

Every electrical engineering text-book suffers from the fact that history must lag behind practice. This is certainly true of industrial electric heating. Before a book can be published further advances have been made and recorded in the technical journals. But this does not interfere with principles and Mr. Beauchamp has therefore done wisely to stick to broad considerations and particularly to deal fully with the heater element.

The apparatus in the book is roughly grouped in accordance with working temperatures. Two preliminary chapters deal clearly and concisely with the economics of electric heating and with the conversion of electricity into heat. They are followed by a chapter describing ovens and muffles, apparatus for the melting of metals, electric welding machines and electrically heated tools and appliances. Then we have a little surprise. Chapter VII deals with canteen cookery and electric baking. Of course, strictly speaking, these applications can be classed as electric heating, but it gave us a little shock. Two concluding chapters on wiring and tariffs put a finale on a most useful book.

The difficulty we experience is to find anything to criticise. There is even a bibliography and an adequate index. It goes without saying that the book is well written and the illustrations are adequate. The one omission that we have been able to discover is that no mention is made of an interesting Swiss oven recently described in these columns. The book is a piece of useful propaganda and we can heartily recommend its purchase and perusal to all electrical engineers.

* "Industrial Electric Heating." By J. W. Beauchamp (London: Sir Isaac Pitman and Sons). Pp. 116; 2s. 6d. net.

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Recent Advances in Applied Electro-Chemistry.*

By M. DE KAY THOMPSON, Ph.D.

Applied electro-chemistry consists of the following rather diverse subjects:—(1) Electroplating and galvanoplastic processes, such as electrotyping; (2) wet electrometallurgy; (3) the electrolytic production of chemical compounds in aqueous solutions; (4) primary and secondary cells; (5) electric furnace products, and the furnaces in which they are made; and (6) gas reactions produced by electricity.

It may be well, first, to explain what will be considered advances in this applied science. There may be differences of opinon on this point, but it will here be considered that an increase in the quantity or improvement of the quality of an electro-chemical product, an improvement in method, apparatus, or efficiency of production, or the extension of electro-chemical methods to new products, would be all advances.

Recent Improvements in Electro-Plating.

In the subject of electro-plating reference is made to a recent improvement in nickel-plating, which consists in the use of nickel fluoride in place of nickel chloride or sulphate, because the fluoride gives a finer grained deposit with higher tensile strength and greater hardness. This is an example of the familiar fact that the quality of the deposit of metals depends to a large extent on the salt from which it is deposited. Although nickel is usually thought of as a bright metal, it may be plated from certain solutions as a black deposit. A solution giving black nickel contains nickel and zinc sulphates, cyanide, arsenious acid, ammonia, and ammonium carbonate. This black nickel was used extensively during the war. Other metals may also be deposited black—for example, silver, copper and platinum.

Lead Plating.

Lead-plating has recently been conducted on an extensive scale for lining gas shells and also for plating on the inside of underweight shells to increase the weight. A solution of lead fluosilicate or borate is used. The electrodeposition of alloys which has been recently adopted consists of equal parts of tin and lead. These two metals are so nearly equal in their electrolytic potentials that there is no trouble at all in depositing them together from solutions of their simple salts. In fact, tin cannot be separated from lead by electrolytic refining. The solution is a mixture of lead and tin fluosilicates or fluoborates. This lead-tin deposit is used for the lining of air-flasks of naval torpedoes.

Other improvements in electro-plating are concerned with the cleaning of the surface in preparation for plating, this being a most important step in the process. One such method consists in simultaneously cleaning and plating with copper from a hot cyanide bath. The hot alkaline cyanide solution removes the dirt and, wherever clean, a good copper deposit is produced by the current. Another method is to electrolyze as cathode in a hot alkaline solution. The hydrogen evolved reduces oxides and helps to carry off the dirt.

In recent years a use has been made of the fact that aluminium can readily be coated electrolytically with a film of oxide. An insulating covering has been thus produced by drawing the aluminum wire through a sodium silicate solution in which it is electrolysed as an anode. The thin film produced will stand 200 to 500 v.

Electrotyping Methods.

In electrotyping, impressions in wax have been commonly used. This method is not sufficiently exact to make substitutes for the steel plates used by the U.S.A. Government in engraving bond issues. Such plates, however, have been successfully produced by substituting for the wax negatives made by electrodepositing alternate layers of nickel and copper on the steel engraving to be copied, stripping this from the engraving and then depositing the actual printing plate on this metal negative. The surface must be slightly greased, so that the two metal sheets can be separated. The printing plate is made by a deposition first of nickel, 0·005 in. thick, and then copper and nickel in alternate layers for periods of one hour during six days. Among other galvanoplastic products, more or less recent, may be mentioned duplicating phonographic records, the metal decorations on glass and pottery, and the production of bronze statues.

* Abstract of a paper read before the Franklin Institute.

In recent years there have been some notable advances in wet electrometallurgy. Numerous early attempts to extract metals from their ores by methods involving electrolysis ended in failure. Among these may be mentioned the Marchese process, where the attempt was made to produce pure copper by electrolysing copper matte anodes. The curious thing about the history of this process is that the laboratory tests were considered encouraging and the process failed when tried on a larger scale.

The history of the Siemens process for copper is very similar. The Hoepfner processes for copper and for zinc extraction also failed. The first success of this kind was achieved at Chuquicamata, where copper ore is leached with sulphuric acid, and pure copper is deposited electrolytically, using unattackable anodes of fused magnetite or "durion" (an alloy of iron and silicon) and copper cathodes. Practically the same process has been extended recently to the extraction of zinc, by depositing zinc from very pure zinc sulphate solutions. Production of electrolytic zinc in quantity began in 1916. A very pure solution is required, and some impurities must be reduced to about one milligram per litre. Cobalt and chlorine cause the most difficulty. In this case lead anodes may be used, and the cathodes are sheets of aluminium. At first, in some plants, the cathodes were rotated, but stationary cathodes are now universal. The zinc is stripped from the cathodes every 48 hours and remelted. The current density is 25 A per sq. ft. In 1920 there were four plants producing electrolytic zinc in the United States, also one in Canada, one in Australia and two in Tasmania. The production in the United States is about 10 per cent. of the world's pre-war production.

The Recovery of Cadmium.

Cadmium is a metal which occurs only in small quantities in its ores, and production is profitable only where it is a by-product. An electrolytic method for recovering cadmium has been developed recently at the mammoth electrolytic zinc plant of the U.S. Smelting, Refining and Mining Company at Kennett, California. In purifying the zinc solution for electrolysis, copper and cadmium are precipitated by zinc dust. This precipitate has the appearance of a black mud. It is dissolved in dilute sulphuric acid, leaving the copper behind, and is then precipitated on zinc sheets. This is dissolved in acid cadmium electrolyte, iron and thallium are removed, and the solution is electrolysed on rotating aluminium cathodes, from which it is stripped. Its uses are as a pigment when changed to the sulphide, and in the metallic state for low melting point alloys.

The following problem is a little different from either recovering metals from ores or refining. This consists in separating the constituents of a copper-nickel alloy. Many ores contain these two metals in about equal amounts, and the smelting process gives an alloy of about equal parts. An earlier electrochemical process, due to David H. Brown, accomplished this separation, but a more recent method is the Hybinette process, originating in Norway, and now in use in Canada. In this process the anodes are not unattackable, as in the case of the copper and zinc recovering processes just mentioned, but consist of the alloy of nickel, copper and iron. The cathode is a thin sheet of copper or iron with the surface treated so that the nickel can be stripped off, and is separated from the anodes by a diaphragm of two sheets of cloth. The nickel sulphate solution circulates to the cathode compartment. This causes a flow through the diaphragm and overcomes the migration of the copper which is dissolved with the nickel at the anode. The solution from the anode compartment is passed over pure nickel, causing the copper to precipitate, and this solution circulates to the cathode.

The production of electrolytic iron has been adopted by the Western Electric Company for making iron powder. Their plant produces 25 000 lbs. a week. The electrolytic iron, owing to its brittleness, is easily ground.

Electrolytic Production of Chloride.

The production of chloride by electrolysis involves special conditions. The hydrate must be removed continuously, but if it is drawn off too rapidly the solution will be too dilute, while if the concentration of the hydrate becomes high, the hydroxyl ions migrate to the anode compartment, form chlorate, and attack the graphite anodes. The correct

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conditions are obtained by having the cathode tight up against the diaphragm. A recent type of cell for this purpose is the Marsh cell, in which the anode and cathode are brought close together by using graphite rods for anodes with corresponding fluted cathodes, thus saving both power and floor space. Another method of removing the alkali is used in the Basel cell, introduced in France during the war. In 1917 these cells were producing nearly half the total French output of chlorine. In this cell the "propulsive" cathode is placed in a comparatively narrow cathode chamber formed by narrow meshed asbestos fabric. The hydrogen liberated in this small chamber produces in the surface of the ellectrolyte a froth consisting of bubbles of hydrogen, the shells of which consist of solution of alkali carried up by the gas. This froth is carried away through the overflow.

Neutral Solutions of Permanganate.

During the war there was urgent need for neutral solutions of sodium permanganate. The chemical method of making this is to heat the manganese dioxide with sodium hydrate, dissolve the manganate formed, and then oxidise to permanganate, either by electrolysis in the anode compartment of an electrolytic cell or by means of chlorine or carbonic acid. This was not even as satisfactory as the same method for potassium permanganate, as the yield of sodium manganate on roasting the dioxide of manganese with sodium hydrate is less than the corresponding reaction for the potassium compound, and that has a rather low efficiency. It had been known for a number of years that a ferro-manganese anode electrolysed in potassium hydrate or carbonate gave a solution of potassium permanganate, but it had not been tried on a large scale. This was done, however, nearly to the point of production, before the armistice. The anodes were 75 per cent. ferro-manganese, separated from the iron cathode by a diaphragm. Of course, pure manganese would work better than ferro-manganese, but this would be too expensive. The principal difficulties were with the anode. The anodes are brittle and cannot be cast in large plates because they invariably crack on cooling, but must be cast in bars, a number of which are clamped to an iron piece to form one complete anode. Then some difficulty was found with the tendency which ferro-manganese has of becoming covered with an insulating layer of oxides when electrolysed, but this may be largely overcome by keeping the temperature down. The current efficiency is only about 35 per cent. This low efficiency is due to the fact that part of the current is used to oxidise the iron, and only part of the manganese is changed to permanganate. The process works equally well for potassium permanganate.

During the war paraminophenol was made by electrolysing nitro-benzene suspended in sulphuric acid solution, but this process was found too expensive to compete with any chemical process.

Electrolysis of Fused Salts.

Some progress has been made during the last few years in electrolysing fused salts. Calcium has been produced in this way in small amounts, but as there is not much demand for this metal in the pure state an alloy of lead, calcium, and barium, known as Frary metal, is now produced in large quantities for a bearing metal, by electrolysing a mixture of fused calcium and baruim chlorides on a fused lead cathode contained in iron pots. The layer of fused salt is 3 to 4 in. thick. The anode is a graphite rod at the centre. The pots are placed in brickwork fired with coal for melting the lead, and the salt mixture is fused by the passage of the current. There is a tendency towards forming metal fog and calcium and barium carbides, so that three days' electrolysis is required to produce an alloy containing 2 per cent. of the alkaline earth metals. When the proper amounts of calcium and barium have been electrolysed into the lead, the alloy is drawn off from a whole series of pots and mixed in a large kettle and further alloyed ingredients are added, such as ½ per cent. of mercury.

Advances in Electric Furnaces.

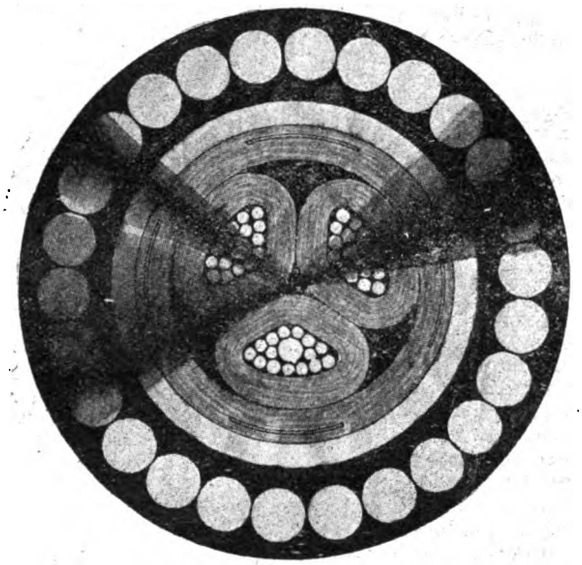
In electric furnaces one of the most interesting advances is the Söderberg self-baking continuous electrode, which has been perfected in Norway. The unbaked mixture is fed in continuously to the furnace and is baked by the heat of the furnace to form the electrode. This is economical and it avoids the difficulty involved in changing electrodes. The material is fed into a casing which progresses into the furnace as a part of the electrode. One of the difficulties in steel furnaces is the high temperature of the furnace lining and uneven temperatures. In recent furnaces the electrodes are placed in a straight line, and the contour of the lining made such that at the slag line the temperature is approximately the same throughout.

Probably the most important of the electro-chemical industries will eventually be the fixation of atmospheric nitrogen. The most recent development in this direction is the Claude process in which everything is essentially like the Haber process, except that the gases are made to react under pressure of 1 000 in place of 200 atmospheres. This increases the efficiency from 13 per cent. by the Haber process to 40 per cent. The process is now in successful operation in France.

Longest Submarine Power Cable in the World.

Example of Japanese Enterprise.

The submarine cable which has recently been laid and is now in use for the purpose of transmitting power from Niihama to Shisakajima, Shikoku, Japan, is said to be the longest of its kind in the world. The Sumitomo, who are one of the largest families in Japan, own a large copper mine in Besshi. The ores from this mine are transported to Shisaka Island in the Inland Sea where they are smelted. The power generated at Besshi is transmitted by an aerial line to Niihama, about 3 miles from the mine, where it is stepped down to 11 000 V and transmitted to Shisakajama. The power transmitted is intended for operating the plant for the landing of the ores and for working the whole of the smelting plant. The submarine cable is about 13 miles long and consists of twenty-three lengths, each measuring 3 000 ft. The cable is



A Large Japanese Submarine Cable.

composed of three sector-shaped conductors having a cross-sectional area of 100 000 circ. mils each. Each conductor is insulated with impregnated paper and the three conductors are laid up into a core, then lapped with impregnated paper and enclosed in a lead sheath. After sheathing a jute bedding is applied, the cable is then armoured with galvanized iron wires, and finally served with jute yarn. The cable contains four copper tapes within the outer belt insulation. These tapes serve as a protection for the power conductors and are also used for two telephone circuits. The finished cable is 3·0 in. in diameter and weighs 6·3 tons per 1 000 ft. It was tested at 30 000 V at the factory, and at a pressure exceeding the working pressure by 50 per cent. after the cable was laid. The whole cable was manufactured by the Sumitomo Electric Wire and Cable Works, and the laying was also supervised by the manufacturers' engineers.

In his report to the Ministry of Transport on a collision which occurred on December 29th on the Electrified portion of the North Eastern Railway, Major G. L. Hall states that "the handling of an unfitted train of 1 400 tons on a long bank of this character behind a single engine is certainly uncommon, and the results up to date speak well for the braking and other characteristics of the electric engines concerned." The report states that the driver of the train concerned cannot be excused for having failed to stop.

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Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

THE RADIATION OF WIRELESS WAVES.

To the Editor of THE ELECTRICIAN.

SIR,—Doubtless many of your readers are accustomed to turn with pleasurable anticipation to Prof. Howe's "Notes on Wireless Matters" when he sets himself, as happily he often does, to scotch a common error or cast a ray of light into a dark place. His remarks in your issue of April 13th, however, seem to me to be unfortunate as regards the reputed critical nature of the quarter-wave length distance from a transmitting aerial—the introductory topic of the Notes.

The passage quoted from Sir Oliver Lodge appears to support the common notion that a sudden change in the electric and magnetic conditions occurs at the quarter-wave length. Prof. Howe—unintentionally, I think—lends countenance to this notion in describing conditions at the end of a horizontal aerial oscillating at its fundamental frequency. The particular, unnecessary, and, indeed, quite unusual relationship which here obtains of about 4 : 1 between the lengths of wave and aerial does, it is true, give a narrow region of very rapid change at the quarter-wave length distance from the uplead. But let the aerial be loaded for use at a greater wave length (or even merely be excited by an alternator of lower frequency), and the region of sudden change will occur no longer at the quarter-wave length but will remain at the end of the aerial. Is it not, indeed, the truth that there is no sort of necessary discontinuity at the quarter-wave length, but that the phase difference between the electric and magnetic fields at any spot changes gradually from about 90 deg. when the spot is near the uplead to about 0 deg. when the spot is indefinitely far therefrom?

With regard to an explanation of the radiation from the aerial, Prof. Howe does not attempt here what, he says, Sir Oliver was attempting, viz., "to make a complicated phenomenon clear to the non-mathematical reader." He describes the cycle of events *if* the oscillation is accompanied by loss due to radiation of energy. A satisfactory non-mathematical picture of the flicking-off process is, in my opinion, still to seek and urgently wanted.—I am, etc.,

L. B. TURNER.

Cambridge.
April 18th.

THE BROADCASTING CONTROVERSY.

To the Editor of THE ELECTRICIAN.

SIR,—With reference to Mr. Challis's article in last week's ELECTRICIAN, of course he is giving more space to the commercial considerations, whereas there is at least one technical condition of paramount importance. I refer to the use of reaction. To deal with his arguments, there is an important principle of high policy involved in the method of raising revenue. It is not desirable that a State Department should collect all the gross revenue and hand some of it over to a more or less private concern.

The dealers have only themselves to thank for confusion in the public mind as to the cause of royalties. If firms *will* advertise "Sets 12s. 6d. plus royalty," why should they expect the whole system to be revised when the attempted "price wangle" has not come off.

I fail to see why the established importer should be given special terms. His existing trade is not being interfered with in any way, so why should he be actually assisted to stab in the back this fledgling industry? As for new ideas, I would like to see imports of new apparatus restricted to exactly one, then all the home makers would start fair and eventually acquire correct technique, instead of just blindly following an early model.

With regard to the alternative suggestions put forward, I challenge the proposition about monopoly, for if such is in the hands of a group of individuals, the working thereof is far more satisfactory—are not the fittings for the use of ships and boilers virtually controlled that way? Licences to manufacture and deal in wireless apparatus would be absolutely unworkable. It would be a matter of extreme difficulty to draw the line between the man who helps a friend assemble parts the latter has bought, and buying the parts himself to assemble for his friend, because the parts are not so obviously identifiable as those for which excise licences are necessary (tobacco, alcohol, cards, sweetening matter, vinegar). A licence to instal is just workable, because in the majority of cases the outside aerial is a land-mark, and in the few cases where frame aerials or indoor aerials only are used the natural desire of the owner to "show off" gives enough publicity to the installation.

But the flat rate is much too high. The existing total of 18s. is steep enough for a humble crystal set, while the Committee's 20s. for a lordly 7-valver is equally disproportionate. Would they seriously advocate a flat rate of admission to theatres? Some form of *ad valorem* tax is the only just charge, and even the existing royalties are a sort of approximation to this.

My own constructive skeleton proposals are :—

(*a*) Put all wireless parts identifiable as such under the Safeguarding of Industries Act.

(*b*) 1. Keep the existing 10s. B.B.C. licence.

2. A new constructor's licence at 10s., plus, say, 2s. 6d. each for examination and sealing of valve panels to ensure that they do and will comply with the very necessary provisions as to radiation, while allowing different components to be substituted at will.

3. Keep the existing experimental licence, but make the chief condition that it may be obtained one month after approval of a reactive set under 2.

According to these proposals, those who just wish to listen will find license No. 1 the least trouble to get. Those who wish to construct their own sets would not be hampered under No. 2 unless they wish to make something that might cause interference with others, while many harmless experiments on aerials, crystals, coils and simple circuits could be carried out, and lastly, those who really wish to experiment with oscillating valves would not be allowed to start until they had had a little experience and were in possession of a non-interfering installation.—I am, etc.,

A. HINDERLICH.

London.
April 23rd.

To the Editor of THE ELECTRICIAN.

SIR,—There is a delightful air of simplicity in the notes which you publish by Mr. Challis on the B.B.C. "controversy." The principle he urges, apart from side issues, is that British firms should provide broadcasting from which the foreigner is to benefit.

A considerable amount of publicity was given to the B.B.C. negotiations during their progress, and so far as I am aware no offer was then made by Mr. Challis's friends to undertake the risk of financing the stations.

Do readers seriously think that English manufacturers would have diverted capital from manufacturing to the provision of broadcasting if by so doing they only created a market for foreign sets?

Mr. Challis talks of "penalising the importer." This is sheer nonsense. Broadcasting is entirely a new business, and the intention never was that the importer should be concerned in it. If I buy a new car my friend is not penalised if I refrain from asking him to ride in it.

In appearing to fight a monopoly, Mr. Challis adopts a familiar trick of propaganda. But what sort of a monopoly is it I wonder in which any *bona-fide* British manufacturer may join and in which the only restriction on trading is that apparatus be British made?—I am, etc.,

B. MITTEL.

London.
April 24th.

MODERN BOILER HOUSE PRACTICE.

To the Editor of THE ELECTRICIAN.

SIR,—The chief value of Mr. Brownlie's able and forcible article in your issue of March 16th is that it again raises the question of boiler house tests. Present-day conditions in the industrial and financial worlds accentuate the importance of cheap power towards which fuel economy contributes so greatly.

Many of the interesting points which he raises have been the subject of letters from other contributors; but there is one aspect of the case which appears to deserve further comment and to justify this belated letter.

What is the object of boiler tests? I suggest that boiler tests are undertaken for two perfectly distinct purposes: (*a*) acceptance tests, to decide whether the plant shall be taken over from contractors, and (*b*) day-by-day tests, which are undertaken (or supposed to be) by the engineering staff running the plant for their own guidance and satisfaction (or

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otherwise), and the conditions of tests will obviously have to vary as widely as their purposes.

Important monetary consideration, perhaps even legal proceedings, may depend on the issue of acceptance tests, and it is therefore essential, as everyone who has had experience in such matters appreciates, for the condition to be as far as possible free from ambiguity or uncertainty.

The contractor virtually undertakes to supply an equipment which, in its *best* condition—i.e., as he hands it over—will deliver a guaranteed percentage of the heat units in the fuel supplied to the furnaces as heat energy in the resulting steam. It arises from this that the following conditions must apply :—

(*a*) The boiler plant must be in what its *maker* considers its *best* condition.

(*b*) The test shall be of reasonable duration and have a flying start and stop with such specified preliminary running period as the contractor may reasonably require.

(*c*) Auxiliaries which are essential to the performance of the combustion and steam-raising *should* be included. Others *may* be by specification.

The auxiliaries do not appear to present much difficulty. Mechanical draught fans are as much a part of the plant as is the chimney in a natural draught scheme, but conveyor motors simply replace manual labour which is not debited to the boiler in older plants. The stoker motor alone seems to be in a dubious position.

(*d*) It is justifiable to specify that dried fuel shall be used in order that the uncertainty arising from a variable moisture content may be, as far as possible, removed.

The efficiency attained in such tests will obviously be an *optimum* figure, unattainable by the staff in normal running conditions; but if the terms which it involves have been laid down by a code and the particular conditions in the specification, there should be no ambiguity. For the satisfaction of engineers and owners of the plant, a reasonable "deterioration" factor—taking into account the heat cost of such things as the other auxiliaries, and the moisture in the fuel—might be determined.

Day-by-day tests are a totally different matter, as their object is to satisfy (or otherwise) the engineer that he is maintaining his plant in the highest state of efficiency compatible with the cost of cleaning and overhaul.

The conditions must be taken as they happen to be at the time of test, and all auxiliaries must be included, as it is the overall efficiency from the point of coal reception to the stop valve with which the engineer is concerned, and not only the plant represented in Mr. Brownlie's diagram as the material supplied by the contractor.

Regular consumption tests on this basis, together with the ordinary continuous "performance" records, render a fairly complete and intelligent control of the steam generating plant and an analysis of its losses to be made with little expenditure of time and trouble if the work is systematised.

Despite all the attention which has been given to the subject in the past few years, there are still steam-driven generating stations in this country, consuming, on an average, 20 lbs. of coal per B. of T. unit (*vide* Electrical Commissioners' Report for 1922); one almost wonders how they do it and how they continue to exist; but their very existence emphasises the importance of careful scientific running of the boiler house.

I desire strongly to support Mr. Brownlie in calling for a revised code for use in boiler testing. It is not easy to devise a code free from ambiguities and yet doing justice to all types of plant; but, if devised and accepted, it would be most useful in securing uniformity of interpretation of results.

It must also be remembered that boiler testing apparatus is susceptible of a limited degree of accuracy only, so that the evaluation of results to fine limits is not justified, and furthermore, as the writer has many times observed and as is well known, the psychology and ability of the observers, however honest they may be, always affect the results upwards or downwards by an appreciable amount from what is probably the true value.—Yours, etc.,

PERCY M. BAKER.

London, S.W.
April 18th, 1923.

To the Editor of THE ELECTRICIAN.

SIR,—Mr. Brownlie's article and the correspondence on this subject has brought out many details of great technical interest, but I have not noticed any reference to the intended methods of measuring the temperatures at the various stages in the process of burning the coal and transferring the heat to the water in the boiler. We are told, for instance, that the temperature of the gases leaving the air heater is to be 236 deg. F. The apparatus which can be relied upon under the circumstances of practical boiler testing, to give a figure that is, by implication from the figure given, an exact one to the nearest single degree, would represent an advance in thermometry that is at least as epoch making as the boiler performance as a whole.

Do those in charge of this job realise what is involved in a measurement of such exactness, or is it the result of reading an ordinary industrial instrument to the nearest 10 deg., say, 230 deg. F., and then applying a correction, which, by laboratory tests, has been found to be + 6 deg. at 230 deg. ?

I raise this point because there is in the attitude of the average steam engineer towards these temperature measurements, a curious mixture of bland indifference and simple faith. We are told, elsewhere, that "simple faith" is better than "Norman blood," but neither is much help where accurate thermometry is desired under the conditions met in a boiler house.

I dare not trespass on your space much further, but would mention, for instance, that some of the following sources of error are to be looked for and guarded against if accuracy is to be attained, even supposing that the apparatus used is intrinsically of high accuracy. Dry flue gases are not good heat conductors—they will only give up heat to the thermometer or pyrometer at a slow rate, depending on the rate of flow of the gases past the inserted part of the pyrometer. But that heat which is received will be partly conducted away by the protection which encloses the actual sensitive part of the apparatus, for instance, mercury or other expanding material, or the junction of the thermo-couple. If the protection is heavy, the conduction effect may be so large that the sensitive part never reaches the true temperature. Some makes of thermo-couple have the actual junction exposed to the gases, and therefore suffer a relatively small conduction effect.

Another matter is that flue gases, if not smoky, are transparent to radiant heat, so that, quite apart from the conduction effect, the pyrometer will not show the true temperature of the gases unless the surrounding surfaces which can radiate to the pyrometer are at the same temperature as the pyrometer stem itself; if those radiating surfaces are, on the whole, hotter, the pyrometer will read high; alternatively, if such surfaces are the relatively cold walls of a metal flue the reading will tend to be low. Again, if the flow of the gases is rapid there may be large stream-line effects, the gases will not be uniform in temperature, and the reading will then depend on the particular location of the sensitive end of the pyrometer.

In view of the very high efficiency guaranteed, and the difficulty of getting the last one or two per cent., so well emphasised by Mr. Brownlie in his letter in your issue of April 13th, I suggest that the manufacturers will have difficulty in getting the desired performance unless very great thought is given to the temperature measurements, because the problem is one of temperatures and temperature gradients from first to last.—I am, etc.,

CHARLES E. FOSTER.

Letchworth.
April 23rd.

To the Editor of THE ELECTRICIAN.

SIR,—It is quite impossible for me, because of lack of space, to reply to all the points raised, and accordingly I am reluctantly compelled again to select a few only.

I do not quite know what Mr. Selvey means when he writes that "the report (i.e., Boiler Test Code) of the Civil Engineers is, of course, open to revision from time to time." The "Civils Code" is so hopeless that to talk of revising it is simply a waste of time, and the last "revision" of this Code in 1913 left it in just as ridiculous a situation as it was at its commencement in 1902.

Mr. Selvey's idea of using the terms "boiler efficiency" and "boiler house efficiency" does not make the situation any clearer, and the only thing that really matters is "*boiler plant efficiency*"—that is to say, for every 100 units of heat as fuel put into the boiler house, or the closed box containing the whole boiler plant, boilers, superheaters, air heaters, economisers, mechanical stokers or coal pulverising plant, boiler-feed pumps, mechanical draught fans, and every other form of auxiliary used directly or indirectly for steam generation, how many units of heat as steam come out of the top of the

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box, that is to say, are available for useful work? Of course, there is nothing to prevent us, in addition, determining the efficiency of any of the units inside the box, whether it be the boiler or the boiler-feed pump, but these are only subsidiary figures.

Some idea of the complexity of this question of boiler plant testing is given by the following list of points, about which there is at present no clear and definite understanding at all:—

What type of calorimeter is to be used for determining the heat value of the coal, and is this to be tested dry or "as fired"? Is the "higher" or the "lower" value to be used, and, if so, what do both these terms mean exactly? How long is the test to be and what are the methods with regard to fluctuation in the evaporation? At what rating is the boiler to be tested? What are the conditions with regard to scale inside the tubes and soot outside? Is a long test of, say, one week, to be included so as to obtain the night and week-end light loads? Is *all* the auxiliary steam or power to be deducted in calculating the nett working efficiency? How is the coal to be sampled from the point of view of moisture content? What are the regulations as regards size and physical condition of the coal, and how are the calculations for efficiency to be made?

The ordinary contract usually supplied as regards efficiency guarantees is almost meaningless, and obviously in reality worth nothing at all since points such as the above are ignored, and anyone who understands the job could easily get 5 per cent. difference in efficiency, or even over, depending upon how he regarded such questions in carrying out the test. Something will have to be done, as boiler plant efficiencies of 85 per cent. and over are now becoming a commonplace because of the advent of pulverised fuel, and it is stated that over 88 per cent. is to be obtained with the "Lopulco" system at the Cahokia Station, St. Louis.

For the new installation at Vitry it is understood that the "Lopulco" guarantees are 84 per cent. efficiency based on the gross calorific value of the fuel, 12 600 B.Th.U., evaporating a normal duty of 140 500 lb. of water from and at 212 deg. F. per boiler of 16 678 sq. ft. heating surface, but capable of 210 000 lb. evaporation for an overload duty of four hours.

I must confess I do not agree with Mr. Selvey's rather airy method of dismissing the possibilities of inefficiency due to unburnt ash in the fuel, and to the effect of soot and dirt deposits on the outsides of the tubes. All I can say is that as regards unburnt material in ash my experience has been very different to that of Mr. Selvey, and, as stated previously, this difficulty has always been one of the inherent objections to the ordinary simple chain grate stoker. In fact, one of the reasons why such good results are possible with the improved modern travelling grate stoker, the multiple retort stoker, and pulverised fuel is this very point of low combustible content in the ash.

My experience in connection with soot cleaning has evidently also not been the same as Mr. Selvey's, and very few engineers in this country seem to realise the importance of this question. Some very elaborate experiments have been carried out in the United States on the non-conductive properties of a thin layer of soot and dirt, and it was found that a $\frac{1}{8}$th in. layer of soot outside the tubes is equal in non-conductive properties to $\frac{1}{4}$ in. scale inside. Experiments undertaken with a perfectly new boiler showed that during a continuous run of five days and nights the exit gases slowly increased from 550 deg. to 650 deg. F., the temperature of the steam in the superheater dropped 25 to 50 deg. F., the temperature of the feed water in the economiser fell 30 deg. F., and the over-all efficiency was reduced by no less than 5 per cent. It has to be remembered also that in most water-tube boilers about 30 per cent. of the evaporation is carried out in 5 to 10 per cent. of the heating surface, and the effect of soot on the few tubes nearest the fires makes a very serious difference. If, therefore, we can have 5 per cent. difference in efficiency depending on the extent to which the tubes are sooted up, it is obvious that in attempting to attain guarantee figures of 85 per cent. efficiency the most careful and detailed agreement is necessary on this point alone.

Mr. Mitchell's figures are extremely interesting and valuable as showing what can be done under actual practical week-to-week conditions, as apart from purely abnormal tests, but, of course, we have to remember that, unfortunately, Dalmarnock is exceptional, and probably not 5 per cent. of British power stations are being run on such modern lines of scientific control. It is quite likely that at Dalmarnock, if air heating was installed, the genuine efficiency would be in the nature of 85 per cent., or at any rate well over 82½ per cent., but, as already stated, everything depends on the air heater. It is interesting to note that Mr. Mitchell's figures for unburnt fuel in the ash correspond to a loss of 1·92 per cent. of the heat in the original coal, and that on test figures the radiation loss is 3·90 per cent., and I am very dubious of the 1 per cent. mentioned in the case of the 85 per cent. guarantee in spite of the efficient and compact arrangement of the whole installation.

One final point in connection with efficient steam generation is that to obtain the best results no one stereotyped method of coal firing can be adopted, and the most careful consideration is necessary, combined with—if possible—the actual installation on, say, one or two boilers of any system under contemplation, and a series of continuous tests spread over a number of months.—I am, etc.,

D. Brownlie.

London.
April 23rd.

Depreciation and Assessment.

To the Editor of THE ELECTRICIAN.

Sir,—I would be glad to know, through the medium of your paper, the position of electrical companies, in various districts, in respect of depreciation allowance, in computation of assessment for income tax, for meters.

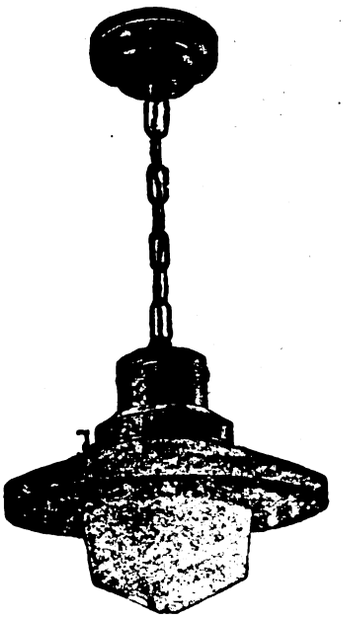
Plant and machinery and electrical instruments are rated at 5 per cent. depreciation; meters not being admitted as subject to any allowance. That meters may be treated under "renewals" does not appear to me to be an equitable arrangement, inasmuch as claims can only be made irregularly and unsatisfactorily. That meters should be treated differently from electrical instruments is rather ambiguous.

Trusting that this letter will interest "Companies" similarly situated.—I am, etc.,

A Company's Secretary.

Some Thoughts on Bowl Fittings.

"Commercial lighting can be expressed in very simple terms—a 10s. bowl fitting!" Thus spoke a contractor who was unwise. He followed up with a statement he thought unanswerable by explaining that 10s. was the highest price that could be allowed per point for the usual type of semi-indirect bowl fitting. He was wrong, and the wise contractor who heard him told him so. There is no need to



A B.T-H. Bowl Fitting.

limit one's vision of commercial lighting to the 10s. fitting. It will undoubtedly "land" some jobs but it will lose many others. A first-class job requires a first-class fitting, and it is for the contractor to explain to the ultimate buyer what the best fitting is.

It is admitted that, taking the whole line of semi-indirect fittings of the open bowl type which are on the market to-day, it is hard to find talking points for some of them, but there are several types of enclosed units available which have many excellent features. These fittings only have to be demonstrated to secure orders.

We illustrate as an example a new fitting by the British Thomson-Houston Co. It is the type of fitting which will secure the business. We shall not describe it in any detail. Folder L.252 deals with it fully, and as the folders are available for overprinting with contractor's name and address, a real contractor to the E.C.A. ideal will see to it that he starts forthwith on a campaign.

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Electromagnetic Motions in Electric Furnaces.*

By CARL HERING.

In a paper on ELECTRODYNAMIC FORCES IN ELECTRIC FURNACES, read before the American Electro-chemical Society in April, 1921, the writer described some recently discovered forces of electromagnetic origin which may be detrimental or useful in types of electric furnaces in which the current passes through the molten material, and in conclusion briefly mentioned a proposed new law to aid one in dealing with these forces.

The purpose of the present paper is to show how this law may be applied in practice to performing useful operations. Formerly only one such force was recognised by physicists, namely, a force exactly perpendicular to the axis of the conductor, which could, therefore, move the conductor only parallel to itself and never in any other direction; but the writer showed, some years ago, that motions in other directions could also be produced.

According to the new law, this very narrow restriction to only one force, due apparently to Maxwell, was entirely unnecessary. If correct, it opens up the door to possible new developments. It seems safe to say that if it were incorrect, it would surely have been pointed out by this time by some one of the many staunch orthodox followers of Maxwell.

An Old Law Re-stated.

This law is merely a restatement in electrical terms of the old, well-known and generally accepted law of nature that such motions will tend to take place as will reduce the potential energy of the system. It states that in a system of electric current-carrying conductors any, and only such, mechanical motions of its conductors will tend to take place as will generate a counter e.m.f. somewhere in the electrical circuits. But whether or not this electrical version is the best one, the general law of nature on which it is based ought to apply to all electromagnetic systems.

Application of the New Law.

The application of this new law may be used to produce electrically some particular motion, as, for instance, for the moving, circulating, pumping, or stirring of liquid masses in electric furnaces; possibly, also, in aqueous electrolytes, though in general these forces, which as a rule increase with the square of the current, become formidable only when the currents are large. Of formulæ for calculating in advance the quantitative value of these forces, little as yet is known; the formula for calculating the pressures produced by the pinch effect is limited to only circular cross sections. In other cases an approximate idea might be obtained by estimating the mechanical power required to be done by such forces, the electrical equivalent of which in watts then is the product of the amperes (in phase) and the counter e.m.f. dividing this by the amperes in the circuit gives the counter e.m.f. required, and of course the direct e.m.f. must be great enough to supply this in addition to that required to overcome the resistance and doing any other work. In a certain furnace in which large quantities of molten brass at rest were continuously being put into rapid motion by such a force, the mechanical power produced was nearly 50 kW (nearly half the power input). In a furnace this is not lost, as it is all converted into heat ultimately. It is generally the power and not the force that one desires to know in advance.

To one who is not an electrical engineer, and who desires to use some of these forces, the crucial clause in this law referring to the generation of a counter e.m.f. may not be sufficiently clear to depend upon in practice. In such cases the following general guides and facts may be of assistance.

General Guides to Phenomena.

All such mechanical forces are due to the magnetic flux; when these forces act to produce motion an equivalent amount of this flux energy or strain must disappear; when the flux produced by a current is thus reduced, the current immediately replaces it, and this generates a counter e.m.f. in the circuit. Theoretically the product of this counter e.m.f. and the current (in phase) must be equal to the mechanical power produced. This assumes that there are no other counter e.m.f's., such as those due to chemical reactions. The forces of the flux act to move the material of the conductor, hence when this is a mobile liquid, or the vapour of an arc, these forces become more evident.

The lines of force by which flux is usually represented always make complete circuits which can never be opened like an electrical circuit. These lines contract or shorten like stretched rubber bands; like lines repel each other, and unlike attract; these forces determine the distribution and relative local densities of the flux.

An e.m.f. is always generated when a conductor moves across a flux or a flux moves across a conductor. A counter e.m.f. is always generated when a liquid conductor is crushed by the pinch effect, or when it is lengthened by the stretch effect, as in both cases new flux is generated. As an illustration of the force which tends to lengthen a conductor, a vertical U-shaped conductor whose ends dip into two mercury cups can be ejected almost violently in this way.

Action of Like Currents.

When two neighbouring conductors carrying like currents are allowed to move toward each other, or away from each other, if the currents are unlike, a counter e.m.f. will be produced. A high flux density near a low one should tend to move the conductors so as to equalize the two densities. A circuit turning a corner should tend to straighten itself. A small conductor connected to a very large one should tend to move away from it.

The tendency of a circuit to lengthen itself as a long compressed helical spring does, may bulge out into a C-shaped path: this is sometimes seen in an electric arc. It even might form a path like the letter S. It has been reported that the rails of a street railway assumed approximately this shape during a large short circuit.

Skin and Hall Effects.

The skin effect, which confines an alternating current more to the outside surface of a large conductor, may add to the motive effect of the flux by changing the current path. The Hall effect, according to which the location of the path of a current may be changed in its conductor by neighbouring magnetic flux, might also be of influence under high current density conditions. The Hall effect moves the current path when the conductor itself cannot move, and might move the conductor if the necessary freedom of motion existed, as in mobile liquid conductors or vapours of an arc.

The position of the solid electrodes entering a molten bath may tend to produce motions in the bath; if the current there turns a corner, the corner effect may become formidable; there is also an abrupt change of flux density at such points. Neighbouring magnets or magnetic bodies may have very decided effects on such motions; thus a bar of iron held beneath an open channel of molten material will very greatly increase the pinch effect; or when held above it a small hill of molten metal will rise under it, being maintained apparently dynamically by a continuous upward flow under the bar. This force both lifts and stirs.

Some Unknown Factors.

There are still numerous unknown factors in this new field. For instance, in the case of two neighbouring baths of molten material separated by a thick wall, through the bottom of which there was an apparently straight hole connecting the two, the pinch effect caused the metal to rise quite high in one bath, i.e. the flow was in one direction. This may have been due to some accidental dissymmetry or to an accidental existing hydrostatic flow before the start, which the pinch effect then kept up and augmented. In another case in which the dissymmetry was intentional, this unidirectional flow was invariably in the same direction. Such conditions might be used as a valveless pump for molten materials.

Pinch Effect Phenomena.

The force of the pinch effect has the peculiar property of tending to move the better conductor to the central axis; thus a copper wire floated on a mercury channel will be sucked down toward the centre quite violently when a sufficiently large current passes. This seems to act to separate good conductors like metals from bad ones like slags; the action is analogous to that in centrifugal separators. Possibly mixtures of metals of different conductivities might be separated in this way.

When there is a strong magnetic field horizontally across a horizontal channel containing the current-carrying liquid conductor, the conductor will tend to move. If it tends to move down, the specific gravity is apparently increased, causing lighter particles to rise; slags, for instance, that carry less current, will become relatively lighter. If the conductor tends to move upward, its effect will be like decreasing the specific gravity. It is believed that the increase could be made many fold, and that the specific gravity of acidulated water has been increased in this way about four times. The effect on different materials depends, of course, on their relative conductivities. A higher resistivity or discontinuous material would be least affected. Metallic aluminium and its chief impurity, its oxide, which have so nearly the same specific gravity, might perhaps be separated by this means. However, the forces in the pinch effect are quite as effective and are far simpler to produce. It has also been proposed to circulate a liquid metal conductor in an electric furnace, by using this force.

* Abstract of a paper presented before the American Electrochemical Society.

Chester Electricity District.

The Town Clerk of CHESTER has received a communication from the Electricity Commissioners stating that they have decided to exclude from the North Wales and Chester electricity district the areas of supply under the Chester Electric Lighting Order, 1890, and the Chester Electricity (Extension) Special Order, 1923. The Chester electricity district will, therefore, consist of the city of Chester and the area included in the Extension Special Order of 1923, which include many parishes in the rural districts of Chester and Tarvin.

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Merchandise to Sell and Profit By.

***In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of* THE ELECTRICIAN.**

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

An Interesting Overload Switch.

We have received from FREDERICK PRATT (who is the sole agent in this country) a price list describing Vanwyck's patent overload switch. The device is of considerable interest because it is, we believe, the only device on the English market that has the particular features which we shall briefly describe. It therefore merits the attention of supply engineers.

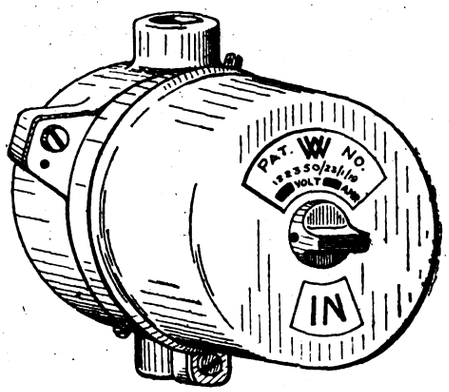


FIG. 1.—OUTSIDE VIEW OF THE VANWYCK OVERLOAD SWITCH.

As a preface to an explanation of the details of the switch it should be mentioned that it has two applications (*a*) as an overload or maximum release switch, and (*b*) as a current limiter. The switch is made in several different types so far as mechanical features are concerned, but space will only permit us to comment on the electrical action.

The switch is somewhat on the lines of the ordinary rotary switch but has many improvements thereon; and in addition, is fitted with a well constructed electro-magnet. In turning the switch to the "on" position a spring is brought under tension and

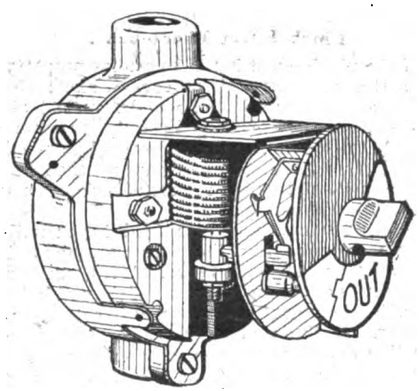
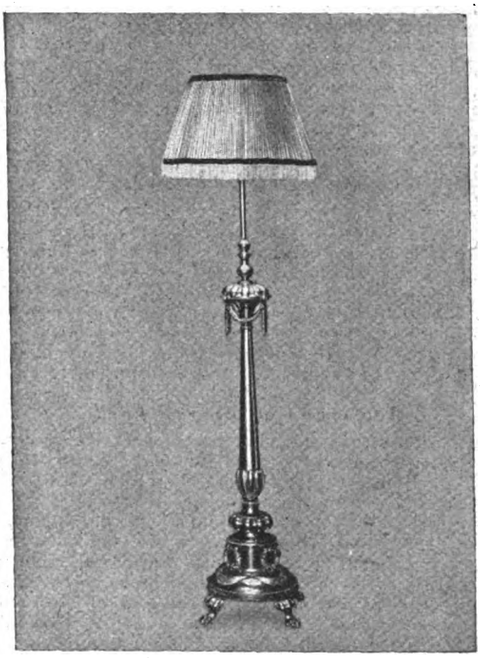


FIG. 2.—THE SWITCH WITH THE COVER REMOVED.

kept so by a pawl. In the event of an overload or short circuit, the electro-magnet operates and the coil core or solenoid trips the pawl, thus bringing the switch immediately to the "off" position. The switch knob having a "loose" coupling cannot be made to bring the switch again to the "on" position until the overload is removed. The adjustment of the tripping gear is effected by a small nut which holds the iron core of coil in position, the core being drawn into the coil through excess of current. Unless otherwise specified, switches are supplied set so as automatically to come "off" at an overload of 50 per cent. above the nominal current. Such an overload, even if carried indefinitely, in no way damages the switch. Fig. 2 shews the switch with the cover removed.

The "Partridge" Duplex Lighting Unit.

The electric light standard is justly a favourite piece of apparatus for the lighting of small rooms, and for supplementing general lighting in larger apartments. It occasionally happens, however, that a more brilliant illumination than that provided by an ordinary floor standard is desirable, and the "Partridge" Duplex Lighting Unit, illustrated herewith, has been designed by Mr. G. W. Partridge, and is marketed by GENERAL ELECTRIC CO. to meet this requirement. This device is equipped with three of four lamps. One, preferably a gasfilled lamp, is arranged within an inverted vitreous enamel conical

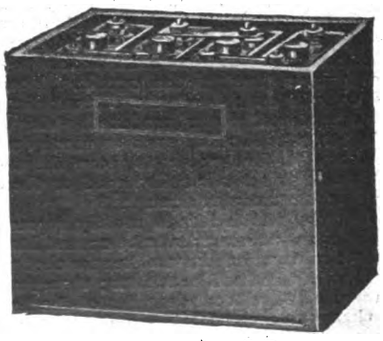


"PARTRIDGE" FLOOR STANDARD, SHOWING INDIRECT LIGHTING EFFECT.

reflector hidden by the silk shade, and thus provides a good totally indirect illumination over a large area. The other two or three lamps are on the under side of the conical shade, and provide the usual local illumination. A two-way switching device is fitted, so that either the indirect or the direct lighting can be employed separately or both can be used together.

A Reliable Wireless Battery.

In few branches of electrical merchandising is the word "service" used in the sense of selling a service instead of selling a cooker, iron or some other named device. The word is, however, much used when talking of accumulators, but unfortunately the wireless boom has revealed the fact that not all the accumulators on the market are service devices. In fact some of them are the very



THE LATEST "NIFE" BATTERY.

antithesis. It behoves all retailers, therefore, to select the make of accumulator they are going to sell with great care and deliberation.

In this connection we can recommend a study of the merits of the "Nife" accumulator manufactured by BATTERIES, LTD. List No. 8 recently published reveals many excellent features of this apparatus, and it will be at once realised how these merits will make pungent selling talk and so increase turnover.

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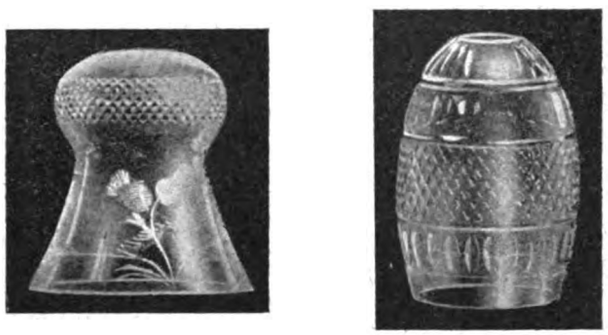
English Crystal Glass Shades.

English crystal glass is world famous and is the finest expression of the glass maker's art. It is the ambition of every housewife to have a fine collection of plain and cut table glass. Why should it not be possible to create a desire for a collection of electric light shades in English crystal glass. To a very large extent the low level of prices to which glass shades have fallen is more the fault of the electrical trade than the domestic buyer. Glass shades are sold, too much on the principle that they have no function other than the very mundane one of being an electric light shade. Salad bowls are

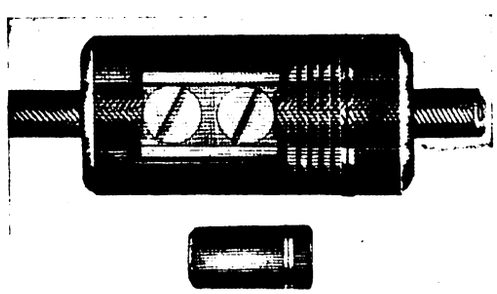


SOME NEW CRYSTAL SHADES.

not only bought for that strictly limited purpose. They are bought for their artistic beauty and their decorative value. So with shades. They can be sold both as shades and as valuable artistic crystal glass for the home. Our argument will only apply if shades on a par with the range listed by the BRITISH THOMSON-HOUSTON CO. are handled. Their range of English crystal shades are very beautiful, and further, the prices are so graded that they include shades from 3s. to 22s. 6d. each. Space will not permit our illustration of the whole range, but the wise retailer will take our advice and see samples of the shades at the many local branches of the B.T.-H. Folder L. 269 can be supplied in quantities overprinted with Mr. "Wiseman's" name and address.

A Labour Saver for Contractors.

We illustrate the "Walger" connector marketed by the EDISWAN ELECTRIC CO. The usefulness of such a device is at once apparent and need not be elaborated. In the catalogue describing the connector the Ediswan Co. pertinently ask "How much money have you spent on solder and tape joints?" The connector is



THE "WALGER" CONNECTOR.

suitable for wires of from No. 14 S.W.G. downwards, and it can be used in any position where it is possible to squeeze in the hand for fixing it. The connector is made in two-way and three-way. Our illustration is of the former and shows a phantom view of the connector, considerably enlarged, in order to make clear the arrangement of terminals. The connector is quite small, being only 1¼ in. long by ⅝ in. diameter.

Prescot Jointing Compounds.

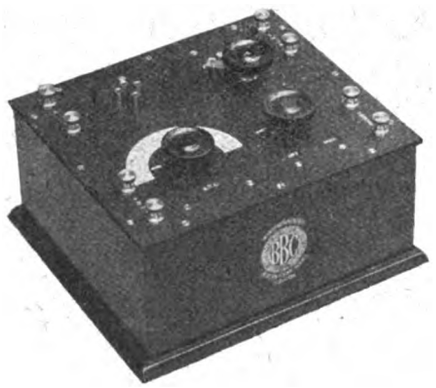
"The success of a modern electrical system depends in no small measure upon the materials employed for filling the joint boxes, joint sleeves and end connections."

The fact that we have culled this statement from the manufacturer's catalogue does not lessen its truth. It will be perhaps argued that Prescot Jointing compounds (or any other compounds for that matter) are not "merchandise to sell and profit by," but most certainly they are one of a multitude of items of raw material which go to make for the most important plank in electrical development to-day—SERVICE. Hence mains engineers must not be behindhand in instructing their purchasing department to buy the best.

Prescot Jointing compounds are made in three grades by BRITISH INSULATED AND HELSBY CABLES, LTD., and we wish we had the space available to render a service to mains engineers by quoting a full specification of each grade. Full information can, however, be secured on application to B.I. & H. for folder No. P177.

"Melbaphones."

Every wireless retailer should have a complete record of manufacturers of this class of apparatus, and a name to be included is AEORADIO, LTD. We have recently had the opportunity of

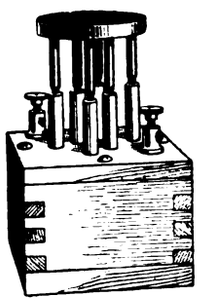


VIEW OF THE "MELBAPHONE."

carefully analysing their most recent price list, which shows an appreciation and knowledge of the needs of the market in the way of popular priced sets. We illustrate a simple one-valve set listed complete with valve at £12.

The "Merican" Atmospherics Absorber.

A new device for the wireless retailer to analyse the possibilities of is the "Merican" atmospherics absorber. It is claimed that the instrument is worked on a new principle of multi-cylinders and



AN ATMOSPHERICS ABSORBER.

static storage plates, with special variable coupling. Each instrument is fitted in polished teak case and is adapatable to any set, either crystal or multivalve. It is manufactured by GARQUARM SPECIALITIES and is marketed at 17s. 6d.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

The National Patent Water Gauge glass illuminator is described in a folder just published by the NATIONAL BOILER AND GENERAL INSURANCE CO.

LEHMANN, ARCHER AND CO. have issued a comprehensive list which will be of interest to those readers of THE ELECTRICIAN whose job it is to buy screwing tackle of every kind.

WATSON AND SONS (Electro-Medical) have sent us a copy of Bulletin No. 52S which they have recently published describing (with prices) the "Canny Ryall" portable diathermy and high frequency apparatus.

We have received from the GENERAL ELECTRIC CO. a copy of leaflet No. BC2940 which, in addition to a description and illustration in colour of the Gecophone two-valve receiving set, contains a selection of unsolicited testimonials from satisfied customers.

We have previously announced the publications of HERBERT MORRIS, LTD. The latest list (Book No. 98) is a mine of information for central station and works engineers and managers who are always seeking the most efficient devices to speed up service and reduce labour charges.

Colliery managers and engineers who scan this column of THE ELECTRICIAN seeking announcements of electrical apparatus that will improve the efficiency of the mines under their control will please note that the BRITISH INSULATED AND HELSBY CABLES have just published a price list No. 491 describing the Helsby magneto mine exploders with shot firing cables and accessories.

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The Electrical Contractors' Dinner.

"Are Wiring Rules Necessary?" asks Mr. Wordingham.

The annual dinner of the Electrical Contractors' Association was held at the Café Monico on Tuesday, Mr. HOWARD MARRYAT, President, being in the chair.

In proposing the toast of the "Allied Associations and Honorary Officials," Mr. C. H. WORDINGHAM said that the progress of the Association was due to its attitude to the industry. They had not used their power to force up prices, but to improve the standard of workmanship, and, as the committee which inquired into profiteering in the cable-making industry showed, buyers were content to pay more for Association products as an insurance against breakdown. He believed in the new scheme for the registration of contractors, and it was gratifying to know that the proposal had met with the support of the E.C.A. The question of wiring rules had agitated the industry for thirty years. It was a subject upon which there were very different views. For instance, the municipal supply engineers supported rules, the supply companies generally opposed them, while some were in favour of minute rules which could certainly not be carried out in practice. The question therefore arose, did the industry want wiring rules? While general specifications were usual, no other section of the industry had rigid rules, which were an attempt by regulation to teach the wiring contractor how to do his work. The Committee were trying to draw up rules which should be equally applicable to a large variety of cases, and he had arrived at the conclusion that they were attempting to achieve an impossible task. He thought it might be better to leave the matter to the Contractors' Association, simply laying down generally the results which ought to be attained. There was no power to enforce wiring rules, and such power was not likely to be granted. The matter must be closely considered, but he was not too hopeful of a solution on the present lines.

The Use of Wiring Rules.

The CHAIRMAN, in his reply, said the effect on the industry if wiring rules were dropped might be serious, as every supply engineer would set up his own set of rules. The registration of contractors was likely to be of lasting benefit to the industry, and he therefore hoped that all sections would support it. The virtue of the scheme was that it threw difficulties in the way of the incompetent, and the Association had no room for the "here to-day and gone to-morrow" type of contractor. Supply engineers should realise that the contractors were their best friends, and should not hesitate to make such concessions as reduced rates for demonstration purposes. No one section was to blame for the present difficulties, for there was a lack of organisation permitting scramble for business which resulted in high selling prices and prevented the inauguration of a stable selling policy. The possibilities of the industry were immense, and the right solution of the problem was to come to an understanding as to how the work could be fairly divided. The Contractors' Association had issued a declaration of trade policy, and he hoped that other Associations would follow suit.

Books Received.

"Four Lectures on Relativity and Space." By C. P. Steinmetz, A.M., Ph.D. (London: McGraw-Hill Publishing Co.) Pp. 126. 10s. net.

"The Dynamo. Its Theory, Design and Manufacture." By C. C. Hawkins. Vol II. Sixth Edition. (London: Sir Isaac Pitman). Pp. xvi+322. 15s. net.

"American Institute of Electrical Engineers. Year Book 1923." (New York: American Institute of Electrical Engineers, 33, West Thirty-Ninth Street.)

"Special Steels. Chiefly Founded on the Researches of Sir Robert Hadfield, Bart." By T. H. Burnham. (London: Sir Isaac Pitman). Pp. 193. 5s. net.

"Electrical Oscillations on Lines." By Louis Cohen, Ph.D. Reprinted from the Journal of the Franklin Institute, January, 1923. (J. B. Lippincott Co.)

"The Heaviside Expansion Theorem." By Louis Cohen, Ph.D. Reprinted from the Journal of the Franklin Institute, December, 1923. (J. B. Lippincott Co.)

"Applications of Heaviside Expansion Theorem" By Louis Cohen, Ph.D. Reprinted from the Journal of the Franklin Institute, March, 1923. (J. B. Lippincott Co.)

"Alternating Current Cable Telegraphy." By Louis Cohen, Ph.D. Reprinted from the Journal of the Franklin Institute, February, 1923. (J. B. Lippincott Co.)

"Science Abstracts." Sections A. and B., March 25th, 1923. Vol. 26, part 3. Issued by the Institution of Electrical Engineers, London. (London: E. and F. N. Spon). 3s. per section.

"A Handbook of Testing. Vol. II.: The Theory of Prime Movers." By C. A. Middleton Smith, M.Sc., and A. G. Warren, B.Sc. (London: Constable and Co.) Pp. 299. 22s. 6d. net.

"Données Numériques d'Electricité Magnétisme et Electrochimie." Extrait du Vol. IV. Published by the Comité International. (Secrétaire Général du Comité, 9, Rue de Bagneux, Paris.) 13s.

"Monographs on Mineral Resources, with Special Reference to the British Empire. Mercury Ores." By Edward Halse, A.R.S.M. Prepared under the direction of the Mineral Resources Committee of the Imperial Institute. (London: John Murray.) Pp. 101. 5s. net.

An All-Electric Ship.

"La Playa" Launched by Cammell Laird & Co.

The "La Playa," an electrically-propelled vessel built to the order of the United Fruit Co. (U.S.A.), was launched by Cammell Laird and Co., at Birkenhead, last week. The vessel is the first of three "all electric" ships ordered by the Fruit Co. The propelling machinery consists of four units, each comprising a four-cylinder Cammel-Laird-Fullagar Diesel engine running at 250 revs. per min directly coupled to a generator supplying continuous current for propulsion purposes at 220 V.

Each engine also drives an auxiliary generator arranged in tandem with the main generator. These auxiliary generators supply power for the ship's auxiliaries and the large refrigeration plant, and also for the excitation of the main generators and the propelling motors The main generators are electrically coupled in series, and although all four are in operation at full power, three, two, or only one set may be used at reduced powers if desired, the combined voltages being 880, 660, 440, or 220, depending on the number of sets on the propelling circuits. The adoption of four main generating sets ensures very economical operation at reduced powers.

The main propelling motor is installed in a separate motor room right aft in the ship, thereby eliminating the usual shaft tunnel and resulting in a clear after hold for the carriage of fruit. The motor has two armatures rotating in separate magnet frames, but mounted on a common shaft.

The whole of the electrical equipment has been designed to meet shipboard conditions in a hot climate, and ventilating fans are provided for drawing air through the motor in order to keep the windings cool when in tropical service. The control arrangements are such that the main propelling circuits are never interrupted, and all regulation and reversing is carried out by varying the field circuits only. Provision is, however, made for isolating any of the generating units as may be desired.

A very extensive equipment of electrically driven auxiliary machinery is provided, including the large refrigerating plant for the fruit spaces, while a small oil-fired boiler is fitted for heating purposes and for supplying steam to the fruit elevators on shore. The main electrical propelling equipment, including generators, control gear and propelling motor is being supplied by the British Thomson-Houston Co.

Rural Telephones.

P.M.G.'s Plans for Extending the Service.

The POSTMASTER-GENERAL last week made the striking statement that of the 13 478 post offices in the country only 4 965 were equipped with public telephone call offices. Of the remaining 8 513 offices, 2 307 were telegraph offices without telephone call-offices, and the balance of 6 206 had neither telephone nor call-office facilities. The figures were given to a deputation from the Central Chamber of Agriculture, which laid before the P.M.G. suggestions made by the Parcel Post and Rural Telephone Committee appointed by the Chamber.

Sir DOUGLAS NEWTON, a member of the deputation, expressed the view that, so far as possible, every post office which was now equipped with a telephone or telegraph wire should be made a public telephone office; and that pressure should be put on railway companies to instal the telephone at all stations at which they were asked to do so. He urged that advantage should be taken of new developments to give priority in regard to party lines; and that the differential treatment between London and the provinces, in respect of mileage, should be looked into. They would also like a better system of weather reports. They wanted a morning as well as an evening report.

Mr. ALFRED AMOS, as a practical farmer, testified to the advantages of the telephone in rural parishes, and asked for a call office in every village post office.

Increased Call-box Facilities.

The POSTMASTER-GENERAL, in the course of his reply, expressed his intention of making a personal appeal to the railway companies as a whole, to see whether they could not allow call boxes to be put up in all their stations throughout the country. The Post Office was everywhere extending the facilities for call boxes.

He then gave the figures quoted above, but added that the Post Office last year provided 538 call offices in rural districts, and he saw no reason why they should not add a similar number this year. In regard to the party wire system, he agreed that it was not altogether satisfactory, and they were experimenting in the hope of being able to arrange in a year or two for rural party lines to have some means of ensuring privacy.

In the matter of weather reports, he was pleased to announce that a new system would come into force on May 1st, when they hoped to send out the best weather reports they could get from the Air Ministry just before 5 o'clock in the afternoon, right up to the end of the harvest.

Sir DOUGLAS NEWTON: I meant a wireless weather report.

The POSTMASTER-GENERAL replied that that was a matter for the broadcasting companies, and he had no jurisdiction over what they liked to broadcast, except that it must be to his reasonable satisfaction.

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Private Bills.

New Capital for the Metropolitan Railway.

The METROPOLITAN RAILWAY (VARIOUS POWERS) BILL was ordered to be reported for third reading by the Unopposed Committee of the House of Commons on April 19th. In the Bill power is sought to raise additional capital to the extent of £2 000 000. Under the Company's Acts of 1911, 1912 and 1913, several important works were authorised, which, owing to the war, were not carried out. Since the date of the original estimates the costs of materials and labour have increased enormously, with the result that the capital which the company was authorised to raise under the Acts mentioned is insufficient. The excess cost over the original estimates in respect of these works is £383 000, and the works include the construction of a new station at Mount Pleasant, a subway at Edgware Road, extensions, etc. In addition, the company has had to expend money out of the general capital on new rolling stock, the extension of the generating station, new switchgear, etc., whilst there is in progress the electrification of the line from Harrow to Rickmansworth, the widening of the line, and the enlargement of the station at Wembley. The total cost of all the items is £1 979 000.

Stoke-on-Trent Corporation and the North Staffs Railway.

The STOKE-ON-TRENT CORPORATION BILL, which, among other things, seeks power to consolidate various Acts and Orders with respect to the electricity undertaking of the Stoke-on-Trent Corporation, and includes provisions as to the laying of mains, etc., came before a Committee of the House of Lords, presided over by the Marquis of Bristol, on April 19th. In addition to the repeal of provisions of these Acts and Orders, it seeks to incorporate the provisions of the Electric Lighting (Clauses) Act, 1899, in the Bill.

The North Staffordshire Railway Co., who are owners of and are responsible for the maintenance and rebuilding of several bridges over their railways and canals within the Borough, petitioned against the Bill, stating that, by reason of the changes in the character of the traffic using such bridges and the increase in the volume of that traffic, and of subsidences in the district, the provisions contained in the Electric Lighting (Clauses) Act, 1899, are not now sufficient for the protection of the Company. They asked for the insertion in the Bill of clauses providing for the removal and replacing by the Corporation of electric mains, pipes and works when any of the bridges had to be rebuilt, widened or altered. It was pointed out by the petitioners that under the provisions contained in the Bill the Corporation would be enabled to lay down electric wires, cables, mains or pipes crossing under the railways and canals of the company, which wires, etc. would interfere with the future widening or improvement of the railways or the widening or deepening of the canals. Therefore, provisions should be inserted requiring the Corporation to repay to the company any extra expenses to which they may be put in carrying out such works by reason of the existence of any electric wire, cable, main or pipe of the Corporation.

The Committee allowed the insertion of a clause embodying the provisions asked for by the Company.

Extension of Nottingham's Supply Area.

The Local Legislation Committee of the House of Commons, presided over by Sir Thomas Robinson, considered, on April 18th, that part of the NOTTINGHAM CORPORATION BILL, which seeks power to extend the area of supply of electricity.

Mr. W. E. TYLDESLEY JONES, for the promoters, explained that the present area of supply is the city area, and it was proposed to extend the area to include the urban districts of West Bridgford, Carlton, Arnold and Hucknall, and certain parishes in the rural districts of Basford and Bingham. All opposition to the proposed extension had been removed, with the exception of that of the urban district of West Bridgford. This, said counsel, was a residential district, except for laundries, to which the Corporation was anxious to supply power. No electricity whatever was now supplied in the district. The Derbyshire and Nottinghamshire Power Co. had powers to supply electricity in the districts which it was proposed should be added to the area of the Corporation for electrical supply, but for certain purposes only—i.e., for power and to authorised undertakers; but they were not supplying anything at all there, and had agreed not to exercise their powers.

No Extension of the City Boundry.

Counsel then referred to the proposed scheme put before the Electricity Commissioners to set up an advisory committee for the East Midlands Electricity District, which would make recommendations with regard to the extensions of generating stations, etc. Amongst other things, it is provided that within two years from the approval of the scheme the Advisory Committee had to submit to the Commissioners a proposal for providing the supply of electrical energy in areas in the districts in which there was no supply and in which there was a prospect of being able to give a remunerative supply. The West Bridgford Council said that the present Bill was inconsistent with the proposal to establish the Advisory Committee; but counsel submitted that it was not. Objection was also raised to the procedure adopted by the Corporation in the present Bill, which was not in accordance with the procedure adopted by Parliament—i.e., that application should be made for a Special Order under Section 26 of the Electricity (Supply) Act, 1919. Counsel submitted, however, that there was nothing to prevent the Corporation applying to Parliament for powers to extend their area of supply when they were before Parliament for other purposes. The petition of the West Bridgford Council stated that if the powers asked for in the Bill were obtained, the Corporation would obtain a vast extension of their limits of supply without being under any obligation which would enable would-be consumers to enforce a supply on reasonable terms. Counsel intimated that the Corporation had no wish to use their powers of supply in the future in order to help them in a future application for the extension of the city boundary. They proposed to supply in the new area at the same price as in Nottingham. The petitioners asked that no powers should be conferred upon the Corporation which would prevent the petitioners from undertaking the distribution of energy within their own district. Counsel said that the idea of setting up a generating station for the supply of West Bridgford was hopeless, and the Electricity Commissioners would never authorise it. So far as a bulk supply was concerned, Nottingham Corporation had not powers to give such a supply, and powers were not asked for in the Bill. A bulk supply from the Derbyshire and Notts Power Co. would be very expensive and the only alternative was for Nottingham to supply the area, as it would other areas which were in agreement.

West Bridgford and a Bulk Supply.

Mr. WROTTESLEY (counsel for the West Bridgford Council) agreed that the Council could not generate electricity, but only wanted to distribute it; they were perfectly content to take a supply in bulk from Nottingham if they obtained powers to distribute and if Nottingham were the proper source; and he asked whether Nottingham would be prepared to supply the Council on terms to be agreed with the Commissioners. He thought there would be difficulty in getting the necessary powers from the Commissioners.

Mr. JOHN H. RIDER (Preece, Cardew and Rider) said he was the engineer responsible for the erection of the Nottingham Corporation's new station at North Wilford. He estimated that in 1927 the Corporation would be able to charge an average price of 4¾d. per kWh for lighting, 1d. per kWh for power, and 1¼d. per kWh for traction. As to West Bridgford, whether the Corporation or the West Bridgford Council distributed the energy there, the result on the power station would be the same, but it would be better for the West Bridgford consumers to take the energy from the distribution mains of the Corporation than of their own Council. No addition would be required to the distribution and office staff of the Corporation, whereas if the West Bridgford Council carried it out, they would have to start *de novo* and appoint their own distribution and office staff, the cost of which would have to be added to the cost of distribution as by the Corporation. There would have to be a substation with a transformer.

Mr. WROTTESLEY, addressing the Committee, asked them to say that the West Bridgford U.D.C. should be left in the same position as they would have been but for this Bill—namely, entitled to go to the Electricity Commissioners and get powers not to generate electricity, for there was no question of that, but to distribute it. He agreed with the policy of generating electricity on a large scale, and was willing, if the Committee thought fit, to take a supply in bulk from Nottingham.

Mr. TYLDESLEY JONES, summing up for the Corporation, said that the whole ground of the opposition was the fear of a possible application by the Corporation in the future to absorb West Bridgford. Certain matters, however, including electricity supply, had now been withdrawn from the arena of local government politics. He asked the Committee to say that the West Bridgford Council, who were beginners without experience, should not distribute, with possibly disastrous results to the ratepayers and consumers.

After deliberating in private, the Committee declared the preample relating to Part VI of the Bill (Electricity) proved.

Legal Intelligence.

Designing an Electrical Thermometer.

In the Mayor's and City of London Court recently, W. F. Stanley and Co., scientific instrument manufacturers, 286, High Holborn, sued Mr. C. E. Parr, electrical engineer, 81, Bishopsgate, for £63 10s. for breach of contract in connection with the design and manufacture of an electrical thermometer.

The plaintiffs' case was that they were employed to make an electrical thermometer from designs left them by Mr. Coltman, who said it was his invention, but he had sold the rights to Capt. Parr. Having, it was alleged, been given a free hand, plaintiffs succeeded in making a satisfactory model. When the account was sent Capt. Parr stated that the amount surprised him. It was out of proportion to the results, and he had been told that it would not amount to more than £10. Plaintiffs stated that their charges for experimental work in making the machine were fair and reasonable. For the defence, it was said that no satisfactory model had been made, and that the price charged was excessive. The judge said that the work done was in accordance with Mr. Coltman's instructions, and must be paid for by the defendant. Using the best judgment he could, he considered that a fair figure was £52 10s., for which he would give judgment for plaintiffs with costs.

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Electrical Trades' Benevolent Institution.

Annual General Meeting.

Mr. FRANK GILL (President of the Institution of Electrical Engineers) presided at the annual meeting of the Electrical Trades' Benevolent Institution on Monday.

The report of the Committee, after dealing with the accounts, states that it is essential that the invested funds shall be greatly increased, because pensions can only be paid out of dividends and interest on investments. The local advisory committees have greatly assisted the work of the Institution, and have caused it to be better known amongst those able to contribute. There has been a temporary falling off in the number of collectors, and the amount collected by them, and the Committee hope that the heads of firms will appoint collectors and encourage members of their staffs to become members of the Institution. The annual festival dinner resulted in a collection of £842 9s. 9d.

The I.E.E. and the Benevolent Institution.

The CHAIRMAN, in moving the adoption of the report and accounts, said the Institution of Electrical Engineers felt great pleasure in being able to help the Benevolent Institution. That Institution and the Benevolent Fund of the I.E.E. did not cover exactly the same spheres, and the latter benefited by the co-operation of the Benevolent Institution. The income was £2 356, compared with £2 907 in the previous year, of which £933 consisted of dividends, against £715; and that £933, of course, took into account the item of £141 income tax recoverable. On the other side, printing, office expenses, etc., were reduced from £281 to £244. Balance of revenue carried to appropriation account was £2 112. Cases in which grants were made were 33, against 11 in the previous year, the total of the amounts given being increased in about the same proportion, £332, compared with £112. The amount carried to the balance sheet was £1 780, compared with £2 504 last year. War Stock was bought to the amount of £2 335, and there was an additional £1 315 of War Stock which was negotiated for during the year but the purchase of which was not completed until January 4th. The total sum invested was now over £20 000. The question of how that fund compared with other similar institutions might be worth referring to. Taking a fund which was over half a century old, they found that its outgoings had recently exceeded their income. Many people had realised that the number of applicants for help was likely to increase as the Institution got older, and it had been necessary therefore to build up the capital stock and not be content with receiving as much money as they paid out.

Appealing to Small Firms.

Mr. J. Y. FLETCHER seconded the motion, and said they did not get enough of the rank and file to join. Large firms who supported that Institution had pension and superannuation funds of their own, but small firms, who had not had time to build up such funds, were the ones they wanted to assist. He would like to see a very large number of small donations.

The report and accounts having been adopted, Mr. W. B. Esson, Mr. J. Y. Fletcher, Mr. R. B. Mitchell, Sir Ernest Spencer and Sir George Sutton were re-elected members of the Committee (Mr. E. Garcke, Mr. C. E. Hunter and Mr. G. C. Law not seeking re-election), and Mr. J. Snow Huddleston, Mr. E. A. Gatehouse, Mr. R. Robson and Mr. A. G. Blake were added to the Committee.

Price, Waterhouse and Co. were reappointed as honorary auditors and thanked for their assistance. Votes of thanks were also accorded the honorary solicitors (Messrs. Sugden and Hextall), the hon. secretary (Mr. F. B. O. Hawes), the chairman (Mr. Frank Gill) and the Institution of Electrical Engineers for allowing the meeting to be held in that room.

N.A.S.E. Prize Competition.

Preliminary notice appeared in our issue of April 6th concerning the prizes offered by the NATIONAL ASSOCIATION OF SUPERVISING ELECTRICIANS for educational papers by members. The full conditions are as follows:—

1. All entries and papers, addressed to the General Secretary, must be received at the head office not later than Monday, April 30th.
2. Subjects of papers must refer to the electrical industry and/or the Association.
3. All papers will be typed out by the head office and each paper given a number.
4. The typed copies will be read at the meeting on May 8th next, by selected members of the Board of Control or others, so that the identity of the writers will not be known.
5. Those present at the meeting on May 8th will vote by putting a cross opposite the numbers of the papers which they think best.
6. Papers sent in will be kept in the possession of the general secretary, and the names of the writers will not be known until after the ballot decision has been declared.
7. A signed declaration that the paper is the unaided work of the competitor must accompany each paper.

It has been decided to call the shield presented by the President for the best paper, "The W. E. Highfield Shield," in recognition of Mr. Highfield's interest in the work of the Association.

Mersey and West Lancs Electricity District.

Wirral Peninsula Secures a Separate Board.

The Electricity Commissioners have issued an order constituting the MERSEY AND WEST LANCASHIRE ELECTRICITY DISTRICT. This establishes and incorporates the Mersey and West Lancashire Joint Electricity Authority and the Wirral Electricity Joint Board. The Commissioners will hold a local enquiry into the scheme on May 15th at the Town Hall, Liverpool, and representations or objections in regard to it must be submitted to the secretary to the Commissioners not later than May 5th.

The formal part of the order follows the usual lines, and the schedule constitutes the district in two parts on the same lines as was laid down by the Commissioners after the inquiry held in January, 1921. The main part of the area includes the boroughs of Bootle, Liverpool, St. Helens, Southport and Widnes and considerable portions of the Counties of Chester and Lancaster, while the Wirral area includes the boroughs of Birkenhead and Wallsey and that part of the county of Chester which is usually known as the Wirral Peninsula.

Constitution of the Joint Authority.

The usual provisions are made for the establishment of a Joint Authority for the main portion of the area and for a Joint Board for the Wirral area. The Joint Authority will consist of twenty-five members, eleven of whom will be appointed by local authority undertakers, four by company undertakers, four by local authorities other than undertakers, one by the Mersey Docks and Harbour Board, one by each of the groups of railway companies operating in the district, two by large consumers and one by the Wirral Joint Board. The basis of voting powers for the undertakers will be one with an additional vote for each 100 000 kWh sold per annum above the first 100 000 kWh sold. The members representing local authorities other than undertakers will have one vote with an additional vote for every complete 5 000 inhabitants in the district, provided that where any part of the district of such authority is within the area of supply of an authorised distributor, the number of inhabitants in such district shall for the purpose of arriving at the number of additional votes, be deemed to be double the actual number. Members representing large consumers shall be elected by agreement, or by ballot, and shall have one vote, with an additional vote for every complete 50 000 kWh of electricity consumed per annum. A large consumer is defined to be a company or person other than those already entitled to elect or appoint to the Joint Authority with a consumption of electricity exceeding 100 000 kWh a year. The Joint Authority may enter into agreements to receive bulk supplies from owners of generating stations in lieu of acquiring them.

Constitution of the Joint Board.

The Wirral Joint Board will consist of three members appointed by the Corporation of Birkenhead, three members by the Corporation of Wallasey, and one member by each of the Urban District Councils of Bebbington and Bromborough, Hoylake and West Kirby, Neston and Parkgate and Wirral. The Joint Board will have power to supply electricity within its own area of supply except where part of that area of supply is already being supplied by an authorised distributor. In this case the consent of that authorised distributor will be necessary before a supply is given.

The Technical Schemes.

The technical scheme for the main area lays down that the standard type of three-phase alternating current at 50 cycles per second is to be used with a main transmission pressure of 33 000 V, and secondary transmission pressures of 11 000 and 6 600 V. The Lister Drive station of the Liverpool Corporation, the stations belonging to the Corporations of Southport, St. Helens and Warrington and the Weston Point station of the Mersey Power Co., will be utilised and extended to an amount to be hereafter determined. The stations at Birkdale, Bootle, Hightown, Liverpool (Waterloo), Northwich, Ormskirk and Prescot, will be utilised without further extensions. Transmission lines will be laid to connect Lister Drive and Bootle, Lister Drive and Waterloo, Prescot and St. Helens, St. Helens and Warrington and St. Helens and Weston Point.

In the Wirral area the Wallasey station will be utilised and extended as may be necessary, and the three stations at Birkenhead, with the stations at Caldey Manor and Hoylake, will be utilised without further extension. Transmission lines will be erected between Wallasey and Birkenhead, and Wallasey, Hoylake and West Kirby. The Lister Drive station at Liverpool and the stations at St. Helens and Warrington will be transferred to the Joint Authority, as will the transmission lines between Lister Drive and Prescot. The Wallasey station will be transferred to the Wirral Joint Board, as will the transmission lines between Wallasey and Birkenhead.

Electrical Progress Illustrated.

The current issue of "The English Electric Journal" is an example of the introduction of modern daily Press methods into house journalism. It consists almost entirely of photographs of machinery or apparatus put into operation by the company during 1922, and is arranged in four sections: electric traction, prime movers, generation and distribution, electricity in industry and aircraft. The result is excellent.

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Parliamentary Intelligence.

Jordan Hydro-Electric Scheme Contracts.

Mr. BECKER, on Monday, asked the Under-Secretary of State for the Colonies whether, having regard to the amount that this country had contributed towards the safety and welfare of Palestine, any special agreement had been come to whereby all contracts for the electrical and mechanical equipment necessary for developing the potential electric power from the Jordan would be placed in this country, to the exclusion of all others?

Mr. ORMSBY-GORE: The answer is in the negative.

Mr. BECKER: If the loan is floated successfully in this country, is there a possibility of a clause being inserted that we shall have the benefit of the contracts from this undertaking?

Mr. ORMSBY-GORE: No. This has reference to a private enterprise in Palestine, and, by the terms of the Mandate, equal opportunities for trade and commerce to all nations who are members of the League is essential.

Mr. BECKER: Is a Mandate which has been passed by the General Assembly of the League of Nations, but has not been approved by this House, operative?

Mr. ORMSBY-GORE: Is it not a question of approval by this House, as I explained in answer to a previous question. We have given the undertaking that we shall administer Palestine in accordance with the terms of the Mandate.

British Empire Exhibition.

Viscount SANDON asked the Parliamentary Secretary to the Overseas Trade Department, on Monday, if any units of the British Empire, including those not under Colonial Office control, were still proposing not to be represented at the coming British Empire Exhibition; if so, which they were; and whether he was making any effort to get this state of affairs remedied?

Lieut.-Col. BUCKLEY: The only units of the Empire who have declared their intention not to be represented at the British Empire Exhibition are the Irish Free State, British North Borneo, Gibraltar and Ascension. All the other units of the Empire either have definitely decided to participate, or still have the question under consideration. I understand that the decision of the Irish Free State is due to the urgent need for economy and to the difficulty of making adequate preparations in existing conditions. British North Borneo has also had to decline on the ground of the expenditure involved. In the circumstances, I do not think that any action on my part is required.

Questions asked in Parliament with regard to wireless matters will be found under "Wireless News," on page 469.

Institution Notes.

The Annual Convention of the NATIONAL ELECTRIC LIGHT ASSOCIATION is to be held in New York from June 4th to 8th.

On April 19th Mr. Norman Macbeth read a Paper before the NEW YORK SECTION of the ILLUMINATING ENGINEERING SOCIETY on "The Application of Artificial Daylight to the Hospital Operating Room."

A general meeting of the RÖNTGEN SOCIETY will be held on May 1st, at the Institution of Electrical Engineers, Savoy Place, London, W.C.2, at 8.15 p.m. The Sixth Silvanus Thompson Memorial Lecture will be delivered by Dr. C. Thurston Holland on "X-Rays and Diagnosis."

The sessional examinations of the INSTITUTE OF COST AND WORKS ACCOUNTANTS will be held on June 4th–6th at London, Manchester, Birmingham, Sheffield, Glasgow, and Bristol. Application should be made on form "C," obtainable from the secretary, 38, Grosvenor Gardens, London, S.W.1, at least 21 days before the date of the examination.

The fifteenth annual congress of the TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION will be held at Swansea on June 21st and 22nd, with headquarters at the Hotel Metropole. The following Papers will be read: "Tramways; and Some of To-day's Problems," by Mr. A. W. A. Chivers, and "Tramway Rolling Stock," by Mr. W. E. Ireland.

Mr. David Martin has been elected chairman of the West of Scotland branch of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS. Mr. David McQueen and Mr. D. Landale Frew have been elected vice-chairmen, Mr. D. S. Baddeley hon. secretary, and Mr. C.E. Hart hon. treasurer. At the annual meeting in Glasgow last week, Mr. James S. Calder read a Paper on "The Low Resistance Earth-plate."

The INSTITUTION OF WELDING ENGINEERS is now enrolling members. The first president is Sir W. Peter Rylands, and the vice-presidents are Sir Robert A. Hadfield, Prof. F. C. Thompson, and Mr. Charles Bingham. For a limited period no entrance fees are payable, and membership is open to working welders as well as proprietors of large concerns. The temporary offices are at 30, Red Lion Square, London, W.C.1.

At Blackpool County Court last week Douglas Cooke, taxicab driver, was awarded £53 2s. 6d. in respect of personal injuries and damage to his cab in consequence of it coming into contact with a LIVE TRAMWAY WIRE, which had fallen down. Blackpool Corporation were the defendants in the case.

Electrical Imports and Exports.

Figures for March and for the Quarter.

IMPORTS.—The following are official values of electrical machinery, apparatus and material imported into this country (*a*) during March, 1923, and (*b*) the aggregate figures from January 1st to March 31st, with increase or decrease compared with corresponding periods of 1922:—

Electrical machinery, (*a*) £82 037 (decrease £54 474), (*b*) £277 099 (decrease £104 446); telegraph and telephone cables, other than submarine, (*a*) £4 677 (decrease £141), (*b*) £19 561 (increase £8 646); telegraph and telephone apparatus, (*a*) £33 079 (increase £19 616), (*b*) £86 808 (increase £47 521); other electrical wires and cables, rubber insulated, (*a*) £7 318 (decrease £3 870), (*b*) £37 495 (increase £18 134); with other insulations, (*a*) £9 473 (increase £1 204), (*b*) £24 215 (increase £7 706); carbons, (*a*) £2 368 (decrease £2 789), (*b*) £11 146 (increase £856); glow lamps, (*a*) £13 643 (increase £2 096), (*b*) £63 592 (increase £10 882); arc lamps and electric searchlights, (*a*) £492 (increase £442), (*b*) £766 (increase £716); parts of arc lamps and searchlights (other than carbons), (*a*) £1 105 (increase £74), (*b*) £4 374 (increase £2 205); batteries, (*a*) £1 1591 (increase £2 921), (*b*) £33 171 (increase £17 486); electrical instruments (commercial and scientific) and electricity meters, (*a*) £7 462 (increase £3 788), (*b*) £28 290 (increase £13 973); switchboards, (*a*) £40 (decrease £374), (*b*) £120 (decrease £1 259); other electrical goods and apparatus, (*a*) £52 368 (increase £5 139), (*b*) £168 672 (increase £34 682). Total of electrical machinery, apparatus and material (other than insulated wire), (*a*) £225 653 (decrease £26 368), (*b*) £755 309 (increase £161 548).

EXPORTS.—The exports of electrical machinery, apparatus and material (*a*) during March, 1923, and (*b*) from January 1st to March 31st, with increase or decrease compared with corresponding periods of 1922, were as follows:—

Electrical machinery (*a*) £296 524 (decrease £188 591), (*b*) £1 015 716 (decrease £420 678); including railway and tramway motors, (*a*) £21 663 (decrease £891), (*b*) £66 654 (increase £13 044); other generators and motors, (*a*) £140 922 (decrease £136 529), (*b*) £526 949 (decrease £272 241); and other electrical machinery, (*a*) £133 939 (decrease £51 171), (*b*) £422 113 (decrease £161 481): telegraph and telephone cables, submarine, (*a*) £47 281 (increase £29 508), (*b*) £149 676 (increase £69 425); other than submarine (*a*) £98 476 (increase £68 637), (*b*) £220 385 (increase £74 649); telegraph and telephone apparatus, (*a*) £116 557 (decrease £63 709), (*b*) £462 213 (decrease £78 856); other electrical wires and cables, rubber insulated (*a*) £82 964 (increase £34 437), (*b*) £296 526 (increase £150 953); with other insulations, (*a*) £92 610 (decrease £5 900), (*b*) £269 398 (decrease £68 069); carbons, (*a*) £7 183 (increase £3 681); (*b*) £17 342 (increase £4 734); glow lamps, (*a*) £20 795 (decrease £17 554), (*b*) £76 033 (decrease £20 909); arc lamps and searchlights, (*a*) £943 (decrease £810), (*b*) £1 689 (decrease £1 156); parts of arc lamps and searchlights (other than carbons) (*a*) £162 (decrease £449), (*b*) £246 (decrease £1 146); batteries, (*a*) £48 934 (increase £1 414), (*b*) £143 457 (increase £37 544); electrical instruments (commercial and scientific) and electricity meters, (*a*) £21 324 (decrease £12 423), (*b*) £78 317 (decrease £27 624); switchboards, (*a*) £3 934 (decrease £11 567), (*b*) £26 980 (decrease £98 885); other electrical goods and apparatus, (*a*) £111 770 (decrease £1 803), (*b*) £324 051 (decrease £12 798). Total of electrical machinery, material and apparatus other than insulated wire, (*a*) £949 457 (decrease £165 129) (*b*) £3 082 029 (decrease £394 808).

Light Without Heat.

Claims Largely Exaggerated.

We understand from our Paris correspondent that the statements recently made in the daily Press of this country that M. Risier, of Strasbourg, had discovered artificial light without heat are largely exaggerated. The principle of M. Risier's patent is a Gusseler tube filled with a special gas. This tube is supplied with energy from the public system through a Ruhmkorff apparatus, which raises it to a high voltage frequency, and luminescence is produced which is intensified by the paint by which the tube is covered. But this luminescence has next to no illuminating power, and the system can only be used for decorative purposes. The inventor hopes, however, to improve the chemical effects of the rays sufficiently to affect photographic plates and to make the equipment utilisable in cinema studios instead of the arcs now employed.

The Bann Hydro-Electric Scheme.

Notice is given of intention to apply to the Parliament of Northern Ireland in the present Session for leave to bring in a Bill to incorporate a company for the purpose of generating and supplying electricity, using water or other power for the generation of electricity, and supplying electricity in the whole of the county of Antrim (except the city and borough of Belfast and the Island of Rathlin), the urban district of Coleraine and Portstewart, and the rural district of Coleraine. This is known as the NORTH ULSTER ELECTRICITY SUPPLY (No. 1) SCHEME, and the proposed works include the construction of dams across the River Bann—(1) on the site of the existing Toome weir, and (2) above the existing Carnroe weir.

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Foreign Notes.

EUROPE.

Marking of Electric Dry Batteries for Denmark.

H.M. Commercial Secretary at Copenhagen reports that a Notice of the Danish Ministry of Commerce, dated March 24th, provides that electric dry batteries (elements) may be sold retail in Denmark only when marked with the name of the country of production, or, in the case of Danish articles, with the town of production. When several objects make up the complete article, the Ministry of Commerce will decide which place of manufacture is to be regarded as the place of production.

Summer Time in France.

The Paris correspondent of " The Times " states that the question of the adoption of summer time in France does not seem to be definitely closed. M. Poincaré has written a letter to the Association of Users of Electric Energy in France in which he states that summer time has not been abandoned by the Government, and that if the question can again be raised when Parliament reassembles, the Minister for Public Works will give it his support. If summer time cannot be voted for this year, the measures will be brought forward again next year.

German Electro-Technical Industry.

The Commercial Secretary at Berlin (Mr. J. W. F. Thelwall), surveying the position of trade and industry in Germany during March based on the reports of Prussian Chambers of Commerce for that month, reports that the electro-technical industry suffered from lack of orders. An ample demand for electrical plant of all kinds existed, but there was nowhere any possibility of raising the requisite capital. Foreign trade was very depressed. Sales of electric lamps again declined considerably. In general, employment in the electro-technical industry is assured for months ahead; restriction of work in individual cases was, however, not to be avoided. Prices have somewhat decreased.

Ghent Electrical Exhibition.

The secretary of the Ghent Electrical Exhibition, which is to be held from June 16th to September 16th, has expressed his willingness to place space to the extent of 1 350 sq. m., at a cost of 40 000 francs, at the disposal of a suitable British association or syndicate which would be prepared to stage a combined British exhibit. It is stated that the Oostflanders County Council has adopted a scheme for the distribution of electrical power throughout the Communes of the district which will greatly increase the use of electrically driven machinery, and will give a great impulse to " l'industrie à domicile," viz., the use of electrically driven machinery, chiefly for weaving, in the homes of the workpeople. British manufacturers of wireless sets and parts will also, it is stated, find a considerable market in Belgium owing to the enthusiasm with which the Belgian public is taking up the installation of wireless. It is understood that the French Comité des Expositions is organising a collective exhibit.

LATIN-AMERICA.

Two Company Results.

The net revenue of the River Plate Electricity Co. for 1922 was £60 066. The dividend on the ordinary stock is at the same rate as last year, namely, 7 per cent., £18 000 being placed to general reserve and £9 680 carried forward.

An interim dividend has been declared on the ordinary shares of the Montevideo Telephone Co. for the half-year ended January 31st, at the rate of 4 per cent. per annum, less tax. A year ago a dividend at the rate of 6 per cent. per annum was declared.

U.S.A.

Big Californian Hydro-Electric Schemes.

It is stated that the construction of the second of a chain of power houses which will ultimately develop over 600 000 H.P. from the waters of the Pitt River in Northern California, is about to be embarked upon. The plant, which will have a capacity of three 27 000 kVA and involve the expenditure of approximately 17 000 000 dollars, will be completed by 1925. The installation will involve the construction of a diversion dam 125 ft. high at a point 2½ miles below Pecks Bridge. From this point a tunnel approximately 22 000 ft. in length, having a capacity of 3 000 cub. ft. per sec., will carry the water to a point above the site of the power house. In connection with the announcement relative to this latest step in hydro-electric development, it is stated that the service is growing at a rate of 20 000 to 25 000 kW a year of peak load.

A New 600 000 Dollar Electrical Company.

Particulars of Albert and J. M. Anderson Manufacturing Co. were filed in London on April 17th, 1923, pursuant to Section 274 of the Companies (Consolidation) Act. The capital is 600 000 dollars in 100 dollar shares. The company was incorporated in Massachusetts, U.S.A., on December 22nd, 1922, to manufacture and deal in electrical motors, dynamos and other electrical machinery etc. The British address is 12, Moor Lane, London, E.C., where S. C. Hackney is authorised to accept service of process and notices on behalf of the company. The directors are: J. M. Anderson, Brooklin; A. E. Anderson, Milton; M. Anderson and A. B. Anderson, Boston; and A. Anderson, Newton Highlands, all in Massachusetts, U.S.A. The file number is 2 205F.

Imperial Notes.

AUSTRALASIA.

Loan for New Zealand Electric Schemes.

The ratepayers of the district have approved a proposal to borrow £200 000 for the Hutt Valley (N.Z.) Electric Power Board's scheme of electricity supply. A bulk supply up to 2 000 kVA is to be taken from the Mangahao system.

Brisbane Electric Light Finance.

The directors of the City Electric Light Co., Brisbane, evidently believe that the profits earned by the company in any year should be utilised in paying dividends for that year, subsequent years being left to look after themselves. In the accounts for 1922, the sum brought forward from the previous year amounts to only £109 10s. 3d., and this is added to the profit for 1922, £90 877 6s. 5d., making an available total of £90 986 16s. 8d. Out of this year's profits the directors paid an interim dividend with dividend duty in September last, amounting to £41 258 2s., and, at the annual meeting on March 14th, they recommended further dividends of 3 per cent. on the 6 per cent. preference shares, 3½ per cent. on the 7 per cent. shares, and 5 per cent. on the ordinary shares, in proportion to the amount paid thereon, free of State Tax. The payment of the recommended dividend, together with the dividend duty and an allowance for Federal Tax, absorbed £49 639 10s. 3d., leaving a balance of £89 4s. 5d. to be carried forward.

CANADA.

A New Form of Earthing Plate.

A form of earthing plate which has been proved to be very very satisfactory is described as follows in the " Bulletin " of the Hydro-Electric Commission of Ontario. It is rolled from a sheet of No. 20 or No. 22 galvanised pure wrought iron as an 8 in. diameter cylinder 30 in. long. A No. 6 insulated copper wire is rolled into contact with an edge of the cylinder and solder run into the joint, which is then painted with asphaltum to prevent chemical action. This earthing cylinder has a useful contact area of at least 5 sq. ft. without including the full inner surface. It is set by boring an 8 in. diameter hole to a depth of 7 ft. or 8 ft. with the same tool as used in setting anchors and dropped to the bottom with the ground wire attached. The cylinder is then expanded into contact with the wall of the hole by ramming the interior full of earth. This earth is at least as easily placed as the driven pipe, costs approximately one-half as much, and, considering the depth at which it is placed, has five times the effective area of a 6 ft. length of 1 in. pipe.

INDIA.

Madras Electric Tramways Dividend.

The gross profit of the Madras Electric Tramways (1904), Ltd., for 1922 was £31 606. After debiting interest and office expenses, providing for debenture stock sinking fund, and transferring £10 000 to depreciation account, there remains £11 110, plus £6 436 brought forward, making £17 546. The directors recommend a dividend on the ordinary shares of 7s. per cent. for the year, free of tax, carrying forward £7 538.

Calcutta Electric Supply Corporation Result.

At the general meeting of the Calcutta Electric Supply Corporation, on April 30th, the directors will recommend a final dividend on the ordinary shares, for the half-year ending December 31st last, at the rate of 6 per cent. actual. This will make 10 per cent for the year, and the directors are further recommending a bonus of 1 per cent. Relief will be given in respect of Indian taxation. The net revenue of the Corporation for 1922 was £285 681, plus £43 229 brought in. Depreciation and renewals fund absorbs £68 149, and reserve for taxation £7 523. The directors also recommend writing off the cost of the debenture issue, £6 267, and of the share issue, £9 375, transferring £8 000 to reserve, and carrying forward £34 439.

Textile Mill Output.

The Probable Influence of Good Artificial Lighting.

In a report on " Variations in Efficiency in Cotton Weaving " which has recently been issued by H.M. Stationery Office, it is stated that though a certain amount of work was done on the extent to which output in textile factories was affected by the lighting of the sheds, no very concrete results emerged owing, apparently, to the difficulty of instituting comparisons between sheds whose lighting arrangements were materially different from each other. In one shed as good results were obtained with artificial as with daylight, while in other sheds daylight work was more efficient than that with artificial light. Though there seems no question that good lighting is accompanied by better output than bad, and that glare and shadows tend to increase the time taken in attending to stoppages, no exact figures can be given to represent the relation of output to this factor.

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Electricity Supply.

Extensions and Developments.

YORK City Council has appointed separate Electricity and Tramways Committees.

LEEDS Corporation is to open an electricity showroom at the works in Whitehall Road.

Mains extensions have been authorised by HACKNEY (London) Electricity Committee at a cost of £364.

TORQUAY Town Council has received from the Commissioners sanction to a loan of £3 500 for electricity purposes.

COVENTRY Electricity Committee has received the City Council's sanction for the provision of additional plant at the Sandy Lane generating station at a cost of £29 842.

EDINBURGH Electricity Sub-Committee recommends that the formal opening ceremony in connection with the new Portobello power station should take place in July.

PRESTON Electricity Committee recommends the erection of transformer sub-stations at the Dock and Ribbleton and the laying of mains at an estimated cost of £19 300.

KEIGHLEY Electricity Committee recommends that application should be made for sanction to borrow £40 000 to meet expenditure already incurred and estimated for the next two years.

RADCLIFFE Electricity Committee has instructed the engineer to prepare a specification for the installation of a 1 000 kW rotary converting plant and necessary switchgear to replace the present generating plant.

SOUTHEND-ON-SEA Town Council has received sanction to a loan of £35 000 for the purchase of three Diesel engines from Mr. R. J. Wright, of Gillingham, with the necessary accessories, etc., and to a loan of £15 779, balance of capital expenditure in respect of the provision of Diesel engines at the main station, and the Leigh and Thorpe Bay sub-stations, and for the erection of a condenser, etc.

A special sub-committee has been appointed by PONTYPRIDD Electricity and Tramways Committee to consider three schemes put forward by the engineer for improvements at the generating station. The first two, which allow for the installation of new plant on an extensive scale, are estimated to involve an expenditure of £33 743 and £21 820 respectively, whilst the third, which is put forward as an alternative to putting down additional plant, is estimated at £6 000.

Alterations in Charges, Proposed and Actual.

BARNES (London) District Council has reduced the lighting charge from 5d. to 4½d. per kWh.

GRIMSBY Electricity Committee recommends a reduction in the flat rate tariff for shop and house lighting from 1½d. to 1¼d. per kWh.

At the annual meeting of the NEWMARKET Electric Light Co., the chairman intimated that as from the beginning of the present quarter the lighting charge would be reduced from 11d. to 10½d. per kWh.

Speaking at the annual meeting of the West London and Provincial Electric Supply Co., Mr. Harry Kahn said that the CHISWICK Electricity Supply Corporation would make a reduction in its charges as soon as circumstances permitted.

Edmundsons Electricity Corporation intimate price reductions in their various undertakings as follows:—WEYBRIDGE, 11d. per kWh for the first 50 kWh per quarter, with a reduction of ½d. for each next 50 kWh, down to 9d. per kWh for all over 200; TWICKENHAM, a similar tariff for lighting, with reductions for heating and power; MELTON MOWBRAY, 10d. per kWh for the first 100 kWh per quarter, and 9½d. per kWh for all beyond.

BURNLEY Electricity Committee proposes all round reductions in charges from the current quarter. A reduction of 0.2d. per kWh, according to scale, for power will make the new charges range from 2.57d. to 1.42d.; for traction the cost per kWh is reduced from 1.8d. to 1.65d.; for heating and domestic purposes, 2.4d. to 2d.; for lighting, 5.75d. to 5.25d.; for lighting and cinemas in daytime, 4.75d. to 4d.; and for public lamps, 3.75d. to 3d.

Tapping New Areas.

GREENOCK Corporation has been invited to state its terms for giving a bulk supply to Paisley.

ABERGELE Urban District Council is considering the question of obtaining a supply of electricity for public and private lighting purposes.

WELLS City Council has agreed to light the streets with electricity, and has accepted a contract with Sanders, Kennedy and Co. for three years.

OKEHAMPTON Town Council is, it is stated, to resume negotiations with Mr. G. K. Blatchford for the purchase of his electric light undertaking.

WALTON-LE-DALE Council has been informed that Preston Corporation will furnish a supply of electricity on the completion of Preston and Blackburn mains.

Residents in SEAHOUSES (Durham) and district have appointed a committee to consider the formation of a private company for lighting Seahouses and North Sunderland by electricity.

HARWICH Town Council proposes to take a bulk supply from the London and North-Eastern Railway Co., and is applying to the Commissioners for sanction to a loan of £23 299 for carrying the scheme into effect.

STIRLING Town Council has consented to the Scottish Central Electric Power Co. laying a main through the borough, in order to supply electricity to Bridge of Allan. The conditions include one for a connection with the transmission line with a view to furnishing a bulk supply of electricity up to 100 kW to the Corporation. The Council has applied for a loan of £2 300 for extending the mains in Riverside ward.

Barford Electric Supply Co. has informed STRATFORD-ON-AVON Rural Council that they are applying to the Electricity Commissioners for an order authorising them to supply electricity in the villages of Wellesbourne, Charlecote, Alveston and Tiddington by means of overhead cables. The company propose to instal additional plant at the mill at Barford. The Council has referred the matter to the Highways Committee for consideration.

Inquiries and Orders.

The Minister of Transport proposes to confirm the ELGIN Electricity Special Order, 1923, made by the Electricity Commissioners for the supply of electricity in the city and burgh of Elgin by the Elgin Electric Supply Co. Any objections must be sent to the Secretary, Ministry of Transport, Whitehall, London, by May 12th.

GOUROCK Town Council is promoting an Electricity Order with a view to securing powers to obtain a supply of electricity from Greenock. At a meeting of Greenock Corporation the Town Clerk reported that he had lodged a petition against the Gourock Electricity Order in respect that the agreement between Gourock Town Council and Greenock Corporation had not been mentioned in the Order, and also that the maximum prices proposed to be charged to Gourock consumers were lower than those which Greenock Corporation were entitled to charge under the Act of 1909.

Col. E. T. Ekin, Chief Engineering Inspector to the Electricity Commissioners, conducted an inquiry lasting five hours at HORWICH into the competing applications of Horwich District Council and Lancashire Electric Power Co. for a special Order authorising the supply and distribution of electricity within the district. South-East Lancashire Electricity Board recommended an Order should be granted to Horwich Council. Mr. C. Henderson, for the Power Co., said the Lancashire Electric Co. linked town to town, and on them depended the development of the area. As Bolton supplied trams, etc., he suggested they now wanted to supply electricity, and possibly swallow up the whole until Horwich eventually became a part of Bolton. The Power Co. were prepared to carry out a scheme in Horwich without a penny cost to the ratepayers. They would compete for a supply to power users, even though they did not get the order. It was stated by the Council that the Power Co. refused to give the Council a quotation in November, and they applied to Bolton Corporation.

Personal Items.

Mr. HARRY PARSONS, managing director of the Parsons Motor Co., has been elected chairman of the Southampton Harbour Board.

We learn that Dr. EDWARD P. HYDE, who organised the Nela Research Laboratories in 1908, and who has for some years been director of research of the National Lamp Works of the General Electric Co. (U.S.A.), has tendered his resignation.

Southampton Electricity Committee has placed on record its opinion that the best thanks of the Council are due to the Borough electrical engineer, Mr. W. G. TURNER, for the ability shown by him in securing the supply of electricity to the Southampton docks.

Mr. WM. KIRKHAM is resigning his position as manager of the Manchester branch of Siemens Bros. and Co. and the Siemens and English Electric Lamp Co., having accepted the post of branch manager in Manchester for G. D. Peters and Co., and Walker Vehicles, Ltd.

Mr. G. W. HOLFORD, who, as already announced, is resigning from the position of general manager to the Salford tramways undertaking, is to be paid £300 as a retaining fee, in case his advice may be needed in connection with any scheme affecting the department. The Tramways Committee has deferred consideration of the appointment of his successor.

Speaking at a students' exhibition and reunion in the Royal Technical College, Glasgow, on Saturday, the vice-chairman, Mr. James Mackenzie, referred to the impending retirement of Prof. MAGNUS MACLEAN, whom they were, he said, very sorry to lose. They had had a little anxiety regarding the filling of his position, but they believed they had got a worthy successor from South Kensington in the person of Prof. PARKER SMITH.

OBITUARY.—The secretary of the B.E.S.A. informs us that Dr. S. S. WHEELER, of the Crocker Wheeler Co., has just died suddenly of heart attack. He was one of the American delegates to the Geneva meetings of the International Electrotechnical Commission.

WILL.—The late Sir JOHN GAVEY, consulting engineer to the G.P.O., who died on January 1st, left £9 318 (net personalty £9 026).

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Tenders Invited.

UNITED KINGDOM.

CARDIFF CORPORATION.—Overhead equipment for tramway extension through Duke Street, from Queen Street to Castle Street. Particulars from the General Manager.

HARROGATE CORPORATION, April 30th.—H.t. or e.h.t. switchboard, for single phase and consisting of eight panels. Specification from the Borough Electrical Engineer.

KEIGHLEY CORPORATION, April 30th.—Supply and erection of poles for 500 yards of h.t. overhead line. Specification from the Borough Electrical Engineer.

SOUTHAMPTON CORPORATION, April 30th.—(1) Extra high pressure cables, and (2) extra high pressure switchgear. Specifications from the Borough Electrical Engineer..

DOUGLAS (ISLE OF MAN) CORPORATION, May 1st.—Lighting equipment for H. B. Noble Public Baths. Specification from the Borough Surveyor.

GLASGOW CORPORATION, May 1st.—Two 30-inch hydro extractors, with electric motors for the laundry department of the Belvidere Hospital. Tenders to the Town Clerk.

GLASGOW CORPORATION, May 3rd.—One year's supply of electrical fittings and accessories, lamp pillars, etc. Specifications from the Lighting Department, 20, Trongate, Glasgow.

MANCHESTER CORPORATION, May 4th.—Low pressure pipework, etc. (spec. B. 41), and low pressure valves (spec. B. 42), for Barton power station. Specifications from Mr. F. E. Hughes, Town Hall, Manchester.

SALFORD CORPORATION, May 7th.—Twelve covers for tramcars. Particulars from the Manager, Tramways Department, 32, Blackfriars Street, Salford.

ILFORD URBAN DISTRICT COUNCIL, May 8th.—500 kW converting plant (schedule G). Specification from Mr. A. H. Shaw, Electricity Works, Ilford.

GREAT WESTERN RAILWAY COMPANY, May 14th.—Six months' supply of stores, including telegraph instruments (item 18), insulators, etc. (19), electric wires and cables (20), telegraph ironwork and tools (21), telegraph drysalteries (22), lamps and fittings (23), and electric lamps (24). Specifications from the Stores Superintendent, Swindon.

POOLE CORPORATION, May 28th.—Electrical installation at Corfe Mullen waterworks pumping station. Specification, etc., may be seen at the office of the Borough Waterworks Engineer, Poole, or the office of Mr. A. P. I. Cotterell, 17, Old Queen Street, Westminster, London, S.W.1.

BRADFORD CORPORATION, June 7th.—One 15 000/20 000 kW three phase turbo-generator, etc. (contract R.218), without condensing plant, which will be the subject of a separate contract. Specification, forms of tender, etc., from Mr. Thomas Roles, city electrical engineer and manager, Electricity Offices, 45 to 53, Sunbridge Road, Bradford.

AUSTRALIA.

COMMONWEALTH OF AUSTRALIA, May 11th.—Cable terminal boxes (schedule Q.576). May 16th.—Four sections trunk-line switchboard (Q.568). June 5th.—Testing instruments (V.120). June 12th.—Motor generators (V.119). June 21st.—Twisted pair wire (N.S.W.8) and switchboard cable (N.S.W.3). Particulars from the Supply Officer, Australia House, Strand, London, W.C.2.

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, June 12th.*—Power plant (schedule No. 19).

POSTMASTER-GENERAL'S DEPARTMENT, SYDNEY, June 21st.*—Switchboard and multiple twin underground cable (schedule N.S.W. 3), and telephone switchboard wire (schedule N.S.W. 8).

IRELAND.

DUBLIN CORPORATION, April 30th.—Magazine flame arc lamps. Specification from the City Electrical Engineer, Fleet Street,

BELFAST CORPORATION, May 7th.—One 1 000 kW rotary converter, with transformer, and l.t., a.c. switchgear (spec. W.10). and one 1 500 kW rotary converter, with transformer and l.t., a.c. switchgear (spec. W.11). Specifications from the City Electrical Engineer and Manager, East Bridge Street, Belfast.

ST. JOHNSTON (LONDONDERRY) PRESBYTERIAN CHURCH, June 1st.—Installation of electric lighting plant. Particulars from the Rev. D. Watson, The Manse, St. Johnston.

NEW ZEALAND.

PUBLIC WORKS DEPARTMENT, WELLINGTON, June 26th.*—Switchgear for Waikato power house.

SOUTH AFRICA.

RAND WATER BOARD, JOHANNESBURG, May 14th.*—1 800 h.t. pin-type porcelain or glass insulators and 27 sets of shackles, suitable for 20 000 V-line (contract 243, section A); also 774 mild steel cross-arms (contract 243, section B) for the Zwartkopjes-Zuwurbekom transmission line.

SIAM.

EXECUTIVE BOARD, MINISTRY OF MARINE, DHONBURI, May 15th.*—Naval stores, including insulated wire.

SWEDEN.

NORRKOPING HARBOUR BOARD, May 5th.*—Electric cranes.

URUGUAY.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO.*—42 000 metal filament lamps.

* Particulars from the Department of Overseas Trade.

Tenders Accepted.

The tender of Collier Bros. for four miles of round copper trolley wire, at £460, has been accepted by BRADFORD CORPORATION.

BATTERSEA (LONDON) BOROUGH COUNCIL are recommended to accept the tender of the Park Royal Engineering Co. for switchgear at £645.

A. Reyrolle and Co. have secured the contract for the main switchboard for the County of London Electric Supply Co.'s new BARKING POWER STATION.

SHEFFIELD CORPORATION have accepted the tenders of Vickers, Ltd., for 500 tramcar tyres, £2 17s. 6d. each, and B. A. Evans, Ltd., for an electric ticket lift, £392.

Amongst the tenders accepted by ELLAND URBAN DISTRICT COUNCIL in connection with alterations to sewage works is that of the Pulsometer Engineering Co. for mechanical and electrical engineers' work.

Marryatt and Place have the contracts for the plant used for charging the electric locomotives used in connection with the Euston-Angel and Hendon-Edgware extensions of the LONDON ELECTRIC RAILWAYS.

LOWESTOFT CORPORATION have accepted the tender of British Insulated and Helsby Cables for three feeder pillars, £140, and are recommended to accept that of Callender's Cable and Construction Co. for cables, £1 983 7s. 6d.

Yarrow and Co. have secured the contract for boilers required in connection with the extension of LONDONDERRY CORPORATION'S power station. The company have also contracts for boilers for Brighton and for the Barking power station.

The METROPOLITAN ASYLUMS BOARD are recommended to accept the tender of Newton and Wright (lowest tender) for X-ray equipment for the Goldie Leigh Homes, at £191 15s. 9d. Three tenders were received, the highest being £208 3s. 5d.

HACKNEY (London) Council have accepted the following tenders: Bruce Peebles and Co., 1 500 kW La Cour converter, £5 615; Johnson and Phillips, switchgear for two 1 500 kW rotary converters and extra high pressure and low pressure feeders, £4 263.

The tenders of Bruce Peebles and Co. for a 200 kW motor converter at £1 520, and W. T. Henley's Telegraph Works Co. for 2 000 yards of e.h.t. and 900 yards of l.t. feeder cable at £2 126 8s. 8d., have been accepted by KING'S LYNN CORPORATION.

It is expected that the second of the new 12 500 kW generators for BELFAST CORPORATION'S old power station will be ready for next winter's load. The cost of this set will be £60 783, and the generator is being made by the Metropolitan-Vickers Electrical Co.

The Electricity Committee recommend PRESTON CORPORATION to accept the tender of the English Electric Co. for rotary converters, switchgear, etc., for sub-stations at the Dock and Ribbleton at £6 953 10s., and that of British Insulated and Helsby Cables for supply and laying of mains at £7 338.

CALCUTTA CORPORATION received eight tenders for six motor-driven treble plunger type geared pumps, with two spare pumping sets varying from R.22 300 to R.59 624, and we learn from the "Contract Journal" that the tender of the General Electric Co. R.22 442 (about £1 500) is recommended for acceptance.

The following tenders have been accepted by CARDIFF CORPORATION:—Ferguson, Pailin, Ltd., e.h.t. switchgear, £1 081; British Insulated and Helsby Cables, 10 500 yards 0.25 sq. in. e.h.t. cable, £8 295, and one year's supply of cable, £7 916; Rees Roturbo Mfg. Co., pump, £398; E. Green and Son, two economisers, £3 236.

GLASGOW CORPORATION are recommended to accept the tender of the Cargo Fleet Iron Co. (the lowest tender received) for 5 000 tons of tramway rails, at £11 per ton. The American and Dutch offers received being higher than that of the Cargo Fleet Co. it is probable that no question will arise as to sending the contract abroad.

The statement, on p. 436 of our last issue, that the tender of the Metropolitan-Vickers Electrical Co. had been accepted for a 15 000 kW turbo-alternator for the Lots Road power station of the Underground Electric Railways Co. of London was inaccurate. The whole contract was secured by C. A. Parsons and Co., and the alternator portion sub-let to the Metropolitan-Vickers Co.

STEPNEY (LONDON) BOROUGH COUNCIL have accepted the following tenders:—Foster Bros. (lowest tender) for steel separators, steam piping, etc., for the Limehouse generating station, £1 147 (four tenders were received, the highest being £1 430); Caird and Rayner, cast iron strainer boxes for turbine at Limehouse station, £137 10s. (four tenders received, varying from £120 to £150)., Caird and Rayner are already making similar boxes for the Council.

Orders for travelling grate stokers have recently been received by the UNDERFEED STOKER COMPANY from the County of London Electric Supply Co. (10 stokers for the Barking station), Salford Corporation (9 stokers), Newport and St. Helen's Corporations, the Folkestone and the Londonderry Electricity Companies, and the Home-Grown Sugar Company, Newark (2 each), Brunner, Mond and Co. (6), Hendon Paper Co. (6), and Samba-Mura (Japan) Power Plant (4). Underfeed stokers have been ordered for Swansea Electricity Dept. (2), Shanghai Water Works (4), the Royal Steam Packet Co., Holland (4), and the Distillers Co., Carsebridge (12). Other orders include an ash conveyor for the Hendon Paper Co. and furnace arches for the Hull, Eastbourne, Hammersmith, Brighton and St. Helens Electricity Departments and the Primrose Colliery.

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Electric Traction.

Tramway Extensions and Developments.

The extension of the SHEFFIELD tramway system at Fulwood was commenced on Monday. It is hoped that the work will be completed in eight or nine weeks.

The DUBLIN United Tramway Co. are substituting cars with covered top decks for the open variety on certain routes. It is hoped that in due course a full service of these cars will be run on all lines.

LEICESTER Tramways Committee is recommending the City Council to sanction the expenditure of £20 000 for doubling the present single track in East Park Road, and of £5 800 for similar work in Queen's Road.

In connection with the reconstruction of the plant at the Holborn and Streatham substations on the LONDON County Council's tramway system, it has now been decided to provide new l.t. cable, etc., at an estimated cost of £2 000.

Prior to formulating a scheme for the utilisation, at an estimated outlay of £300 000, of the Edge Lane Hall estate as a tramway depot for storage and repairs, the LIVERPOOL Tramways Committee has sent a deputation to London, Birmingham, Glasgow, Leeds, and York, to study existing depots.

Work was begun this week at BIRMINGHAM on a new length (about four miles) of electric tramways from Selly Oak to Northfield, Longbridge, and the Lickey Hills, one of Birmingham's new recreative places. The double track is on the sleeper principle. The service should be in operation in August.

HULL Tramways Committee has decided to have a medical examination of all candidates for employment in their traffic department. The drivers at present on the cars are also to be medically examined as to a liability to sudden collapse while driving, and also as to their eyesight for long distance.

CARDIFF Tramways Committee has adopted a recommendation of the general manager to apply to the Council for permission to borrow £43 350 for the purchase of another 25 covered-in cars. It was necessary, stated the general manager, to purchase new rolling stock, and this car would meet the requirements of the system.

Fares, Receipts and Passengers.

A big increase was reported in the PLYMOUTH tramway receipts for the three weeks ending March 31st. The report showed that the number of passengers was 1 763 833, against 1 269 329 for the corresponding period last year. Receipts amounted to £11 231, an increase of £3 201.

LLANDUDNO Council has been informed by the Llandudno and Colwyn Bay Electric Railway that no fare reduction is possible owing to the present heavy cost of track repairs. A special meeting of the Council is to be held at an early date to consider the railway's request to be allowed to run Sunday cars.

At a meeting of the WORCESTER Watch Committee, on Friday last, it was reported that the Worcester Tramway Co. had succeeded in its application to maintain fares at 1½d. over the city routes, and Alderman Cook remarked that the position of the company was now made secure for a year. He did not consider that the city was being fairly treated, and he thought that having regard to the feeling of the citizens the committee should consider whether it was not possible to establish a service to compete with the company. He suggested that the Town Clerk should advise them as to their power. It was agreed to discuss the matter at another meeting.

Non-Unionist Question at Cardiff.

CARDIFF Tramways Committee has received a letter from Mr. G. J. Ball, secretary of the Cardiff branch of the Transport and General Workers' Union, stating that the members had passed a resolution on the 15th inst. that they would discontinue working with non-Unionists employed on the tramways after June 2nd next, and forwarded a list of names of 90 men who were non-members. It was decided to hold a special meeting of the committee to discuss what action the committee should take when a report was submitted from the National Industrial Council.

Sequel to Hull Purchase of Belgian Rails.

The purchase of 2 000 tons of tramway rails from a Belgian firm by the Hull Corporation Tramways Committee, which recently attracted considerable attention, has had an unexpected sequel. The Committee has received a letter from the secretary of the Unemployment Grants Committee intimating that if the Corporation adhere to their proposal to purchase materials abroad for the present scheme, the Committee will be unable to approve the scheme for the purpose of a grant.

The Town Clerk replied that the Corporation were not aware, when coming to a decision with regard to the purchase of tramway materials, that they would be disqualified from participating in any assistance from the Unemployment Grants Committee in the event of their purchasing from abroad, and that this was not a condition laid down by the Unemployment Grants Committee.

The Committee has resolved to make another appeal to the Department, and, failing satisfaction, to refer to the local members of Parliament.

Wireless News.

P.M.G. Appoints Committee of Inquiry.

The state of affairs referred to in the daily Press indiscriminately as the broadcasting "wrangle," the wireless "muddle" or the B.B.C. "scandal," has culminated in the appointment by the POSTMASTER-GENERAL of a committee to consider the whole question in the widest terms. The chairman of the committee is Major General Sir Frederick Sykes, and the other members are Major the Hon. J. J. Astor; Mr. F. J. Brown, (Assistant-Secretary, General Post Office); Sir Henry Bunbury (Comptroller and Accountant-General, General Post Office); Viscount Burnham; Mr. W. H. Eccles (President, Radio Society of Great Britain); Sir Henry Norman; Mr. J. C. W. Reith, (general manager, British Broadcasting Co.); Field-Marshal Sir William Robertson; Mr. Charles Trevelyan.

The terms of reference are to consider:—(a) Broadcasting in all its aspects; (b) the contracts and licences which have been or may be granted; (c) the action which should be taken upon the determination of the existing licence of the Broadcasting Co.; (d) uses to which broadcasting may be put; (e) the restrictions which may need to be placed upon its use or development. The address of the Committee will be the General Post Office, London, E.C.

Questions in the House.

Prior to his statement on Tuesday concerning the appointment of the Committee, the POSTMASTER-GENERAL was subjected to a good deal of questioning on the various aspects of the present broadcasting arrangements. Asked by Captain WEDGWOOD BENN whether it was proposed to continue the prohibition of the import of wireless apparatus, Sir WILLIAM JOYNSON-HICKS replied:—"The importation of wireless apparatus is not at present prohibited, but the provision that apparatus used under the broadcasting receiving licence must be marked with the British Broadcasting Co.'s trade-mark prevents the use of imported apparatus for ordinary broadcast reception as distinct from experimental purposes. There is no similar provision in respect of apparatus used under the experimental licences."

Captain BERKELEY wanted the Postmaster-General to notify the British Broadcasting Co. that their licence was not binding until approved by the House, in view of the provisions of Standing Order 72. The Postmaster-General replied that the licence was not a contract for the purpose of telegraphic communication beyond sea, and did not, in his view, fall within the scope of Standing Order 72. Replying to Mr. HURD, Sir William JOYNSON-HICKS stated that negotiations were still in progress for the granting of licences to private enterprise for wireless telegraph services between this country, the Dominions and foreign countries. Mr. AMMON wanted the royalties of the British Broadcasting Co. reduced and the profits of its constituent firms controlled. He also wished to know whether the Postmaster-General would revise or cancel the Company's agreement, in view of the Company's inadequacy "to meet the needs of the new situation." The reply to these drastic suggestions was that the Committee would consider such points.

Wireless in China.

The Peking correspondent of "The Times" reports a difficult situation with regard to wireless which has arisen in China. Two years ago an American company contracted to erect wireless stations in China, and it has now landed engineers and material. The Government, however, refuses the necessary consent to the starting of the work, on the ground that other powers have protested that the American agreement conflicts with rights previously acquired by their nationals. The Japanese are mostly concerned under the Mitsui Agreement of 1918, which gave them a wireless monopoly for a period of 30 years. The Americans contend that the monopolistic clause of that agreement is contrary to the theory of the "open door" and incompatible with the terms of the Chinese-American Treaty of 1859.

Under the Japanese agreement a large wireless station has been for several years under construction near Peking, but it is not yet open for traffic owing to technical difficulties.

Wireless Station for Greenland.

The Danish Home Minister, M. KRAGH, has formulated a plan for the erection of a wireless station at the most southerly point of Greenland, at an estimated cost of half a million kronor.

Among the Duke of York's wedding presents is an ELECTRIC HEATER from the Independent Air Force Dinner Club.

The threatened strike of municipal employees at DERRY electricity works, has been averted, the Corporation having agreed to a proposal by the representative of the men for an immediate reduction of 3s. per week, no action to be taken in regard to a further reduction of 2s., which the Corporation had decided to enforce.

We understand that the results from the recent WIMBLEDON ELECTRICAL EXHIBITION exceeded all expectations. Orders for the hiring of 106 cookers were taken, as well as for a large number of kettles and irons. The Exhibition was only open for eight days, and it is thought that the amount of business done in this time constitutes a record.

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Companies' Reports, Dividends, etc.

BRITISH ELECTRIC TRANSFORMER CO.—Dividend recommended of 7 per cent. on the preference shares, placing £4 000 to depreciation reserve and carrying forward £8 137. The profit for 1922 was £20 429, plus £12 708 brought in.

BELL'S UNITED ASBESTOS CO.—Balance dividend recommended of 1s. 6d. per share on the ordinary shares, making with the interim dividend paid in October last a total distribution of 10 per cent. for the year. After providing for income and corporation taxes, the amount to be carried forward is £37 911, an increase of £3 897.

The British Thomson-Houston Report.

The British Thomson-Houston report for 1922 shows a profit of £494 592, compared with £509 259 for the previous year. Deducting interest on debentures and loans, £118 614, the net profit totals £375 978 against £389 813 for 1921, when interest absorbed £119 446. Including £230 704 brought forward the amount now available is £606 682, from which the directors recommend placing to reserve £50 000, writing off cost of converting preference shares £13 125, writing off patents, licenses and goodwill £9 427, placing to depreciation of plant account £82 959, and writing off office equipment £6 999, leaving £444 171. It is proposed to maintain the ordinary dividend at 6 per cent., tax free, carrying forward £236 671. From the profits of 1921 the directors placed to depreciation of plant £60 000 and reserved £100 000 for contingencies, which item appears in the current balance sheet.

Babcock & Wilcox: Bonus Issue Proposed.

The report of Babcock and Wilcox for 1922 shows a net profit of £787 600, compared with £490 181 for the previous year. The directors propose that the share premium account of £545 069, together with £1 603 759 from the general reserve, be capitalised and distributed among the holders of ordinary shares registered on May 17th next in the form of fully-paid £1 ordinary shares in the proportion of one new share for each ordinary share held. The 2 160 000 new shares thus created will rank *pari passu* in all respects with the existing ordinary shares, and will increase the capital of the company to £4 620 000. Including £71 243 brought forward, the accounts show a balance available of £858 844, against £590 009 for 1921, when £99 828 was brought in. The directors recommend a final dividend of 9 per cent. on the ordinary shares, making 17 per cent. for the year, and in addition a bonus of 3 per cent., making a total distribution of 20 per cent., compared with 16 per cent. for the previous year, placing to the reserve fund £200 000, granting to the staff pension fund £20 000, carrying forward £194 125.

Supply and Lighting.

READING ELECTRIC SUPPLY CO.—The gross profit for 1922 was £24 637, which, after providing for interest on debenture stock, depreciation and redemption, permitted of the distribution of a dividend of 6 per cent. to the ordinary shareholders, and left a carry forward of £1 730.

Traction Companies' Results.

BIRMINGHAM DISTRICT POWER AND TRACTION CO.—Dividend recommended of 5 per cent. on the ordinary shares for 1922, carrying forward £3 959. The gross profit was £88 800 and the net profit £30 000. Allocations include £9 667 to debenture sinking fund and £8 000 provision for renewals.

PETERBOROUGH ELECTRIC TRACTION CO.—The report for 1922 states that the revenue from all sources amounted to £23 015, a decrease of £6 251 compared with the previous year. Expenses, including debenture interest and £3 000 placed to renewals fund, amounted to £22 765, a decrease of £3 841 compared with previous year. There remains a balance of £250, to which is added £1 271 brought forward from last account, making an available balance of £1 522. The directors recommend that this balance should be applied as shown in accounts, viz., to dividend on preference shares at rate of 6 per cent. for year, £1 320, carrying forward £202.

Cable and Telegraph Companies.

GREAT NORTHERN TELEGRAPH CO. OF DENMARK.—Final dividend and bonus proposed of 22 per cent. in all, including 5 per cent. already paid, carrying forward £309 762. Allocations include £33 333 to reserve and renewal fund and £55 556 to pension fund.

New Issues.

MANSFIELD ENGINEERING CO. (1923), LTD.—An offer was made on Saturday of 62 500 shares of £1 each at par. The authorised capital is £100 000, of which 37 500 shares of £1 each are allotted to the vendors of the Mansfield Engineering Co., Ltd.

NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO.—On Monday an issue of £352 000 in five and a-half per cent. debenture stock was offered for subscription at par. Primarily the issue is made to provide for the retirement of the £226 200 in seven and a-half per cent. debenture stock, while also providing additional capital for the extension of the business.

New Companies.

SCAMMELL AND ABBOTT, LTD.—Private. Reg. April 18th. Cap. £1 000 in £1 shares. Electrical engineers and wireless telegraphy and telephony engineers, etc. E. W. Scammell, 147, Solihull Road, Sparkhill, Birmingham, is a director.

NEWTOWNBUTLER ELECTRIC SUPPLY CO., LTD.—Private. Reg. in Belfast March 28th. Cap. £1 000 in £1 shares. To produce and accumulate electricity, to carry on business as electricians, etc. Reg. office: Crom Road, Newtownbutler, Co. Fermanagh.

WEBBER ENGINES, LTD.—Private. Reg. April 9th. Cap. £100 in £1 shares. Manufacturers of, agents for, and dealers in electrical, gas, oil, petrol and all other engines and appliances, iron and brass founders, engineers, etc. Solicitors: W. A. Zebell, 11, Queen Victoria Street, London, E.C.4.

HARGREAVES HAMILTON AND CO., LTD.—Private. Reg. April 9th. Cap. £10 000 in £1 shares. Mechanical and electrical engineers, founders, acetylene welders, makers of textile, etc., machinery. manufacturers and patentees of electrical and other machinery. Reg. office: Silverwell Lane, Bolton.

EXPERT ELECTRICAL CO., LTD.—Private. Reg. April 7th, Cap. £300 in £1 shares. Wholesale or retail dealers in electrical articles of all kinds, etc., and to adopt an agreement with E. J. Hammond, E. H. Jackson and E. J. Donaldson. Reg. office: 47A, Earls Court Road, Kensington, London, W.

SPEEDWELL PRESS CO., LTD.—Private. Reg. April 3rd. Cap. £3 000 in £1 shares. To adopt an agreement with R. Francis, and to carry on the business of general manufacturers for motor, marine, electrical, wireless and general engineering metal workers and manufacturers, etc. Reg. office: Glebe Road, Letchworth, Herts.

"M.K." ELECTRIC, LTD.—Private. Reg. April 17th. Cap. £2,000 in £1 shares. To acquire the business of manufacturers of general electrical accessories and appliances, etc., carried on as the "Heavy Current Electric Accessories Co.," at Park Road, Edmonton, Middlesex. Reg. office: Barretts Factory, Park Road, Edmonton, London, N.18.

HORACE GREEN AND CO., LTD.—Private. Registered April 16th. Cap. £20 000 in £1 shares. To take over the business of dynamo motor manufacturers and electrical engineers carried on by H. Green, G. S. Green, L. R. Green, A. Green, and Julia Green at Cononley, Yorks, as "Horace Green and Co." Reg. office: Station Mills, Cononley, near Keighley.

HULBURD PATENTS, LTD.—Private. Reg. April 10th. Cap. £5 000 in £1 shares. Mechanical, electrical, hydraulic and general engineers, manufacturers of and dealers in machines, mechanica. instruments and contrivances of all kinds and characters, registering. recording and automatic machines, etc. Reg. office: 17, Cottons Gardens, Kingsland Road, London, E.2.

TOWNLEA ELECTRICAL CO., LTD.—Private. Reg. April 17th. Cap. £1 000 in £1 shares (300 6 per cent. preference and 700 ordinary). To acquire the business of electrical engineers now carried on by A. J. Horn and D. C. Tibbles at 112a, High Street, Willesden Junction, as the "Townlea Electrical Repair Co." Reg. office: 112a, High Street, Harlesden, London, N.W.10.

E. M. BATES, LTD.—Private. Reg. April 19th. Cap. £1 000 in 950 10 per cent. cumulative participating preference shares of £1 and 200 ordinary shares of 5s. each. To acquire the business of an agent for electric washers, ironers, vacuums, and drying machines now carried on by E. M. Bates at 61, High Street, Manchester. Reg. offices: 37, Cross Street, Manchester.

EMBLETON AND BARKER, LTD.—Private. Reg. April 13th. Cap. £1 000 in £1 shares. To adopt an agreement with F. Embleton and G. W. Barker, and to carry on the business of electrical engineers, manufacturers of electrical machinery, apparatus, instruments, cable, glass and porcelain ware, insulation materials, etc. Reg. office: 70, West Street, Gateshead-on-Tyne, Durham.

THOMAS INVENTIONS DEVELOPMENT CO., LTD.—Private. Reg. April 7th. Cap. £1 000 in £1 shares. To acquire and turn to account patent and other rights for any inventions relating to internal combustion engines, all manner of road and rail vehicles, generating plant, pumps, compressors and electrical machines, etc. Reg. office: 29, Spring Gardens, Whitehall, London, S.W.1.

BIRMINGHAM WIRELESS CO., LTD.—Private. Reg. April 18th. Cap. £1 500 in £1 shares. To take over the business of manufacturers and factors of and agents for wireless sets and apparatus carried on by E. D. Glendall and C. D. Aston, at Carlton House, High Street, and 7 and 9, Pershore Street, Birmingham, as the Birmingham Radio Co. Reg. offices: 7 and 9, Pershore Street, Birmingham.

KENT BROS. ELECTRIC WIRE CO. AND E. H. PHILLIPS, LTD.—Private. Reg. April 18th. Cap. £15 000 in £1 shares. To acquire all or any of the assets of the business now carried on at Perry Hill, Catford, Kent, and 15, Berners Street, London, W., as "The Kent Bros. Electric Wire Co. and E. H. Phillips," and to carry on the business of manufacturers of and dealers in electrical, mechanical and scientific apparatus, appliances and accessories, telephones, telegraphs, wireless instruments and accessories, wire, cables and materials for making cables, and cable equipment of all kinds, etc.

G. H. HUDSON-HARNELL MANUFACTURING CO., LTD.—Private. Reg. April 17th. Cap. £5 000 in £1 shares. To acquire the businesses of manufacturers of fountain pens, stylographic pens, propelling pencils, electric lamps, and any article of which erinoid forms the material, electrical engineers, brass and electro mascot makers, stationers and dealers in all articles appertaining to the stationery trade and dealers in engineering accessories and machines, carried on by G. H. Hudson and Co., of 65-66, Basinghall Street, E.C., and the Harnell Manufacturing Co., of 65A, Westow Street, Upper Norwood, S.E., as the G. H. Hudson-Harnell Manufacturing Co.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

CARPENTER (C. A.), LTD., 9, Coleman Street, E.C., electrical engineers. £11 15s. 8d. February 21st.

COLLINS, W. AND SONS, 12/14, Mill Row, Kingsland, electricians. £19 17s. 4d. March 5th.

CUNNINGHAM, SLATER, LTD., 146, High Street, Kensington, electrical engineers. £38 0s. 8d. March 8th.

JENNER, Alfred James, and POWLES, George Herbert (trading as JENNER AND POWLES), 107A, Jack Lane, Leeds, electrical engineers. £21 8s. 6d. March 12th.

O'TOOLE AND REDMOND, 6, Portland Street, Kingsdown, Bristol, electrical engineers. £12 1s. March 8th.

TAPLIN, H., AND CO., 16, Lordship Park, N., electrical engineers. £15 1s. March 5th.

THOMAS, J. E., AND CO., 49, King Street, Carmarthen, electrical engineers. £16 6s. 11d. February 28th.

TURNER BROS., 12, Manor Road, Stoke Newington, electrical engineers. £22 4s. 8d. February 28th.

WALTON, J., Tatton Buildings, School Road, Sale, electrical contractor. £23 12s. 1d. February 28th.

Receiverships.

KELVIN-HARDY ELECTRIC CO., LTD. A. A. Whittingham-Jones, of 41, Castle Street, Liverpool, ceased to act as receiver and manager on April 9th, 1923.

PRYCO, LTD. L. W. Stanley, of 9 and 10, Pancras Lane, E.C., was appointed receiver and manager on April 5th, 1923, under powers contained in debentures dated October 30th, 1922.

Private Meetings, etc.

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

CHAMBERS, D. J., electrical engineer, Volta Works, Dawber Street, Wigan. Creditors were called together on April 19th, when a statement of affairs was presented by Seampton and Brown, I.A., 28, Market Street, Wigan, disclosing liabilities of £847 (£553 to the trade and £295 to a cash creditor), and a deficiency of £612. A resolution was passed in favour of the matter being dealt with under a deed of assignment with Mr. A. H. Seampton as trustee. The following are creditors: Bridge Electrical Co., Manchester, £48; General Electric Co., Ltd., Manchester, £189; Smith and Cookson, Liverpool, £32; Ward and Goldstone, Ltd., Manchester, £23; White, J. C., Manchester, £26; Sutton, B. (executors of), Wigan, £294; Castle Engineering Co., Manchester, £29.

SMALL, C. R., trading as the CLACTON ELECTRICAL CO., High Street, Clacton-on-Sea. Creditors were called together on April 20th, at the offices of Poppleton, Appleby and Hawkins, accountants and auditors, 4, Charterhouse Square, E.C. A statement of affairs was presented which disclosed liabilities of £2,623, of which £623 was due to the trade and £2,000 to cash creditor. The bank was a fully secured creditor for £500, who held securities estimated at £1,200. The assets consisted of: stock at cost £350, expected to produce £200; book-debts £150, estimated to realise £100; cash in hand £86; and surplus from fully secured creditors £700. The assets therefore totalled £1,086, or a deficiency of rather more than £1,500. It was explained that the bank was a fully secured creditor and held the deeds of the freehold property estimated to be worth £1,200. The cash creditor was Mr. Small, Sen., who had intimated that if the matter was dealt with privately he would stand aside until the other creditors had been paid in full. The debtor commenced business after being demobilised in 1920. The freehold premises were purchased for £1,200 and £500 was expended on fitting them up. Negotiations were taking place for the sale of the property and it was believed that there was every prospect of the figure mentioned being obtained. It was unanimously resolved that a deed of assignment should be executed to Mr. E. H. Hawkins, while a committee was appointed consisting of representatives of Clark, Hunt and Co., J. and W. B. Smith, Ltd., and the British Thomson Houston Co., Ltd.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Notices of Intended Dividends.

GREATHEAD, Oswald, and GREATHEAD, Walter, carrying on business in co-partnership, under the style of GREATHEAD BROTHERS, 50, Burnley Road, Brierfield, electrical engineers and contractors. Last day for receiving proofs, May 1st. Trustee, C. H. Plant, Official Receiver in Bankruptcy, 13, Winckley Street, Preston.

DAVIS, William Aaron, 3, Coronation Street, but now 14, Basing-Hall Street Leeds, electrical engineer. Last day for receiving proofs, May 10th. Trustee, H. C. Bowling, Official Receiver in Bankruptcy, 24, Bond Street, Leeds.

WILDE, Frederick, 18 and 20, Vauxhall Road, Liverpool, as THE LIVERPOOL ENGINEERING CO., electrical engineer. Last day for receiving proofs, May 5th, 1923. Trustee, L. Nicholas, 19, Castle Street, Liverpool.

Bankruptcy Proceedings.

ELECTRICARS, LTD. In this voluntary winding-up the joint liquidators, Mr. W. Morris and Mr. A. Black, recall the fact that on February 27th last a resolution was passed to wind up voluntarily, on the ground that the company could not by reason of its liabilities continue its business. No meeting of creditors had been called because negotiations have been proceeding since the passing of the resolution, which it was hoped would result in the creditors being paid in full. "We are glad to be able now to inform you," the liquidators state, "that a contract has been entered into between the company and its liquidators and Edison Accumulators, Ltd., whereby the latter company have agreed to acquire the assets of the business and to discharge its liabilities subject to the liquidation being annulled by order of the Court. Application will be made to the Court to annul the liquidation at the earliest possible moment, and we have very little doubt but that the Court will agree."

STANDARD ELECTRIC SIGN CO., LTD. Under a winding-up order made against this company on February 20th, on the petition of a shareholder, the statutory meetings of the creditors and of the shareholders were held last week at Bankruptcy Buildings, Carey Street, W.C. A statement of the company's affairs was submitted showing unsecured liabilities £7 463, assets £90 and a total deficiency of £13 761 with reference to the shareholders. The Official Receiver reported that the company was formed in July, 1921, its chief object apparently being to erect advertising signs on tramway and electric lamp standards and to use those standards for the purpose of advertisement. The promoter was Mr. H. T. Hart Spratt. The issued capital amounted to £6 298 and the company was carried on through the medium of loans and of deposits received from advertisers, but it never possessed sufficient capital to carry out its ambitious programme and its business had been conducted in a slipshod manner. The failure was entirely attributable to mismanagement on the part of the directors. The most elementary duties of a director were not carried out and there were many matters calling for a strict investigation on the part of the Official Receiver.

We are requested to state that BARLOW BROS. AND CO., Albion House, New Oxford Street, London, W.C.1, have no connection with the firm trading under a similar name, a meeting of whose creditors was reported in our last issue.

Prices of Metals, Chemicals, etc.

TUESDAY, April 24.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£76 10 0	—	10s.
Electro Wirebars	,,	£81 10 0	5s.	—
H.C. Wire, basis	per lb.	11 5/16d.	—	—
Sheet	,,	11⅜d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 3 5/16d.	—	—
Brass 60/40—				
Rod, basis	,,	7½d.	—	—
Sheet, basis	,,	10½d.	—	—
Wire, basis	,,	11d.	—	—
Pig Iron—				
Cleveland Warrants No. 3	per ton	£6 12 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 10 0	—	—
Lead Pig—				
English	,,	£27 5 0	—	£1 5 0
Foreign or Colonial	,,	£26 0 0	—	£1 7 6
Tin—				
Ingot	,,	£213 0 0	—	£1 5 0
Wire, basis	per lb.	2s. 0½d.	—	⅛d.
Aluminium Ingots	per ton	£110 0 0	—	—
Spelter	,,	£33 17 6	—	£1 2 6
Mercury	per bottle	£9 17 6	—	7s. 6d.

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2¾d.
,, (Roll-Brimstone)—,, £8 5s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.— ,, £26 10s. per ton, £7 10s.
Boric Acid (Crystals). ,, £55 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 3d.; plantation 1st latex, 1s. 3d. to 1s. 3½d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

180 290 R. BOSCH A.-G. Ignition magnetos. (14/5/21.)
191 890 W. W. NOBBS. Electric heating and cooking apparatus. (14/11/21.)
191 893 W. GEE. Pedal-actuated motor control switches. (20/3/22.)
191 897 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Electric heaters. (19/11/21.)
191 910 PREMIER ELECTRIC WELDING Co. and Dr. J. H. PATERSON. Welding by electric arc. (30/11/21.)
191 929 F. J. CHAMBERS. Electro-magnetic wave receiving and amplifying systems. (13/12/21.)
172 973 W. SCHAUFELBERGER. Electric heater for bed-warmers, clothing, etc. (20/12/20.)
191 943 P. V. POWELL and P. FROST-SMITH. Control switches for electric vehicles. (29/12/21.)
191 947 M. J. RAILING, C. W. SAUNDERS and J. H. COLLINGS. Electrical bell indicators. (3/1/22.)
177 140 AUTOMATIC TELEPHONE MANUFACTURING CO. Telephone systems. (16/3/21.)
174 361 SIEMENS-SCHUCKERTWERKE GES. Mounting of commutators. (20/1/21.)
174 925 H. WEISS. Methods of introducing anodes for metal vapour rectifiers. (1/2/21.)
174 648 ALLGEMEINE ELEKTRICITATS GES. H.T. insulators of bushing type. (31/1/21.)
174 937 W. B. TOPP. Electric heating and cooking apparatus. (5/2/21.
191 971 FERRANTI, LTD., and A. H. HIGGS. Protection of switchgear. (6/2/22.)
175 279 SIEMENS AND HALSKE A.-G. Alternating current generators. (8/2/21.)
191 974 L. M. BERNON and A. E. L. MORELLE. Motor road vehicles. (14/2/22.)
176 388 DR. H. MARLIERE. Apparatus for the electric ringing of bells. (7/3/21.)
192 007 P. BRUNET and G. PELLETIER. Mounting thermionic valves. (3/5/22.)
182 103 SIEMENS AND HALSKE A.-G. Telephone systems. (21/6/21.)
181 730 L. VALLINO. Overhead points or switches for trolley conductors. (18/6/21.)
190 450 W. P. D. VAN DER KNAAP. Telegraph recorder relay. (16/12/21.)

APPLICATIONS FOR PATENTS.

April 9.

9 615 A. SHARP. Wireless receiving apparatus.
9 616 C. E. RAEBURN and W. E. TAYLOR. Variable condensers.
9 623 S. O. COWPER-COLES. Electro-deposition of metals.
9 628 B. A. PILKINGTON. Electro-magnetic sound apparatus.
9 639 N. HUNT. Inductance coils, etc.
9 641 L. DUNWOODIE. Headpiece telephones.
9 642 J. CRAWFORD and E. MCKILLOP. Electric signal apparatus.
9 652 C. J. COLEMAN. Headphones.
9 659 WESTERN ELECTRIC Co. Selecting switches.
9 664 METROPOLITAN-VICKERS ELECTRICAL CO. Protection of electric circuits. (7/4/22, U.S.)
9 665 METROPOLITAN-VICKERS ELECTRICAL CO. and J. A. KEYSER. Dynamo electric machines.
9 666 METROPOLITAN-VICKERS ELECTRICAL CO. Prevention of overspeeding of rotary elements.
9 667 METROPOLITAN-VICKERS ELECTRICAL CO. Electric power or distribution systems. (11/4/22, U.S.)
9 690 R. C. BROWNE. Telephone receivers. (9/9/22, U.S.)
9 695 BRITISH THOMSON-HOUSTON CO. Production of electric oscillations.
9 696 BRITISH THOMSON-HOUSTON CO. and H. F. FARMER. Electric motor control.
9 698 W. A. CATHERWOOD. Connecting wires in electric circuits.

April 10.

9 731 P. C. STEPHENS. Aerials for wireless telephony.
9 735 L. DUNWOODIE. Headpiece telephones.
9 739 W. H. HINGSTON. Variable condenser.
9 740 R. T. WAITE. Plug switches.
9 751 C. L. CUTHBE. Earphones or telephone receivers.
9 752 HOLMES AND JAMES and H. E. SUTHERLAND. Electric fuses.
9 753 HOLMES AND JAMES and H. E. SUTHERLAND. Cases for fuses, switches, etc.
9 762 R. T. WALLACE. Coupling telephone instruments.
9 780 O. C. MORISON. Wireless receiving apparatus.
9 781 E. WILLIAMS and T. H. BOOKER. Binding posts or terminals for electrical apparatus.
9 782 JOHNSON AND PHILLIPS and W. H. JOHNS. Loud speakers for wireless telephones.
9 783 BURNDEPT, LTD., and C. F. PHILLIPS. Variable condensers.
9 784 METROPOLITAN-VICKERS ELECTRICAL CO. Dynamo electric machines. (9/4/22, U.S.)
9 787 E. P. RIDDELL. Variable condensers.
9 794 PHILIPS GLOEILAMPENFABRIK. Electric lamps with coiled filaments. (27/4/22, Holland.)
9 804 BRITISH THOMSON-HOUSTON CO., A. P. YOUNG, and E. G. PARROTT. Magneto-electric machines.
9 805 BRITISH THOMSON-HOUSTON CO. Wireless signalling systems. (10/4/22, U.S.)
9 810 B. R. WINGFIELD. Temperature controlling devices for electric heating apparatus.

April 11.

9 815 F. HAMER. Conversion of kinetic energy in fluids into electrical energy.
9 816 L. BURGOYNE. Tuning or resistance coil.
9 847 N. DREY. Electron discharge devices.
9 858 F. A. HUNTER. Amplification of electro-magnetic impulses.
9 860 M. B. MEDLAM and C. H. STONE. Radio receiving circuits.
9 862 E. E. BRAMALL. Switches.
9 867 COVENTRY AUTOMATIC TELEPHONES, LTD. Telephone systems.
9 868 C. J. COLEMAN. Loud speakers for wireless telephony.
9 869 WESTINGHOUSE BRAKE, ETC., CO., R. DELL, and L. H. PETER. Electric signalling for railways.
9 885 BRITISH THOMSON-HOUSTON CO. and A. P. YOUNG. Telephone receivers.
9 888 and 9 890 METROPOLITAN-VICKERS ELECTRIC CO. Condensing steam turbine plant.
9 889 METROPOLITAN-VICKERS ELECTRICAL CO. and N. G. LANGRISH. Resistances.
9 891 METROPOLITAN-VICKERS ELECTRICAL CO. Electric welding (11/4/22, U.S.)
9 899 W. F. M. and W. M. EDWARDS. Electric terminals.
9 904 R. T. WALLACE. Crystal cup and cover for wireless telegraphy.
9 905 W. STUBBS. Electric heaters for liquids.
9 910 E. A. BRADBURY. Wireless telephone receivers.

April 12.

9 951 PARKINSON AND W. AND B. COWAN, LTD., and H. J. MEADS. Vapour lamps.
9 954 A. REYROLLE AND CO. and B. H. LEESON. Circuit breakers, etc.
9 959 C. C. EVANS. Automatic cut-outs for accumulator charging.
9 974 J. G. LUCAS. Series parallel condenser switch.
9 979 FORGES ET ATELIERS DE CONSTRUCTIONS ELECTRIQUES JEUMONT. Connection of electrical machines. (27/12/22, France).
9 982 C. G. RIDDELL. Prevention of access to electric switches on motor cars.
9 988 S. L. PRICE. Wireless detectors or amplifiers.
10 000 METROPOLITAN-VICKERS ELECTRICAL CO. Current collecting brush devices. (13/4/22, U.S.)
10 012 L. E. RICHARDS. Holders for telephone headpieces.
10 014 G. STEPHENSON. Wireless receiving apparatus.
10 026 R. S. ALLEN. Electric motor control.
10 031 A. WEST & CO. Liquid controllers for slip ring motors.

April 13.

10 040 W. H. COLEMAN. X-ray apparatus.
10 069 W. G. WALTER. Wireless aerials.
10 072 R. MACLAREN. Gravity electrical piston gas valves.
10 075 C. J. COLEMAN. Crystal rectifiers.
10 082 M. W. W. MACKIE. Continuous current dynamos.
10 083 A. W. FISHER. Wireless detector.
10 093 A. ROTHSCHILD. Electric terminal.
10 095 G. MARR. Switch.
10 096 ENGINEERS (PENGE), LTD., and S. A. HUSS. Loud speakers for telephony, etc.
10 097 H. J. CARTER. Securing electric light shades.
10 103 GES. FUR DRAHTLOSE TELEGRAPHIE. Wireless transmitters (13/4/22, Germany).
10 104 A. PHILLIPS. Inductance coils.
10 106 S. G. BROWN. Cable telegraphy.
10 112 and 10 113 W. H. JOHNS. Loud speakers for wireless telephony.
10 117 BRITISH THOMSON-HOUSTON CO., A. P. YOUNG, and J. H. BUTCHER. Telephone receivers.
10 118 WURTTEMBURGISCHE METALLWAARENFABRIK. Simultaneous deposit of galvanic metal castings of different thicknesses. (18/7/22, Germany.)
10 121 H. A. GAYDON. Resistances and switches.
10 125 F. S. SMYTHE. Electric governing of water turbines.
10 129 J. LUCAS, LTD., and H. W. F. IRELAND. Current generators.
10 135 AKT. GES. BROWN, BOVERI ET CIE. Apparatus for controlling vehicles driven by electric motors. (6/6/22, Germany.)
10 136 W. DUBILIER. Variable condensers. (16/9/22.)

April 14.

10 168 T. E. BEAUMONT. Star coils for receiving wireless telephony.
10 170 J. L. TAYLOR. Electric terminals, etc.
10 178 R. S. WOODS. Inductance coils for wireless telegraphy, etc.
10 182 H. BOHLE. Electrically heated cooking utensils.
10 190 R. M. BALSTON and T. H. J. WATTS. Electrically controlled governor.
10 196 M. L. MAGNETO SYNDICATE and D. K. MORRIS. Transformers.
10 208 A. MACLENNAN. Wireless receiving apparatus.
10 222 J. N. CHAVIARA and J. F. GILL. Homopolar current generators or motors.

Arrangements for the Week.

FRIDAY, APRIL 27th. (To-day.)

PHYSICAL SOCIETY OF LONDON.

5 *p.m.* At the Imperial College of Science, South Kensington, London.
1. "The Analysis of Bubbles in Glass," by the Research Staff of the General Electric Co., London.
2. "A Simple Regenerative Vacuum Device and Some of its Applications," by Mr. H. P. Waran.
3. "Application of the Eötvös Torsion Balance to the Investigation of Local Gravitational Fields," by Capt. H. Shaw and Mr. E. Lancaster-Jones.
4. Demonstration of an Electromagnetic Inductor, by Mr. L. F. Richardson.
5. Demonstration of an Experiment Illustrating Time-Lag in Vision, by Dr. F. Ll. Hopwood.

INSTITUTION OF ELECTRICAL ENGINEERS. (SOUTH MIDLAND CENTRE.) (STUDENTS' SECTION.)

Annual General Meeting. Lecture on "Mining Switchgear," by Mr. F. H. Beacon:

INSTITUTION OF ELECTRICAL ENGINEERS. (MERSEY AND NORTH WALES (LIVERPOOL) CENTRE.)

7.15 *p.m.* At Compton Hotel, Liverpool. Annual General Meeting.

INSTITUTION OF ELECTRICAL ENGINEERS. (DUNDEE SUB-CENTRE.)

7.30 *p.m.* At University College, Dundee. Meeting of Scottish Centre.

JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette on "Stock Control," by Mr. J. Fearn.

ROYAL INSTITUTION OF GREAT BRITAIN.

9 *p.m.* At the Institution, 21, Albemarle Street, Piccadilly, London. Lecture on "Measurement of the Heating Value of Gas," by Mr. C. V. Boys.

SATURDAY, APRIL 28th.

INSTITUTION OF BRITISH FOUNDRYMEN.

6.15 *p.m.* At Neville Hall, Newcastle-on-Tyne. Lecture on "Some Experiments with Moulding Sands," by Mr. C. W. H. Holmes.

MONDAY, APRIL 30th.

ROYAL SOCIETY OF ARTS.

8 *p.m.* At John Street, Adelphi, London. Howard Lectures. "The Development of the Steam Turbine," by Mr. S. S. Cook. Lecture 1.

TUESDAY, MAY 1st.

ROYAL INSTITUTION OF GREAT BRITAIN.

5 *p.m.* At the Institution, Albemarle Street, London, W.1. Annual Meeting.

INSTITUTION OF ELECTRICAL ENGINEERS. (EAST MIDLAND SUB-CENTRE.)

6.45 *p.m.* At the College, Loughborough. Lecture on "An Electric Harmonic Analyser," by Prof. Miles Walker.

RÖNTGEN SOCIETY.

8.15 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London. General Meeting.

WEDNESDAY, MAY 2nd.

INSTITUTION OF ELECTRICAL ENGINEERS.

6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, W.C.2. Lecture on "The Design of Inductances for High-Frequency Circuits," by Prof. C. L. Fortescue.

INSTITUTE OF METALS.

8 *p.m.* At the Institution of Mechanical Engineers, Storey's Gate, Westminster, London. Lecture on "The Inner Structure of Alloys," by Dr. W. Rosenhain.

THURSDAY, MAY 3rd.

ROYAL INSTITUTION OF GREAT BRITAIN.

3 *p.m.* At the Institution, Albemarle Street, London, W.1. Lecture on Modern Electric Lamps: "II.—Glowing Solids in Gases," by Prof. J. T. MacGregor-Morris.

FRIDAY, MAY 4th.

INSTITUTION OF CIVIL ENGINEERS.

6 *p.m.* At the Institution, Great George Street, London, S.W.1. James Forrest Lecture on "The Interdependence of Abstract Science and Engineering," by Sir Richard Glazebrook.

JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette on "A.C. Neutral Point Earthing," by Mr. S. A. Stigant.

EDINBURGH ELECTRICAL SOCIETY.

8 *p.m.* At Philosophical Institute, 4, Queen Street, Edinburgh. Annual Meeting and Prize Distribution.

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THE ELECTRICIAN

ESTABLISHED 1861.

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CONTENTS.

Notes of the Week	473	Boilermakers Locked Out	489
Trading Policy	475	Personal Items	489
The B.B.C. Controversy	476	Imperial Notes	490
The Control of the Speed and Power Factor of Induction Motors. Illustrated	478	Foreign Notes	490
The Drive of Power Station Auxiliaries	480	Electric Locomotives for Mines	490
Institution of Electrical Engineers	481	Electric Traction	491
Correspondence	482	Wireless News	491
Books Received	482	Companies' Reports, Dividends, etc.	492
A Short Circuit Test on a 40 000 kVA Turbo Alternator	483	New Companies	492
The Electrician "All-Electric" House Competition. Biographical Notes of the Prize Winners	484	Business Items	492
Electricity Supply Development	485	British Electric Transformer Co.: Annual Meeting	493
Parliamentary Intelligence	485	Tenders Invited and Accepted	493
Electrical Contractors' Association	485	Commercial Intelligence	494
Merchandise to Sell and Profit By. Illustrated	486	Institution Notes	495
Private Bills	488	Forty Years Ago	495
Electricity Supply	489	Prices of Metals, Chemicals, etc.	495
		Patent Record	496
		Arrangements for the Week	496

Notes of the Week.

The Broadcasting Controversy.

On another page of this issue Sir William Noble makes a spirited reply to Mr. Challis's indictment of the Broadcasting Co.'s methods which appeared in our issue of April 20th. He points out that the Broadcasting Co. has been a real aid to British industry and that the success or failure of broadcasting is therefore a vital matter. With this statement all will agree. On the other hand, he remarks that the Electrical Importers have no stake in the country and that their interest in broadcasting is mainly what their name implies. On that part of the controversy we do not propose to comment except to say that to adopt Free Trade in broadcasting apparatus, and to do away with licence fees, as suggested by Mr. Challis, would, with exchanges at their present figure, be a distinct setback to a growing British industry. Much has been made of the number of firms who refuse to join the Broadcasting Co. Sir William Noble states that the membership is 564, and further applications bring the total to 596. When it is remembered that only British firms are eligible these figures in themselves form a not unimpressive comment on more than one of Mr. Challis's arguments.

Present and Future.

We think also that Sir William Noble makes a good point when he pleads that the Broadcasting Co. has not had a chance. Its birth was inauspicious and for almost the whole of its life it has been subjected to criticism. Seeing that the inauguration of such an undertaking is always difficult it is a wonder it has done as well as it has. In fairness the present arrangement should be allowed to stand for the two years laid down in the Post Office agreement and we hope that the Committee will report that this should be done. But when that agreement expires we suggest to all parties that fresh arrangements might be made. The interlinking of broadcasting and manufacturing, whether by "big sixes" or otherwise is too close. If the revenue necessary for broadcasting were obtainable from licence fees alone a separation of these two activities would be possible, and this separation would ultimately be to the advantage of the user, the manufacturer and the Post Office. At the end of two years many of the present arguments against this course will have lost their force. British manufacturers of wireless apparatus will, or ought to, have established their position, and it is to be hoped that the importation of cheap apparatus will not be so easy.

A Wireless Slump.

There are many reasons why this unfortunate controversy should be settled at the earliest possible moment. And one of the most important of these is that a slump has occurred in the sale of wireless apparatus. This is unfortunate at a time when manufacturers were beginning to get into the swing of the business, but, having all circumstances in view, it can hardly be described as unnatural. The paragraphs, columns and discussions on the subject of broadcasting which have appeared in the daily Press during the past few weeks have, to put it mildly, puzzled the public. Those who were about to buy wireless sets are holding off until they can decide for themselves whether to become a listener-in is or is not an illegal act. Even those who have sets are not certain whether they are entitled to use them, and sales are also suffering on that score. Uncertainty is never good for business, and we therefore hope that the Committee will deliberate and report with the least possible delay.

Are Wiring Rules Necessary?

Speaking at the Annual Dinner of the Electrical Contractors' Association, Mr. C. H. Wordingham asked the pertinent question: Are wiring rules necessary? He pro-

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ceeded to give some reasons why they are not only unnecessary, but often undesirable. These reasons may be summarised in the sentence that it is impossible to draw up one set of rules that shall be equally satisfactory for all classes of work, and that supposing it were possible, the result would be to shift the burden of producing good workmanship from the contractor to the compilers of the rules. Incidentally, there is no power to enforce such rules. It is of course the old problem of standardisation over again. Standardisation is often desirable, but it can easily be carried too far, especially in an industry which is developing so quickly as our own. Put in another form, standardisation is like the minimum wage. It is a minimum, but it may easily become a maximum as well. That sort of thing is not required by the wiring contractor or by anyone else. What is required is the publication of a short list of standards applicable to all conditions. The details of each particular installation could then be left to the consulting engineer or the contractor.

The Lighting of Printing Works.

THE lighting of printing works was the subject of two papers read before the Illuminating Engineering Society in 1912; but, like many others, it is a subject that repays review from time to time, and Mr. GASTER'S address at the last meeting of the Society covered a great deal of new ground. On the technical side it would appear that the chief tendency during recent years has been towards overhead lighting so as to obtain an even illumination up to 10 foot candles and to allow the workers to see in comfort in any part of the room. This applies particularly to the lighting of the compositors' cases. Conditions in machine rooms, where the space is fully occupied by rotary presses, are difficult, and there are other special problems which can only be solved by the joint efforts of the lighting expert and the actual user of the light. This particular discussion, afforded a striking instance of the value of interchange of views by the two sides. Mr. C. W. BOWERMAN, who opened it is a past-president of the Joint Industrial Council of the Printing and Allied Trades of the United Kingdom, while Mr. HOLMES and Mr. GOODWIN, the two secretaries of this body, represented the workers and the employers. They all expressed warm approval of the paper. Useful suggestions were made by a number of other speakers concerned with the printing industry, all of whom welcomed the efforts which the Society is making towards the solution of this complex problem. It was stated in the paper that there are something like 250 000 workers engaged in the printing industry, and that the cost of lighting forms only about 1 per cent. of the wages bill. In some modern newspaper works excellent examples of illumination are to be seen, but in others unscreened lamps and antiquated methods are still in evidence. The Society has taken a judicious step in getting in touch with leading employers and workers' representatives, and their investigations should have a most beneficial effect.

Lighting from the Journalist's Standpoint.

WE were also glad to see that Mr. GASTER did not confine himself to the lighting of printing processes, but devoted a section of his paper to the needs of journalists. There are some thousands of newspapers and journals published in the United Kingdom, and the number of journalists must run into tens of thousands. The need for suitable illumination in the editorial department is at least as great as in the sections of the building devoted to actual printing processes; yet these needs are sometimes strangely overlooked. In view of the fact that the manuscripts of contributors are often (as we are only too well aware!) extremely difficult to decipher, good lighting is indispensable. The occupation of the proof-reader is also exacting and there is no doubt justification for the system of local shaded lights, giving 10 foot-candles or more on the paper, which is usual in well-equipped newspaper premises. The public sees the journal in its finished state, but the journalist sees it in embryo. Proofs are pulled hurriedly on more or less inferior paper, and have to be compared with manuscripts often overlaid with scribbled author's corrections. Finally, it must be remembered, as Mr. GASTER pointed out, that the efforts of journalist and printer alike are devoted to a production which is essentially *an appeal to the eye.* This is particularly true of modern productions in which illustrations play such an important role. It is an axiom that work should be inspected under conditions of illumination at least as good as those by which it will be viewed by the public. But it is an axiom that is often forgotten.

An Electrical Pioneer.

ANOTHER electrical pioneer has been placed on the retired list. But this time it is not a person, but an inanimate object, if such a term can be fittingly applied to an electric locomotive. It has been decided to relegate the first electric locomotive which ran on the City and South London Railway to the South Kensington Museum and so to celebrate what was a real electrical advance and incidentally to call attention to the fact that even electric traction is no longer in its infancy. The City and South London Railway was not the first electric railway in this country. Pride of place is claimed by the Giants Causeway and Portrush Electric Tramway and by the Brighton Beach Electric Railway, both of which were opened in 1883. But neither of these systems used locomotives and the latter, though it had a most adventurous career, was a very local affair. A description of the equipment of the City and South London Railway appears in our issue of November 7th, 1890 (the line was actually opened on November 4th by the Prince of Wales, afterwards King Edward VII) and therein it is stated that fourteen locomotives had been built by Mather & Platt for operating the line each with an effective horse-power of 100 and a speed of 25 miles per hour. The special feature of their design, a feature which has long been dropped, is that the shafts of the armature were the axles of the locomotive. A motor was fitted to each axle and the axles were not coupled but worked independently. At present locomotives are still used on the railway, but when the reconstruction now in progress is finished a change may be made to the more usual multiple unit system. Meanwhile we congratulate the pioneer on its entry into a select community and wish it a happy retirement and many visitors.

English Electric Progress.

IF the results obtained by the English Electric Co. during 1922 are indicative of the state of the electrical industry generally, it may be said that we have successfully withstood the shock of trade depression. The available balance was £318 264, as against £363 659 in 1921, which in all the circumstances may be considered satisfactory; and a dividend of 5 per cent. less tax is being paid. But even more pleasing than this result is the evidence given in Sir CHARLES ELLIS'S speech of the determination of the company to take every advantage of improving their position. Existing designs are being revised, and new lines are being developed with ceaseless activity. Large contracts have been obtained in electric railway work and water-power business; and in connection with the former great reliance is placed on the company's system of camshaft control. The result is an ever-filling order book. The secret of this success, it is claimed, lies in technical mastery of the subject. Whether that claim is true or not, it will be agreed that in recognising the importance of technical knowledge the company have gone to the root of the matter. To acquire the best brains and to make the best use of them is the surest way to secure a bright and successful future for English electrical engineering. If that be done, in combination with sound financial methods, we need have no fear for the future.

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An Electrical Landmark.

UNDER the heading of "Forty Years Ago" we last week recorded that a knighthood was conferred on Dr. C. W. SIEMENS, F.R.S. Quite recently we were celebrating the centenary of the birth of this electrical pioneer, and the two landmarks form a virtual coincidence to which attention may well be drawn. It is hardly necessary in the columns of THE ELECTRICIAN to describe what SIEMENS was or what he did for the electrical industry. Those who have read his life will remember that he was an immigrant and an immigrant of a kind that any country does well to receive with open arms. After early struggles, not very different and certainly not less arduous than those of others whose business it is to break new ground, he gained a success which left its mark upon his time and upon electrical progress. That in forty years the work that he began has developed beyond all expectation is the more reason that he should be accorded due recognition.

Public House Wireless.

AT last a bench of magistrates has taken its courage in both hands and now the frequenters of the "Blue Pig" and the "Spotted Lion" will be able to imbibe their post-war liquor to the tune of broadcasted music, children's stories and moral talks. The fortunate town is Merthyr, where sometimes neither the conditions nor the inhabitants are too happy, and we shall therefore be interested to see the effect, if any, on those statistics which are used by all parties to further the particular cause they have at heart. It may seem a stretch of imagination to couple public houses with education, but it is not inconceivable that something sent out on the ether may touch an answering chord, even in one of those resorts, and do good which might otherwise have been left undone. In that case the Merthyr magistrates will deserve a statue—or an aerial.

Trading Policy.

Idealism has both its advantages and disadvantages. Its disadvantages are that its possessors become too much imbued with the idea in itself (whatever it may be) and too prone to lose sight of, or to minimise, the difficulties which prevent the idea's realisation. The natural corollary is that injustices are perpetuated, unwise things are done and pitfalls that ought to be avoided fulfil their purpose by preventing progress. For these reasons experience and predilection make criticism rampant; and the worth of the idea is obscured by the policy and the actions of those who propound it. In addition, of course, anything new is opposed by those who are adverse to change. Idealising advantages are that, properly handled, it gives an idea for which to work and a chance for that spirit which is the very life of progress to operate.

Ourselves and the Contractors.

Having these things in mind we were not surprised, when some weeks ago we published a series of articles on trading conditions in the electrical industry under the heading "Manufacturer—Factor—Retailer," to find that the suggestions therein made were ignored or subjected to the underground criticism of ironic laughter. The way of pioneers is always hard and the way of idealists, partly through their own fault, is harder still. We are, however, gratified to see that many of the suggestions put forward in these articles form the basis of a statement on Trading Policy which has been prepared by a Committee of the Electrical Contractors' Association. This statement will be found set out on another page of this issue.

What the Contractors Propose.

The proposals of the Contractors' Association are briefly: that sufficient control should be obtained by them over the electrical retail trade to ensure a regulation of the conditions under which it works, that these conditions should be improved, that manufacturers and wholesalers should be kept in their proper places with regard to such matters as direct trading and supply, that buying in quantity should be resorted to in order to reduce costs, that retail showrooms should be inaugurated, that a moderate scheme of price maintenance should be supported, that discounts should be regulated, that a policy that will attract capital and the best men should be framed, that the different sections of the industry should not compete with each other and that co-operation in the great task of educating the public should be the main object.

Chaos and Discounts.

There is little that is either strange or new in these proposals. Trading conditions in the industry are admittedly chaotic; and it is common ground that if any progress is to be made things cannot go on as they are. To take the question of discounts as an example. As we showed in the articles to which we have referred, discounts many and various exist and these operate in most cases without the application of any rule but the needs of the moment. Certain attempts have been made to improve matters, we believe with some success, but a rigid policy should be agreed and applied so that all may know where they are. The natural results of the present lack of method are that many people are securing discounts to which they are not entitled and direct selling is being resorted to by manufacturers and wholesalers to the disadvantage of the retailer. The report with which we are dealing remarks that the maintenance of a healthy and prosperous body of retailers is essential to success. Health and prosperity will not be attained until this question has been tackled fearlessly and conclusively.

Too Many Traders.

The definition of what is meant by the words manufacturer, wholesaler and retailer is also urgently required. The Contractors' Association report makes a laudable effort to deal with this problem. But the matter must be carried further. At present there are something like a dozen classes into which those dealing in electrical apparatus can be divided and the first object of any movement towards better things should be to reduce the number of sellers and to limit the activities of each class to the work to which its functions most rightly belong. To do otherwise means a division of effort, and that division is a large part of the cause of our present difficulties.

A Matter for the Whole Industry.

We therefore welcome this report of the Contractors' Association. It was what was badly wanted and we hope it will lead to definite results. But this important question is obviously not a matter for any one section of the industry alone. Speaking at the Annual Dinner of the Electrical Contractors' Association on this problem, Mr. HOWARD MARRYAT said that no one section was to blame for present difficulties. This is only a tactful way of saying that all sections are to blame and the blunter expression is nearer the truth. The contractors are to blame for an inertness which has allowed, some would say forced, manufacturers and wholesalers to become retailers. Manufacturers are to blame for falling into temptation to do what it is not their business to do and for the growth of firms who are manufacturers, wholesalers and retailers all in one. The very presence of the wholesaler is a complication to some extent necessary, but in any event a movement which should be closely watched. The net result has been that that important link with the public, the contractor, has weakened and weakened until we begin to wonder whether the time has come when it will hold any longer. A vital matter for the industry is that that link should be strengthened. Any policy which will enable that to be done will receive our support.

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The B.B.C. Controversy.

The Broadcasting Co.'s Case Examined in Detail.

By Sir WILLIAM NOBLE, M.I.E.E.

The Editor of THE ELECTRICIAN has asked me to comment on the article on the above subject by Mr. Frank W. Challis, which appeared in THE ELECTRICIAN of April 20th. Mr. Challis says he represents the views of the Electrical Importers' and Traders' Association. I shall state my own views, but as I have a good knowledge of the company and the steps leading up to its formation, I have little doubt my views will be subscribed to, in the main, by the members of the British Broadcasting Company.

What the B.B.C. Has Done.

May I say at the outset that at present there are nearly 600 bona fide British manufacturers who are members of the B.B.C. Many of these firms have acquired factories and installed plant; the others have increased their accommodation and added to their plant; all of them have engaged additional staff and workpeople. The firms in the B.B.C. have, since broadcasting commenced, invested in the wireless busines many hundred thousand pounds, and have during the past six months given employment in their factories to many thousands of workpeople who would have been idle but for this new industry. Besides these firms, however, many firms in allied trades—these I need not enumerate in this journal—have greatly increased their output and their number of workers. To all these B.B.C. and allied firms the success or failure of broadcasting is a vital matter.

Some Questions for Mr. Challis.

Who are the firms represented by the Electrical Importers' and Traders' Association? How many have factories? How much have they invested in the business? For how many *British* people have they found employment? These are pertinent questions which, I think, should be answered by Mr. Challis.

Further, when the Postmaster-General, at the outset of the negotiations with the manufacturers, required a guarantee that sufficient capital would be forthcoming to ensure successful broadcasting six firms, at the first public meeting held, undertook the responsibility. It was open to any firm to take a share in the liability, but no other firms came forward, and these six firms became responsible for a sum of £100 000.*

Another stipulation by the Post Office, *to prevent anything resembling a monopoly*, was that *any* bona fide British manufacturer of wireless apparatus would be allowed to join the company. To encourage small firms to join, one share of £1 was made the qualification. As I have already stated, nearly 600 have already joined. How many members of the Association of which Mr. Challis is secretary have joined or are eligible to join the B.B.C.; and further what has the Association contributed to the advancement of broadcasting?

I mention the foregoing matters at the outset because it is important that the public should get a clear conception of the different view points of manufacturers and importers in regard to the B.B.C.

Now as to Mr. Challis's article—I shall use the same headings as in his article.

Present System an Adminstrative Failure.

Mr. Challis opens by saying that the present system has so far failed administratively. I should rather put it that so far the B.B.C. has not had a chance. The company has been in existence only some four months, and it has up till now done remarkably well in the matter of administration, and only those with an inner knowledge of the great difficulties with which the company has had to contend are in a position to judge.

Were the agreement with the Post Office, which took some months to complete, to be strictly observed in the letter as well as the spirit, I have no doubt as to the success of the B.B.C., and it might very well have been given the brief trial of two years stipulated for by both parties to the agreement without any change. Trouble having arisen, I am personally glad the Postmaster-General has appointed a committee to investigate the whole matter.

* These are the firms sometimes referred to sarcastically as the "big six." As a matter of fact so far as Broadcasting is concerned they are "big" for it was by their enterprise that broadcasting was given so early and successful a start in this country.

Free Trade and Revenue.

Mr. Challis remarks that the royalty on apparatus in an average case is considerably the larger fee. I think it should be made widely known that the Postmaster-General stipulated, when agreeing to pay the B.B.C. half the Post Office licence fees, that a royalty should be contributed by manufacturers of about 10 per cent. of the nett selling price; the B.B.C. is therefore not responsible for this royalty, but of course agrees that manufacturing royalties are a necessity to the existence of the company. The amount the B.B.C. will receive from the Post Office will for some considerable time be but a moderate percentage of the annual cost in maintaining the stations, supplying programmes, paying staff, rents, etc.

Broadcasting will not stop in January, 1925. As neither side was sure of the future of broadcasting in this country, two years was the period stipulated by the Postmaster-General during which protection would be guaranteed to British manufacturers. Some time prior to December, 1924, the terms of the agreement are to be reconsidered. By that time there will be so much capital invested there can be no question of the cessation of broadcasting.

Cost From Licence Fees Alone.

Mr. Challis says "the proper method of raising revenue would appear to be to meet the cost of the concerts entirely by annual licence fees." An excellent suggestion—from a representative of importers of foreign apparatus. Even had the Postmaster-General last year agreed to an increased rental, which he would not, there would have been no broadcasting in this country if there were no restriction in the use of foreign apparatus. Who would have guaranteed the capital for the provision of buildings, the erection of stations, and the general financing of the company? Certainly not British manufacturers and probably not the E. I. and T. Association. I doubt if any Postmaster-General would ever agree to raise between £160 000 and £180 000 in licence fees to hand over to a broadcasting company to provide a service which would enable foreign manufacturers and British—even all-British—importers to make money.

Broadcasting Creates a New Industry.

One of the great points made—and I personally think it a most important point, especially at the time—by the then Postmaster-General was that broadcasting would create a new industry in this country. It has: thousands have been found employment. If free importation is allowed, with the foreign rates of exchange as they are at present, it spells death to the wireless industry in this country—in all such references I mean the wireless industry in so far as it results from broadcasting.

Why did wireless boom so tremendously in the United States of America with no licenses and therefore no license fees? Simply because it created a great new industry. Probably the full 100 per cent of the broadcasting apparatus in use in America was manufactured in America. I doubt if there is in that country an E. I. and T. Association.

Membership Essential for Approval.

Mr. Challis says: ". . . The B.B.C. transfer may not be used legitimately even by a manufacturer whose apparatus has been approved by the Post Office unless he joins the B.B.C. . . . " But no manufacturer can get a Post Office approval certificate unless he is a member of the B.B.C. Moreover, I doubt if there is a single *bona-fide* British *manufacturer* of wireless apparatus who is not a member of the B.B.C., or who has not applied to be a member. I doubt if Mr. Challis can give any names of such manufacturers. I may add that before broadcasting was mentioned in this country there were probably not more than twenty British firms manufacturing wireless apparatus; now there are about 600—surely proof that a new industry has been created.

Again, Mr. Challis says: ". . . Also the B.B.C. transfer can be easily bought and is being put upon apparatus of *inferior* quality. . ."—the italics are mine. The B.B.C. mark is now registered, and the company is taking steps to prevent its illegal use; in fact, already four firms have handed over their stock of B.B.C. transfers and have undertaken to sell no more. Legal action will be taken against

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any firm which sells the registered mark to firms not members of the B.B.C.

I do not, however, believe that any British *manufacturer* was making wrongful use of the transfer; it may have been done by importers, especially do I think this likely, because Mr. Challis says it was being put on apparatus of "inferior quality."

Abolish the Royalty Method.

The Post Office insisted on the royalty method, and it was a wise decision.

Turning to Mr. Challis's paragraphs marked (*a*) (*b*) (*c*).

(*a*) The members of the public who have intelligently followed the broadcasting question know quite well it is not a patent royalty.

(*b*) The B.B.C. royalty on a valve is so small that no reasonable person would object to its payment, especially since once the country is nearly "saturated" with sets, the B.B.C. will have to depend to some extent on the royalties from additional and replacement parts. In any case the additional valve or valves may improve reception from a distant home station, as well as giving reception from foreign stations.

(*c*) The public would be quite right in assuming that the British manufacturer cannot at present compete in price with countries such as Germany and Austria. Mr. Challis must be well aware of this himself. When the rates of exchange have been stabilised then this country can compete as it did before 1914. The public would be entirely wrong in thinking that the British manufacturer is grossly profiteering. He is getting only a fair return on the large sum of money invested in the business.

The Question of Imports.

I quite agree with Mr. Challis that importers are handicapped —and so they should be. If there were no form of embargo on imports from countries with a greatly depreciated exchange, the British manufacturers of wireless would have to go out of business. There would not be 600 *bona-fide* British manufacturers, and there would not be thousands of employees engaged in the making of wireless apparatus. On the other hand, the importers of foreign apparatus would flourish. This is to my mind the crux of the complaint of the E. I. and T. Association.

The public certainly pay a royalty on the sets bought, but it is not a large sum and it is non-recurrent. The annual outlay is small; broadcasting is certainly the cheapest form of entertainment possible.

The Broadcasting Agreement Impossible.

Mr. Challis refers to "the monopolistic character of the British Broadcasting Co., and the oppressive character of the B.B.C. Agreement." I wish he had enlarged on the subject of monopoly. *Every* British manufacturer of wireless apparatus may join the B.B.C. by taking one £1 share. If this is a monopoly, I am afraid I have never been able to grasp the true meaning of the term.

I happen to know every paragraph of the B.B.C. Agreement, as unfortunately I spent, in common with some other gentlemen, many hundreds of hours on that agreement. I know of nothing in it that is oppressive to British *manufacturers*. It is well known to members of the B.B.C. that Clause 4 (*j*) has been deleted, and what was intended by that Clause has been incorporated in Clause 4 (*c*).

The actual number of firms who have applied for membership is 596 and the number so far admitted to membership is 564.

Alternative Suggestions.

Mr. Challis makes a few suggestions, to which I shall briefly refer :—

1. As already stated, there is no monopoly. The firms would have been glad if the Post Office would have undertaken broadcasting, but the suggestion is mere foolishness.

2. The second suggestion is too involved to be understood, unless it means that importers should be free to sell all wireless apparatus and parts of foreign manufacture and the licensees of the Postmaster-General were free to use the same for broadcasting. Were this so there would be no broadcasting in this country.

3. The fees suggested by Mr. Challis would certainly be agreeable to importers, but not to British manufacturers and British dealers in British wireless apparatus.

The History of British Broadcasting.

Having briefly dealt with the main points in Mr. Challis's article, I may now, at the risk of some repetition, add some further observations.

The initiative which led to the formation of the company came from the Post Office. They knew that, if the American chaos were to be avoided, one broadcasting authority was essential. Then came the constitution of that authority.

At the first meeting convened by the Post Office to consider broadcasting in May, 1922, some twenty firms were represented. These were probably all the British firms then engaged or interested in the manufacture of wireless apparatus. On October 18th, when the final meeting of manufacturers was held prior to the formation of the B.B.C., over three hundred firms were represented. This large accession in numbers was due to the fact that British business men had quickly realised the possibilities of wireless broadcasting. These three hundred and many additional firms have joined the B.B.C. and have invested large sums in the business, but they did not risk this capital expenditure in the new enterprise until they had an assurance from the Postmaster-General that for at least two years they would have some measure of protection.

The protection took the form of regulations that only sets made by members and approved by the Postmaster-General should be used in conjunction with the broadcast licence, and that no foreign material should be used in such sets.

Another reason for the Postmaster-General's approval of sets was to ensure against reception being spoiled by use of reaction.

Not only did the members of the B.B.C. undertake the commitments of the broadcasting service and lay out capital in new production as a result of the protection promised, but all the transmission patents held by members of the company, without which broadcasting could not be carried on, were pooled without charge to the members of the company.

Wireless Becomes Popular.

What happened? Wireless became immensely popular. Many technical journals taught their readers how to make up simple sets. Hundreds of firms came into existance, and more, with no previous interest in wireless, opened new departments. Widespread evasion of any licence ensued, and widespread infringement of the terms of the licences. Companies with no part in launching the enterprise reaped the benefit.

Four thousand firms are now said to claim a revision of the constitution. I should like to have a list of these firms. Where were they eight months ago with respect to wireless?

The agreement was negotiated with one Postmaster-General, passed and signed by another, discussed more than once in the House of Commons, and approved by the overwhelming sense of the House. The opposition comes now, when broadcasting has been made popular by the efforts and risk of others, not from responsible bodies of commercial opinion, but from importers and those who are prepared to reap where others have sown.

B.B.C. Sympathetic Towards Amateurs.

The Broadcasting Company are entirely sympathetic towards those who wish to make their own sets, but who, under the present regulations, are unable to do so without infringement. Although the terms of the agreement are clear, they have given proof that they will consider sympathetically any modification which does not violate the fundamental conditions of their licence. The issue of a constructor's licence on any terms means a serious diversion of trade from those six hundred members who, in faith of the agreement and the protection promised, subscribed the capital and proceeded to manufacture. Nevertheless, the company consented to the issue of such a licence, and the present hitch is due to a difference of opinion as to its terms. The Postmaster-General's proposal that the constructor's licence should be issued at 10s. is agreed, but the terms, in the company's view, must be consistent with the agreement. If the Postmaster-General proposes an alteration in the agreement which would deprive the B.B.C. of a considerable proportion of their revenue it is surely not unreasonable for the B.B.C. to ask the same protection on component parts which he has granted on complete sets.

A Speaking Flame.

Dr. de Forest's Invention.

It is reported in the "New York Herald" that Dr. de Forest has invented a speaking flame and expects immediately to be able to apply it to "talking pictures" and broadcasting. He is also said to have invented a "reversal" of the thermophone for the same purpose. In this apparatus a wire heated to a dull red electrically changes its resistance when the sound waves impinge upon it so that a representation of these waves can be obtained in the microphone.

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The Control of the Speed and Power Factor of Induction Motors.

In the concluding portion of his fourth lecture, Prof. Miles Walker compares the performance of an induction motor when provided with a Le Blanc exciter and a d.c. exciter, and discusses the use of pole changing devices in conjunction with the former equipment.

Lecture IV.

Induction Motors in Different Exciters.

The performance of an induction motor when provided with (*a*) a Le Blanc a.c. exciter, and (*b*) a d.c. exciter, may be compared. In recent years the so-called synchronous induction motor has come very largely into use. This consists of an induction motor designed with a higher reluctance in its magnetic

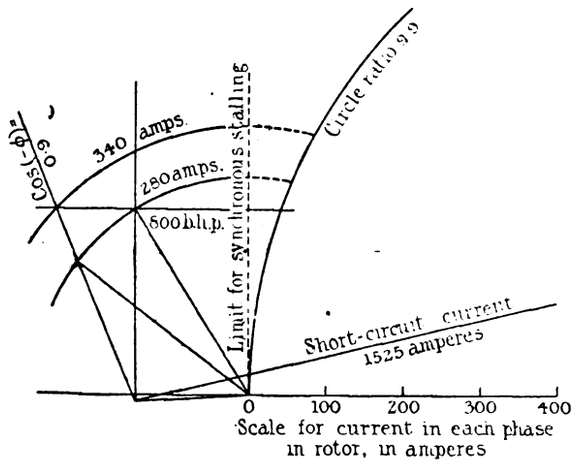

FIG. 46.

circuit than an ordinary induction motor, so as to require more ampere turns on the pole. The reluctance is obtained by increasing the air-gap or by saturating the iron teeth of the rotor. The performance of this machine is very fully described in a recent paper by the late Dr. Kapp.* It is there stated that the cost of this type of machine is approximately 20 per cent. more than the cost of an ordinary induction motor of the same output, due to increased losses in the rotor.

At an excitation of 340 A it runs at full leading power factor of 0·9 and has then an overload capacity of 50 per cent. These motors are perfectly satisfactory for the purposes for which they are supplied. It may be that the reason why electrical manufacturers supply this type of machine instead of an induction motor supplied with a phase advancer is because they regard the induction motor and exciter as standard machines with which they are familiar, whereas the phase advancer is as yet strange to many of them.

An inspection of the characteristic curve of the induction motor supplied with phase advancer given in Fig. 41 shows the great superiority of this combination.

In the design of an ordinary induction motor the designer is considerably hampered in getting a large ouput from a given frame, because, in view of the necessity of getting a good power factor he is limited in depth of slot he may use. Moreover, the necessity of keeping down the magnetising current introduces further limitations. If, however, an induction motor is designed for use with a phase advancer to operate at unity power factor, not only is it possible to make the slots considerably deeper than in an ordinary induction motor, but the copper is utilised to better advantage. Besides this, it is possible to work at higher flux density in the gap because one is not afraid of the large magnetising current. It is no exaggeration to say that one could take the frame of a 500 H.P. induction motor as ordinarily designed and build a 700 H.P. motor on it for use with a phase advancer. As the losses in the phase advancer need not exceed more than 0·75 per cent. it is easy to save these losses in the efficiency of the main motor, so that the efficiency of the combination would be higher than an induction motor without phase advancer.

If an advancer is designed to generate an e.m.f. which assists the e.m.f. generated in the rotor circuit, the slip of the main motor can be reduced to $\frac{1}{2}$ per cent. and the output in the kVA rating of the advancer need not be more than $\frac{3}{4}$ of 1 per cent. of the rating of the induction motor.

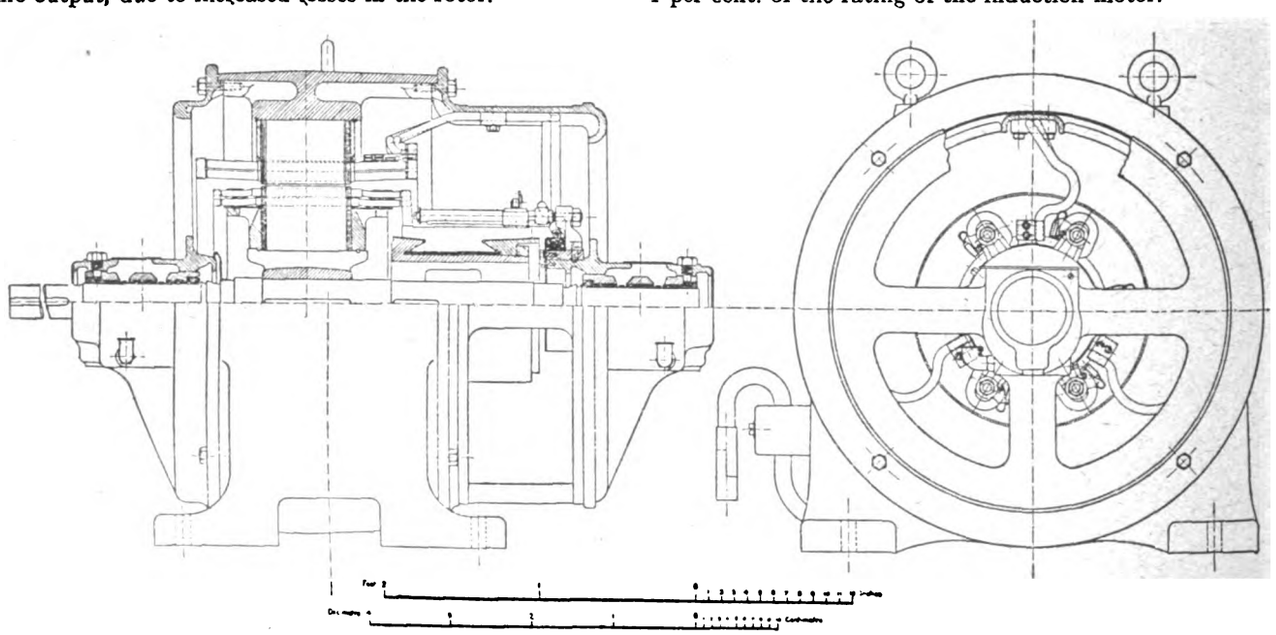

FIG. 47.—SECTIONAL VIEW OF A 30 kVA PHASE ADVANCER SUITABLE FOR IMPROVING THE POWER FACTOR OF A 1 500 H.P. INDUCTION MOTOR TO 100·95 LEADING.

Fig. 46 gives the circle diagram of a 800 H.P. Crompton synchronous motor of 2 000 V, 25 cycles, 250 revs. per min. With an excitation of 280 A on the rotor, the motor runs at unity power factor at full load and has then an overload capacity, and at that excitation will take an overload of about 20 per cent. before falling out of step.

*"Journal I.E.E.," vol. 61, p. 89.

The magnetic circuit of the phase advancer must have sufficient cross-section to take the maximum flux, while the rating of the machine depends upon the square root of main square value of the flux. In this respect the advancer is at a disadvantage. As soon as the manufacturers get more familiar with this type of machine they will supply it instead of the d.c. exciter.

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Instead of the induction motor being all the time over-excited and having, therefore, an unnecessary I^2R loss and a danger even then of the machine going out of synchronism and causing pulsations in the exciter circuit, it is possible with a phase advancer to supply an excitation just sufficient to give unity power factor at full load. Where an overload is thrown upon the motor the phase advancer automatically gives a much larger current so that the useful overload capacity of the motor is very much greater than with a synchronous machine.

It will be seen from the sectional elevation of the phase advancer given in Fig. 47 that there is nothing very difficult, from the manufacturers' point of view, in building machines of this type instead of the ordinary exciter. The punchings are like those used in an ordinary induction motor with some of the teeth cut away (see Fig. 48) and the winding is of the ordinary two-layer type (see Fig. 49).

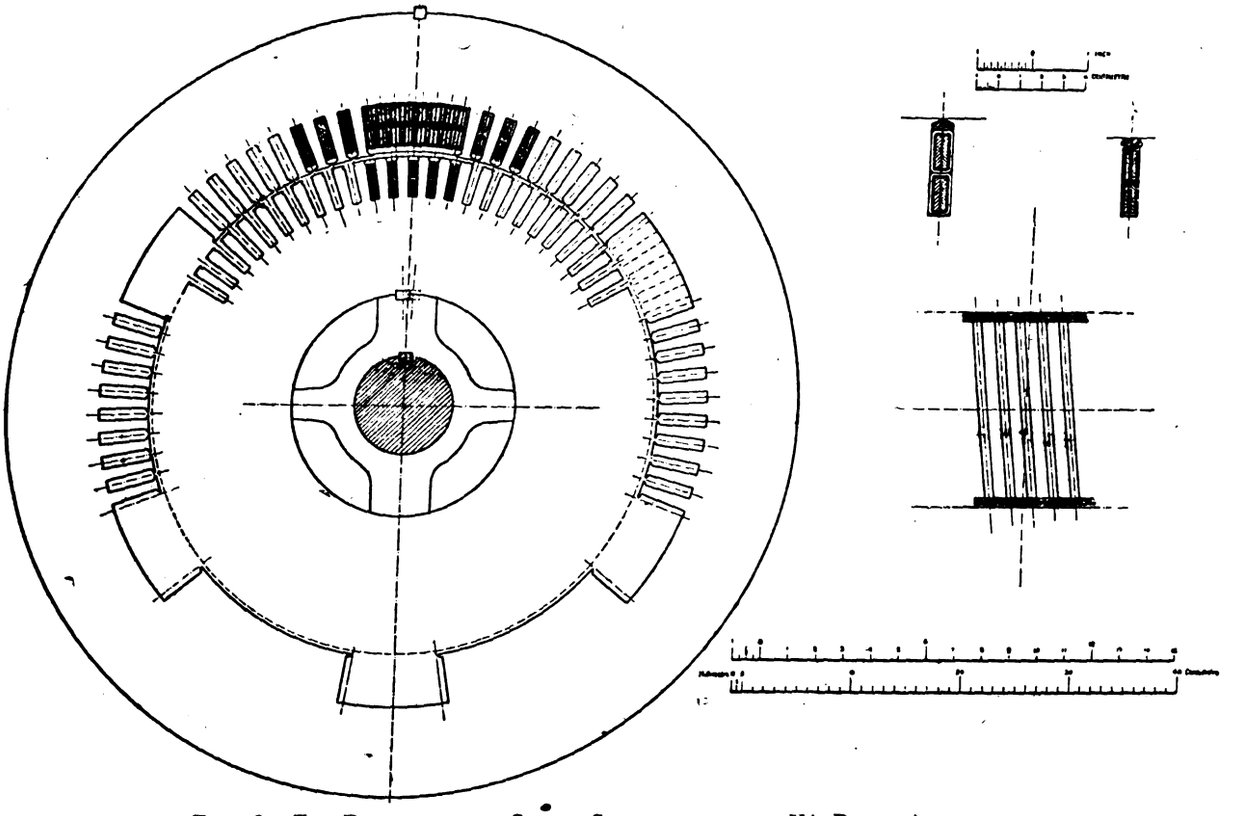

FIG. 48.—THE PUNCHINGS AND COPPER SECTIONS OF A 30 KVA PHASE ADVANCER.

Use of Pole Changing Devices in Conjunction with the Le Blanc Exciter.

Where a very wide range of speed is required on an induction motor it is possible to use pole-changing devices in conjunction with the Le Blanc exciter for getting intermediate speeds at high efficiency. For instance, by building a Hunt cascade motor having normal running speeds at 600, 300 and 200 revs. per min. and installing a Le Blanc exciter having a kVA rating of 25 per cent. of the motor, it is possible to run at any speed from 50 to 75 revs. per min. with good efficiency throughout the range. At the same time, the power factor can be maintained at unity.

The Kapp vibrator has been very fully described in the "Journal of the I.E.E.," vol. 51, p. 243. It has one advantage over the Le Blanc exciter in that the speed of rotation is low when the current is at its maximum. This makes the commutation problem easy. The Le Blanc exciter, however, commutates perfectly well, and has the great advantage of having only one armature and only three sets of brushes, instead of six. Moreover, the speed of the Le Blanc exciter can be made very high, so that the D^2L is very much lower than for a Kapp vibrator. One of the greatest advantages of the Le Blanc exciter, however, is that by its means the slip can be reduced and in that way the kVA of phase advancer required is very much reduced.

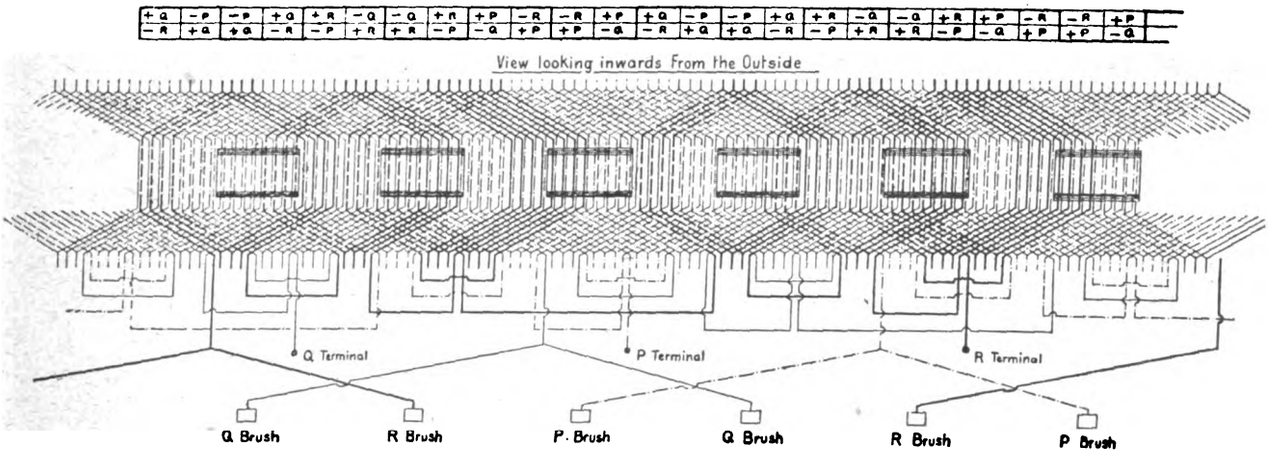

FIG. 49.—COMPENSATING AND EXCITING WINDINGS OF A 30 KVA PHASE ADVANCER.

Dr. T. F. Wall has described* some interesting experiments with lead accumulators used as condensers in series with the rotor circuit and has shown that a leading current can be obtained by their use.

* "Journal I.E.E.," vol. 61, p. 128.

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The Drive of Power Station Auxiliaries.*

By L. BREACH and H. MIDGLEY.

The Paper comprises a consideration of (1) the different types of auxiliaries in a station, (2) the different types of supplies available, and (3) the suitability of the types of auxiliaries and supplies for varied conditions of working.

At the present time auxiliaries require much thought and attention from the designing engineer. In selecting a scheme the purpose of the station must be considered, i.e., whether for constant running on high load factor or for ordinary commercial loads with a factor of about 30 per cent., or whether the plant may run only for a few hours in the year. In other words, it must be determined whether continuity of supply or simplicity of design are the more important. The Paper is concerned only with a modern station equipped with large turbo-alternators, mechanical stoking, etc.

The Grouping of Auxiliaries.

Auxiliaries may be grouped according to length of time during which they may be shut down without causing serious inconvenience or damage. In a large power station with 10 000 kW turbo-alternators loss of vacuum must at all costs be avoided. The grouping may be as follows :—(*a*) those which must on no account stop (air extraction and station lighting), (*b*) those which must not stop longer than, say, 60 secs. (boiler feed pump, power for control circuits, etc.), (*c*) those which may not stop for not longer than 5 min. (water extraction, individual stokers and forced draught and induced draught fans, etc.), (*d*) those which may stop for about 12 hours without shutting down the station (coal and ash conveyors, coal crushers, pumps for water-softening plant, etc.).

The only way to ensure continuity of supply from pumps under (*a*) is to have duplicates (unless the flow of circulating water is due wholly or partly to gravity). Connections should be so made that an electrical fault on one circuit will not shut down both pumps. The importance of alternative supplies for the station lighting is obvious.

Auxiliaries classed under (*b*) must be so arranged that in event of failure others are immediately available, while the same applies to (*c*), though a longer interval before the change-over is permissible. As regards (*d*) spares are carried for parts likely to cause trouble, e.g., motor-armatures. These can be installed without entailing a shut-down for a few hours, during which time the auxiliary can be dispensed with.

Possible Systems of Auxiliary Supply.

Possible systems of auxiliary supply include : (A) direct steam drive, (B) electric from main alternators via h.t. busbars, (C) electric from main alternators direct, (D) electric from main alternators via special windings on main transformers, (E) electric from special steam driven a.c. or d.c. generators (house set), (F) electric from special a.c. or d.c. generator on shaft of main turbo-alternator. These systems must be considered in connection with starting up, running on full or no load, shutting down any section of system, and all conditions of faults at electrical end.

In deciding the merits of these schemes reliability, simplicity, attention needed, first cost, effect on overall efficiency, complete working costs and effect on feed-temperature and "heat balance" must be considered. Absolute reliability comes first, and cost should be regarded as secondary. In general, the cost of auxiliary plant is only about 5 per cent. of that of the whole station. Direct steam drive requires more attention than electric drive, but is absolutely independent. The engine type need only be considered for very small sizes, but turbine-drive is useful. Much attention must be devoted to keeping the many steam pipe joints tight, and the heat losses somewhat reduce overall efficiency. Direct steam drive is, however, specially suited to the boiler feed pump. As regards (B) once it is decided to step down for the auxiliaries one may as well reduce to 400 V for all motors. The choice of a.c. and d.c. supplies for auxiliary motors is a debatable question. Direct current motors require more attention than do a.c. motors, but can be economically subjected to speed regulation and have the great advantage of being able to be run off a stand-by battery.

The greatest drawback to a.c. motors is that speed-regulation is not economical, and the number of speeds available from cascade motors, etc., is limited. System (C) was at one time very popular, as if one of the main generator switches is opened the auxiliary supply is not cut off. System (D) is in use at the Dalmarnock station of the Glasgow Corporation, but is only suitable when step-up transformers are directly coupled to their respective alternators and switching carried out on h.t. side. The system (E), electricity supply from special house set, is the most popular in this country, but the disposal of the exhaust steam requires consideration. It would appear advantageous to dissociate the house set from the duty of feed heating. The use of a special alternator on the main alternator shaft (F) is a comparatively new proposal, and has evident merits ; the choice of a.c. or d.c. is a matter for discussion ; in the latter case it would run in parallel with the other d.c. plant and battery which is available for emergencies.

Effect of Station Conditions.

The conditions of the station are also important, e.g., whether it is isolated, one of several linked stations within the area supplied, or a stand-by station. In the main part of the Paper the author compares seven different schemes assuming that all are designed for a station containing five 25 000 kW turbo-alternators of which four would be required for maximum load. Steam is assumed to be required by four boiler houses one of which supplies full load steam for one turbine. Each boiler house contains six boilers, five being required for the maximum output of one turbine, and each turbine has two separate circulating pumps. Each set of turbo-auxiliaries is generally independent of the others ; similarly the group of boilers for one turbine forms a complete unit, though in emergencies it may be used to supply steam to any turbine. The use of two circulating, two air and two extraction pumps is practically essential for 25 000 kW turbo-alternators, but for smaller sizes one may have two circulating pumps for the condensers of two turbines, running in parallel on the water side ; the two pump motors being fed from independent sources.

In the original paper details of the auxiliaries are given and are the same in all schemes. Each boiler house contains one electrically driven and one steam driven feed pump, either capable of supplying the whole boiler house, and both always available for immediate use. The feed systems of different boiler houses are also interconnected. Six motors are provided for the stokers, of which only three, of 10 H.P. each, are required at one time. Except for the stand-by feed pump, steam driven auxiliaries are not considered in view of the extra attention they require and the increase in the boiler-feed make-up.

Regulation with A.C. Motors.

Where a.c. motors are used, regulation should be obtained by variable speed gears for stokers, by valves for pumps, and by dampers for fans. In all cases but one (No. 5) the main alternators are assumed to be connected to 6 600 V busbars, which are in four sections. The h.t. system is also in four sections coupled only at the main station, but not at sub-stations. Switches are inserted between various sections of the sub-busbar, but are only for use in emergency or cleaning. The number of oil-switches on the main busbars has been kept to a minimum, since every switch must be capable of breaking the whole capacity of the section to which it is connected. Synchronous motor-generators are only proposed where necessary to provide for feeding a.c. bars from d.c. bars. In other cases induction motors are suggested.

The various schemes all assume a station which is not interconnected with any other supply. The schemes only are concerned with motors coming under the first three groupings, no special provision being regarded as necessary in the case of those which can be shut down for periods up to 12 hours.

In the original paper the chief features of the various schemes are set out and the circuit arrangements illustrated by diagrams.

The Possible Schemes Analysed.

Scheme 1 assumes a *special d.c. generator on the shaft of the main turbo-alternator.* The generators would be self-excited, and reverse current relays are needed between them and d.c. busbars to prevent any possibility of motoring. Maintenance would be fairly high because of the large number of d.c. motors. However, reliability is an important feature. Should any minor trouble ensue, the troublesome generator would be

* Abstract of Paper read before the Institution of Electrical Engineers.

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switched off the bar, the d.c. supply being maintained by the other generators.

Scheme 2 assumes *two auxiliary a.c. busbars, each fed by a transformer*. An interconnector is provided between the two 400 V a.c. busbars, so that if either transformer were out of action all the a.c. motors could be fed from the other transformer. However, this would mean the sacrifice of the duplicate supply, so possibly an additional transformer should be carried for use in such emergencies. In this system it would be desirable to have at least one of the motor-generators of the synchronous type so as to be reversible. The scheme is simple in operation, and efficient, and maintenance is moderate. But where continuity of supply is very important it is doubtful if the scheme can be considered really satisfactory.

Scheme 3 involves a *special a.c. generator on the shaft of the main turbo-alternator, for turbine auxiliary motors only*. This scheme has also merits as regards simplicity and ease of maintenance and the special generator should be more satisfactory than the d.c. generator in scheme (1) and continuity of supply could be relied upon to a considerable extent.

Scheme 4 includes a *special a.c. generator on the shaft of the main turbo-alternator, for turbine and boiler house auxiliary motors*. Some special switching arrangement is necessary in changing over so as to avoid paralleling auxiliary generators either with main supply or with each other. This can be effected by a plug board with six incoming supplies, illustrated diagrammatically in the original paper, but the details would require careful design. In starting up the first set, steam should be raised under natural draught, and the author describes the series of processes in detail. The chief difficulties in the scheme appear to be connected with the change-over switch, as this would give some risk of mistakes, and would probably be expensive.

Scheme 5 is based on *a special winding on the main step-up transformer*. This scheme is also efficient, and does not require much maintenance, but the exact degree of reliability is open to question. The change-over switch would again require care, but appears to be simpler than that in Scheme 4.

Scheme 6 assumes *two auxiliary busbars fed respectively by a transformer and motor-generator*. This arrangement should be reliable, flexible and simple to operate. Maintenance would, however, be high because of the large number of d.c. motors used. As a large battery is required, the first cost of the scheme would be high.

Scheme 7 assumes *two d.c. auxiliary busbars fed respectively from a motor-generator and condensing house service turbo-alternator*. This scheme would be simple and highly reliable, but extra attention would be required because of the inclusion of a house-set, and maintenance would probably be high.

Advantages of the Various Schemes.

In the concluding portion of the Paper the authors review the advantages of the various schemes, and their merits and drawbacks are summarised, in a comprehensive table, under such headings as method of starting first, second and succeeding sets; effect of fault (*a*) with one set on load, (*b*) with two or more sets on load, and general suitability for station with 33 000 V busbars.

While a decision as to merits is somewhat difficult, the authors suggest that the schemes might be arranged in three groups, the first and best group containing Schemes 1, 6 and 7, which are of approximately equal merit; the second group comprising Schemes 2, 3 and 5, while the third group would contain only Scheme 4, which is an example of what to avoid.

We have received from ADAM HILGER a pamphlet describing Prof. Coker's apparatus for determining the distribution of stress in structural and machine members. This apparatus, as well known, makes use of polarised light, and by it it is possible to measure the stress distribution under any system of loads within ± 2 per cent. The pamphlet is excellently illustrated, and contains a useful bibliography. A leaflet dealing with the Low-Hilger audiometer has also been received.

The Post Office, in conjunction with the Air Ministry, is now communicating DAILY WEATHER REPORTS TO TELEPHONE EXCHANGES. For this purpose Great Britain has been divided into forty districts, and each exchange has the forecast appropriate to the area in which it is situated. The forecasts cover the period from 6 p.m. on the day of issue till 6 p.m. on the following day. The forecasts are available between 5 p.m. and midnight each day on demand by telephone subscribers, and should be of especial benefit to farmers and other residents in rural areas. Subscribers on rural party lines receive the information free of charge, a local call fee being charged in the case of other subscribers.

Institution of Electrical Engineers.

At the meeting of the INSTITUTION OF ELECTRICAL ENGINEERS on Thursday, April 26th, a Paper was read by Messrs. L. Breach and H. Midgley on "The Drive of Power Station Auxiliaries." This will be found in abstract on the preceding page of this issue.

In announcing the discussion was open, the PRESIDENT commented on the "thin" meeting, and appealed to those present to speak. To do so, he added, was only fair to the authors.

A Flexible System Required.

Mr. W. B. WOODHOUSE (Yorkshire Electric Power Co.) remarked that in power station design undue emphasis was often placed upon production cost, and especially was the question of fuel consumption exaggerated at the expense of other factors. He was delighted, therefore, to read a Paper which stated that reliability should be the first consideration. The whole question of reliability was determined by the complete rigidity of connection which alternating current produced. A disturbance on any part of an a.c. system was carried immediately and completely to every other part of the system. If the links on the electrical side could be made flexible instead of rigid, as at present, the question of station auxiliaries would be very much simplified, and steam driven auxiliaries could be abandoned. It would also be possible to consider a system in which all the auxiliaries were a.c. The disadvantages of small steam driven auxiliaries increased with higher pressures, and for this reason the tendency would be against a large number of steam auxiliaries. With large units the house turbine became a reasonable size; a high steam pressure could then be used and a fairly efficient result obtained.

The Psychological Effect of a Stoppage.

Mr. H. BRAZIL emphasised the psychological effect of a breakdown on the staff. Sections (a) and (b) of the author's classification ought to be amalgamated, and arrangements ought to be made for the plant in section (d) to be started up in less than twelve hours. Rotary converters were not desirable things to have in a generating station. Induction motors were most reliable as regards remaining in circuit when a breakdown occurred, but it was not sufficiently known how good synchronous motor generators were. It was a mistake to economise too much on batteries, as these often enabled the station to be started again very quickly.

Economies of the Right Auxiliary Plant.

Mr. J. S. HIGHFIELD said that not only was absolute reliability of the first importance from the point of view of maintaining the supply, but also to save the plant from a great deal of damage. If the auxiliary plant was used in the right way it effected many economies. It was imperative that feed pumps, circulating pumps and certain other apparatus should be run quite independently of the main plant. That could only be done by having a separate steam plant or by supplying them from an auxiliary turbine quite independent of the main station. He preferred the latter, and the authors had given many reasons why it was better. Batteries were useful so long as they were charged, but when there was a serious accident in the power station, unless the battery was of an enormous size, it was likely to become discharged. A battery was essential in a large plant for maintaining a certain amount of lighting.

Importance of Duplicate Auxiliaries.

Mr. L. M. JOCKEL said he could hardly imagine running a large modern turbo-alternator to atmosphere for more than about two minutes. Any operating engineer who had tried it with modern water-tube boilers knew that the results were disastrous, and that there was a complete collapse. The authors ought to have included the water extraction pumps as well as the air extraction pumps under the heading of (a) in their classification of auxiliaries and times of stoppage. It was quite possible to run the air extraction pumps for several minutes—he had helped to do it for ten minutes. Similarly, in regard to (c), ventilating fans were included as permitting a possible stoppage of five minutes. But with independent ventilating fans it was possible to keep them running for long periods. Duplicate auxiliaries were most important, particularly with the larger units. The direct steam driving of auxiliaries was a reliable and economical proposition at first sight, but he was glad to see the authors were not converted to it. He did not think the authors had done justice to the scheme of electric drive from main alternator *via* h.t. busbars, and on the question of a.c. *versus* d.c. for auxiliary

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motors, whilst it was true that in some cases there was trouble with d.c. motors, that could very often be traced to the motors being too small for the job or to unsatisfactory machines being supplied due to competitive prices. It was stated in the Paper that electric supply from house service set was the most popular system of auxiliary electric supply in the country, but he was not convinced that that was so. The idea had been carried out in America, but the results showed that the heat balance was not very much superior.

Mr. W. E. HIGHFIELD referred to the difficulties of designing a special generator to run from the shaft of the main alternator. These difficulties were a drawback to the schemes 1, 3 and 4 referred to in the Paper. The suggestion that a group of boilers should be fed by two feed pumps, one steam driven and the other electrically driven, was all right when all the boilers were working, but what happened if only a few of the boilers were in use ?

A Word for High Tension A.C. Supply.

Mr. J. R. COWIE thought the authors were wrong in disregarding 3 000 V supply for the larger auxiliaries. The paper raised a thorny problem which anyone could sit down and try to think out, and it would have been useful if the authors had gone further and shown how the necessary power was to be distributed, because it was most difficult to work out the cable system. Auxiliary switchboards should be close to the control engineer, who was generally some distance from the power station.

The Author's Reply.

Mr. H. MIDGLEY, in reply, said that more flexibility could be achieved by using reactances. The house turbine had not been considered in any of the schemes because it involved extra operating staff. The authors' main objection to the house turbine was on that account. The battery was one of the most useful pieces of apparatus in the station, and there had been instances where it had been installed of breakdowns lasting for a much shorter time than would otherwise have been the case. The fascination of the thermo-dynamic aspect was a thing which might be overdone ; the more important thing was to obtain a reliable supply with the simplest possible system.

Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

BROADCASTING AT GLASGOW.

To the Editor of THE ELECTRICIAN.

SIR,—I have read with some interest the article entitled "Broadcasting at Glasgow" in your issue of April 13th. The author calls it "Some Personal Impressions," but I cannot agree that these impressions are entirely mine in all respects, and I would ask you to bring the following points to his notice.

The writer speaks of a complete cessation or cut-off of the broadcast which occurred "for a second or so." It is physically impossible in the normal way for the apparatus to cease oscillating through over modulation for so long a period as a second, because a device is used whereby if any voltage at all is impressed on the valve, the oscillations are still generated in the radiating system. If this occurs, it is an intermittent fault at the transmitting station due to some accidental cause, not through any fundamental poor design in the apparatus.

The author states that "the microphone should be placed in such a position or so screened that under no circumstances can the amplitude reach this breakdown point." If the writer would tell us how to get over "blasting" as it is called, he will largely help the progress of the art.

There is an arrangement at work in the Glasgow studio whereby the control is adjustable inside the listening room, which is next door and has a view into the studio. But, and here comes the rub, how is the poor wretched controller to know when the singer or speaker is going to change from a *ppp* to *fff* either in speech or in music ? The man must be a prophet, not an operator, if he is to know this. Of course he tries his best, but I would ask the correspondent to have a try at the game and even up the broadcast by turning a handle. Of course, the transmission could be consistently under modulated, but then spurious noise would be present.

Automatic limiting methods look hopeful at first, but it must be remembered that all amplification must be distortionless, and it is difficult to conceive a limiting device which gives no distortion. This is not to say that the problem is intrinsically insoluble, but a little thought and an experience of the complexities of the subject will show that it is not easy of solution.

I felt I could not let the article pass without the above comment, which I hope shows that the problem of solving the "blasting" trouble is not so simple as might, from reading the article, be supposed.

It is very pleasing, however, to read that your correspondent so enjoyed the Opera and other transmissions. I hope all your readers agree that we can give, and have given, very good transmissions, but that we always "study to improve."—I am, etc.,

For the British Broadcasting Company, Ltd.,
P. P. ECKERSLEY,
Chief Engineer.

London,
April 30th.

MODERN BOILER HOUSE PRACTICE.

To the Editor of THE ELECTRICIAN.

SIR,—As the correspondence which followed on Mr. David Brownlie's article shows that there is a keen interest amongst engineers on the subject of boiler-house efficiency and boiler-plant testing, I suppose that many readers will be interested in a discussion in your paper of the testing codes. I myself have made many tests according to the Continental code, and have thus been able to discover its good points as well as its faults. Together with Mr. Gerken, manager of the Pluto Stoker Company, at Nymegen, Holland, I have studied this code and we have tried to find a more up-to-date form for it. I should be very pleased if you would allow me to publish this in your paper, and in this case I hope that Mr. Brownlie and other readers will be good enough to give their opinion of it. In this way we might perhaps help to arrive at an international code, as suggested by Mr. Brownlie in his book on boiler-plant testing.

There are many questions arising from the very interesting correspondence in connection with Mr. Brownlie's article, but I will only draw the attention to one question which has not yet been discussed, and that is what has to be done if during the tests the safety valve of the boiler is working. In that case a certain amount of steam leaves the boiler as saturated steam instead of superheated steam. Now the amount of heat units required to evaporate 1 lb. of feedwater of 180 deg. F. to saturated steam of 210 lb. is 1 061 B.Th.U. To superheat this steam to a total temperature of 677 deg. F. 160·5 B.Th.U. are necessary. Thus, by blowing off saturated steam instead of superheating the steam 1 061 B.Th.U.'s instead of 1 221·5 B.Th.U.'s are used. If the tests are calculated as if all the steam had been superheated, the total efficiency obtained in this way will be higher than the real total efficiency. Could Mr. Brownlie tell me if this point has been foreseen in the contract ?

J. EDWIN O'BREEN.

London,
April 27th.

Books Received.

Journal of the Institution of Electrical Engineers. (London : E. and F. N. Spon, Ltd.) 10s. 6d. net.

"The Radio Experimenters' Handbook." By P. T. Coursey. (London : The Wireless Press, Ltd.) 3s. 6d. net.

"How to Build Amateur Valve Stations." By Philip R. Coursey. (London : The Wireless Press, Ltd.) Pp. 70. 1s. 6d. net.

"Wireless Telephones." By J. Erskine-Murray, D.Sc. (Third Edition). (London : Crosby Lockwood and Son.) Pp. 84. 4s. 6d. net.

"Electrons, Electric Waves and Wireless Telephony." By J. A. Fleming. (London : The Wireless Press, Ltd.) Pp. 326. 7s. 6d. net.

"Elektrische Durchbruch-Feldstarke Von Gasen." By Prof. W. O. Schumann. (Berlin : Julius Springer.) Pp. 246. 5s. 10d. net.

"Alternating Current Electrical Engineering." By W. T. Maccall. (Cambridge : University Tutorial Press.) Pp. 493. 15s. net.

"A Dictionary of Applied Physics." Vol. IV. Edited by Sir Richard Glazebrook, K.C.B. (London : Macmillan and Co.) Pp. 914. 63s. net.

Science Abstracts—Sections A and B., Vol. 26, Part 4, No. 304. Issued by the Institution of Electrical Engineers. (London : E. and F. N. Spon, Ltd.)

Leave has been granted TO AMEND PATENT APPLICATION No. 33 247 and cognate application No. 7 115 of 1922 (Gilson) so as to include the Dubilier Condenser Company (1921), Ltd., as applicants.

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A Short Circuit Test on a 40 000 kVA Turbo Alternator.

An interesting test, subjecting a 40 000 kVA, 6 600 V turbo-alternator to a sudden single phase (line to line) short circuit, when running excited at full voltage, was made recently at the Rotherham Corporation Electricity Works, in the presence of Mr. Edward Cross, the engineer and manager. This machine is the largest power unit which has been constructed in this country and was supplied by the BRITISH THOMSON-HOUSTON CO.

Details of the Test.

In order to carry out the test, the section of the busbars to which the machine is normally connected was isolated from the rest of the system on the far side of the busbar interconnecting switch, and two of the three terminals of this switch, on the far side, were short circuited by heavy copper connectors.

The actual short circuiting of the machine was performed by closing the busbar interconnecting switch, the main switch having been set to trip instantly on overload, thus making the conditions much more severe than when the time-lag device is used. In this manner a test was obtained, not only on the alternator, but also on the oil switch which was used, this being one of the well-known B.T-H. motor operated (H6) type.

It is interesting to note that the switch opened the fault in an extremely satisfactory manner, the only visible result being the throwing of a small quantity of oil, estimated at about half a pint, the cleaning up and replacement of which is a very small price to pay for clearing a fault on the busbars of a large power station. On a similar switch, used to make the short circuit, no oil was thrown and no parts were in any way damaged despite the very severe conditions of closing on a dead short circuit.

An Oscillograph Record.

The accompanying illustration, which is reproduced from the oscillogram, gives a complete record of the short circuit current, which, at the moment of short circuit, rose to maximum R.M.S. value of 18 200 A, i.e., 5·2 times the normal rated current of the machine. This corresponds to a short circuit reactance of 19·2 per cent. as usually expressed in regard to full load current.

A maximum short circuit current of only 5·2 times the normal full load current is considerably lower than has usually been obtained with turbo-alternators. The advantage, however, of keeping the maximum current at a low figure is obvious; the forces are correspondingly low, and, as is shown by this test, safety of operation is obtained even under the severe conditions of a short circuit on the busbars.

It is not always an easy matter to design a successful high reactance alternator, but the British Thomson-Houston Co. have always maintained that immunity from trouble under short circuit was one of the first considerations, and the results of this test justify their policy. However, in view of the size of the unit under test, the forces are necessarily large and it is very satisfactory to find that the whole of the installation, including turbine, alternator, cables and switchgear, withstood the test without any signs of distress. The oscillogram shows the stator current (curve No. 1), the earth current (curve No. 2), the line voltage (curve No. 3) and the rotor current (curve No. 4).

Voltage Conditions.

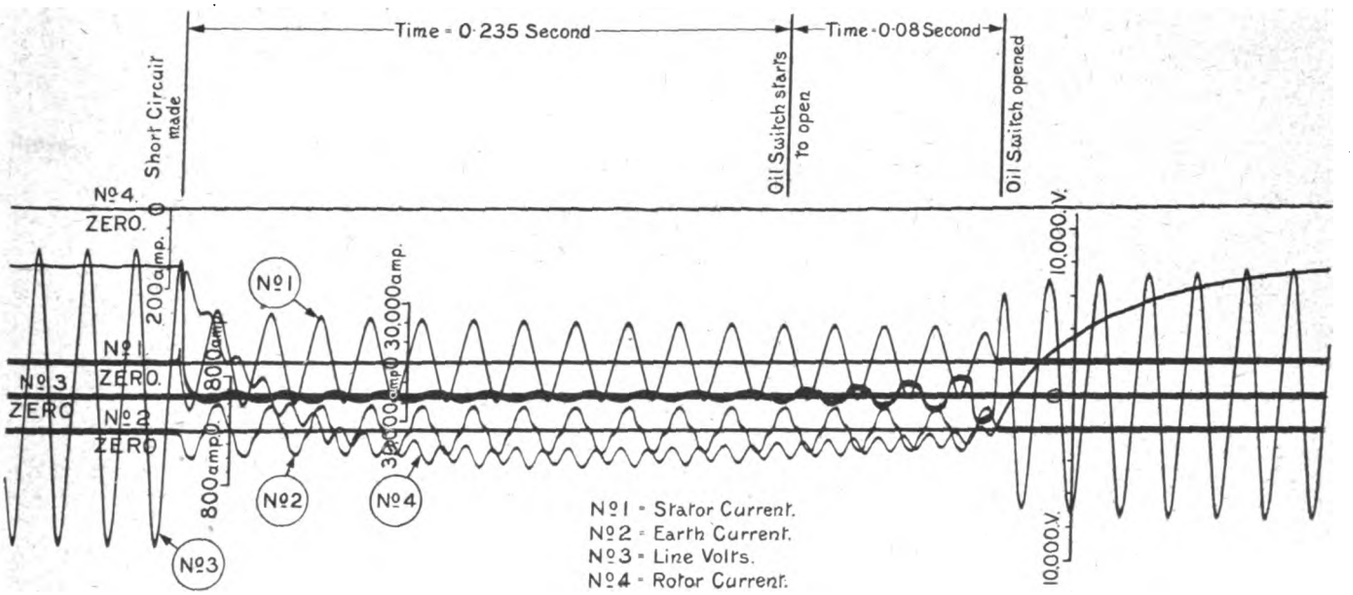
The voltage, which, of course, falls practically to zero when the short circuit is applied, rises again to normal value after the fault has been cleared. Also, during the period of short circuit it will be noticed that this curve assumes a constant ripple, the increase in amplitude at the end of this period indicating the point at which the contacts of the switch commence to open. The increase in amplitude of this curve continues from this point until the switch breaks the circuit completely, when the curve again rises to normal values.

The small amplitude of curve No. 2, the current flowing through the neutral connection of the machine, is due to the current limiting resistance through which the neutral point is connected to earth.

Sine Wave Closely Approximated.

Although the machine was subjected to a single phase short circuit, it is interesting to note, in curve No. 1, how closely the alternator current approximates to a sine wave, the usual distortion of the current wave under short circuit being largely eliminated by the efficient squirrel cage windings on the rotor; the effect, however, of the heavy short circuit can be seen in the small double frequency ripple which appears in the rotor current curve (No. 4).

The timing of the oscillogram shows that the operation of the overload trip of the switch was effective in rupturing the current at the end of 16 cycles, that is, after approximately $\frac{1}{3}$ sec.



OSCILLOGRAMS OF TEST ON 40 000 KVA TURBO ALTERNATOR.

A Metropolitan-Vickers Long Service Association.

A new association has been formed at the Metropolitan-Vickers Electrical Co.'s Works at Trafford Park, the members of which can all show 20 years' service or more. It speaks well for the conditions of service with the company when it is recorded that there are already 302 members of this association, the majority of whom, including ten women, are workpeople.

On Monday the Association held its first dinner and social evening at the Works. The two toasts of the evening were "The Metropolitan-Vickers Electrical Co." and "The Metropolitan-Vickers Long Service Association." The first of these was responded to by the managing director, Capt. R. S. Hilton, who took the chair, and the second by Mr. S. Ratcliffe, one of the oldest employees of the company, and Chairman of the Works Committee.

The annual meeting and conference of the WHITLEY COUNCIL (South Coast District) for the electricity supply industry was held at Bournemouth last week. The programme included a visit to the Bourne Valley power station.

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"The Electrician" "All-Electric" House Competition.

Biographical Details of the Successful Competitors.

In the electrical industry a man's work cannot be separated from his career.. For the information of our readers, therefore, we give below biographical details and photographs of the three prize winners in our "All-Electric" House Competition, whose names were announced last week, as we think these will be of general interest.

The First Prize Winner's Experience.

The first prize winner, it will be remembered, was Mr. PHILIPPE ERNEST PERONNE, of 141, Camden Street, London, N.W. Mr. Peronne informs us that though his name is French, he was born in London. He was educated at University College School, London, gaining there a Salomon Scholarship for Electricity. He then passed through the City and Guilds' Technical College, Finsbury, at the time when Prof. Silvanus P. Thompson was Principal, and was so successful in his studies he was able not only to gain the Diploma, but to be awarded the Salomon Scholarship by the Institution of Electrical Engineers. This Scholarship, however, for personal reasons, he did not take up.

After leaving Finsbury Mr. Peronne gained experience in various works, including those of the Lancashire Dynamo and Motor Co., at Trafford Park, and with the Peninsular and Oriental Co. on their Australian service. Subsequently for a couple of years he was Superintendent of the Photometer Department of the Osram Lamp Works of the General Electric Co., and for a similar period was in charge of the test room of the Electrical Apparatus Co. After a short time with Siemens Bros., Stafford, as assistant foreman in the winding department, he joined J. Stone and Co., and undertook for them a year's tour in India and Ceylon as Deputy Technical Representative of their train lighting department.

In the meantime he had been elected an associate member of the Institution of Electrical Engineers. Mr. Peronne had further indirect experience as representative of Pritchett and Gold's and the Electric Power Storage Co., of Heatley and Gresham, and with the Russa Engineering Works.

Considerable Experience in House Wiring.

While with these firms he obtained a considerable experience in house wiring matters, experience which doubtless stood him in good stead in formulating the scheme which the judges were able so favourably to pronounce upon last week. This experience he has added to with his present firm, Marryat and Place, and he informs us that in this connection his opinion of the St. Helens Cab Tyre Cable for house work is excellent.

Mr. Peronne has been with Marryat and Place for some five years in charge of their Sales Department, and is specially connected with country house work and foreign installations. He informs us that he has been assisted in the preparation of his scheme by Mr. Arden, who served his apprenticesihp with Marryat and Place, where he gained a wide and varied experience of the erection and maintenance of wiring installations. Mr. Arden is now with the M.P. Electric Welding Machine Co. as draughtsman.

The winner of the second prize, Mr. W. M. CRAUFURD, of 205, Eglinton Road, Plumstead, S.E., is of purely London extraction. He was educated privately, and subsequently received his technical training at the Woolwich Polytechnic.

Unlike the other prize-winners he has been faithful to the same firm throughout his engineering career, and, considering that that firm is Siemens Bros. and Co., he cannot be said to have made a bad choice.

Mr. Craufurd entered Siemens' Woolwich works in 1903, and spent four years in the shops, two years in the central station and fourteen years in the Cable Sales Department, with which latter branch he is still connected. It may be added that three of those fourteen years includes a period of War Service with the London Electrical Engineers.

Mr. EDWIN WHYTOCK, the third prize winner, hails from Scotland. He was educated at George Heriot's Hospital Edinburgh, and served his apprenticeship with Cox-Walkers, electrical engineers, and Aitken and Allan, mechanical engineers, both Edinburgh firms. He also took the Engineering Course at the Heriot-Watt College, Edinburgh.

Subsequently he was appointed Assistant Inspector of Installation Work with the Edinburgh Corporation Electricity Department, and since then has been mostly occupied with maintenance work on plant in shipyards, collieries and engineering works in the north of England and in Scotland.

"THE ELECTRICIAN" "ALL-ELECTRIC" HOUSE: PHOTOGRAPHS OF PRIZE WINNERS.

MR. P. E. PERONNE (FIRST PRIZE). MR. W. M. CRAUFURD (SECOND PRIZE). MR. E. WHYTOCK (THIRD PRIZE).

Some Thoughts on the Competition.

Examining these three biographical careers, we are rather surprised to note that all the prize-winners are not only men of experience—which might be expected—but men who can hardly be described as being of the younger generation.

In discussing this matter with others it has, however, been pointed out that the younger men in the electrical industry appear to be singularly lacking in ideas, and that all the work of the development, with all the freshness of outlook, which it requires is at present being conducted by those who may be called middle-aged.

We, therefore, hope that the interest which has been aroused by this competition will not only have its effect in solving the problem of the "All-Electric" house, but will also indicate to the younger generation the ways in which their thoughts should be turned, and the necessity of exploring every avenue to find better methods of doing what has already been done, and new methods of doing what still remains to be done.

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Electricity Supply Development.

Useful Statistics from "The Electrician" Tables.

"The Electrician" Annual Tables of Electricity Supply Undertakings, the 1923 edition of which has just been published, show in no uncertain way how the supply of electricity in this country and throughout the world is developing. The development is both lengthwise and broadwise, though in this country progress under the first of these headings is small. For instance, Table A, which deals with British Electricity Supply Undertakings, shows that this year 631 undertakings are in operation as against 624 last year, but this increase is mainly due to a transfer of entries from Table B, which deals with small electricity stations and projected schemes.

Progressive Increases in Connections.

On the other hand, the existing undertakings show an increasing development which is quite satisfactory. At one end of the scale we have such systems as Manchester where the connections have increased from 203 500 kW to 212 744 kW, and Glasgow where the increase is from 105 523 kW to 173 272 kW. At the other end of the scale we find such places as Goring and Streatly, where the connections have increased from 95 to 110 kW, while somewhere about the middle comes Leyton with an increase from 4 918 to 5 403 kW.

Table C, which deals with the British electrical power companies, remains the same as regards the number of entries, though here again there is a satisfactory development in connections.

In Table D, which deals with Colonial electricity supply undertakings, the number of entries has increased from 397 to 404. This number, of course, does not include the whole of such undertakings, but a certain amount of difficulty is experienced in obtaining this information, and the tables are therefore as up to date as can be expected. This is evident from Table E, which deals with smaller Colonial electricity supply undertakings.

Tables F and G deal with the foreign electricity supply undertakings, and here again a satisfactory increase is to be noticed. In Table H particulars are given of Colonial electric tramways and railways, and finally two pages deal with electricity undertakings in the Argentine and Chile, respectively.

As in former years, full particulars are given of the chief officials, systems of supply, consumers' voltage, connections, steam raising and generating plant, and prices charged. The whole of the statistics have been carefully revised and, as we know from experience, will prove as indispensable to all branches of the electrical trade during the coming year as they have done in the past.

We need only add that the tables are published at 10s. net, or 10s. 9d. post free, by Benn Brothers, Ltd., 6–8, Bouverie Street, London, E.C.4.

Parliamentary Intelligence.

Metropolitan Railway Bill Passed.

In the House of Commons on Monday, the Metropolitan Railway (Various Powers) Bill was read the third time and passed.

Colonies and the British Empire Exhibition.

Sir Harry Brittain asked the Under-Secretary of State for the Colonies on Monday, what is the total outlay contemplated by the Governments of the Dominions, India, and the Colonies on participation in the British Empire Exhibition?

Mr. Ormsby-Gore: It is not yet possible for me to give figures with any degree of accuracy, since the extent of the expenditure of each unit depends upon circumstances. So far as my information goes, the Dominions expect to spend a total of some £1000 000, and the Colonies and Protectorates at least £250 000, but the exact amounts are quite uncertain. In some cases private subscriptions are being raised to supplement Government grants. I have no information as regards India.

Coal Consumption in Power Stations.

Mr. Hardie, on Monday, asked the President of the Board of Trade whether he could give the lowest consumption of coal used in the production of electrical energy in the United Kingdom, taking the production on the basis of the unit?

Colonel Ashley: I have been asked to answer this question. The returns for the year ending March 31st, 1923, are not yet complete. For the previous year, the lowest consumption of coal per unit of electricity generated at public supply stations in Great Britain was 1·7 lb. The Commissioners have no corresponding information for Irish electricity undertakings, which are no longer under their jurisdiction.

Questions asked in Parliament with regard to wireless matters will be found under "Wireless News," on p. 491. Reports of the proceedings of the Select Committee considering Private Bills appear on p. 488.

It is reported from Copenhagen that Prof. Nils Bohr has discovered that the atomic weight of hafnium is between 179 and 181. The element has not yet been completely isolated, but it is hoped this will be effected before long. Prof. Bohr has discovered that hafnium is impenetrable by X-rays and the metal should therefore be of considerable use in medical science.

Electrical Contractors' Association.

Important Statement of Policy.

A special committee, to formulate a trading policy to be followed by the N.E.C.T.A., Ltd., in order to realise the ideals of the Electrical Contractors' Association, was appointed by the Council on October 16th, 1922, and its report was issued on Friday last. The Committee accepts it as a fact that the industry is not as well organised as it should be, especially with regard to the method of distribution to the user, and that some improved relationship between the manufacturing, wholesaling, and retailing sections of the industry must be set up if the best results are to be achieved. The Committee has therefore, in outlining a trading policy to guide the Association, earnestly set itself the task of laying a basis upon which such an improved relationship may be built.

A Strong Retail Trade Essential.

The recommendations made must, it is stated, be considered in the nature of a compass rather than a chart. It is not suggested that the Electrical Contractors' Association should dictate to other sections of the industry, but stress is laid on the importance of maintaining a healthy and prosperous body of retailers. "Unless trading conditions are such as to encourage brains and money into the retail field," the report states, "the reproach which has so often been hurled at the electrical contractor must continue, and a great deal of costly research, development and advertising on the part of electricity suppliers and manufacturers is sterile."

The Committee has consulted prominent manufacturers and wholesalers, and its recommendations has been so drafted as to receive their general support. The Committee found that manufacturers and wholesalers generally would welcome the policy which is now outlined, and is calculated to create a large and thoroughly substantial retail section of the industry.

The Committee does not propose that its recommendations can be carried into effect immediately, nor, as regards some of them, for a long time perhaps, but considers that the policy now formulated should be followed consistently and so far as is possible in the making of all trading agreements.

Recommendations of the Committee.

In making its recommendations, the Committee has kept in view the broad principle of the Association in trading, which is, by co-operation or otherwise, to establish its membership in a sound position commercially and financially so that it can control the details of its own business without undue interference from any other section of the trade.

The first two recommendations are to the effect that the Association must aim at obtaining such share of the control of the electrical retail trade as will ensure that all regulation of the conditions of retail electrical trading is carried out with the collaboration and consent of the Association, which must aim at strengthening its own position by obtaining special benefits for its membership. With a view to promoting cost reduction the third recommendation provides for the elimination of the middleman, except the genuine wholesaler who carries a substantial stock and supports the manufacturer by large contract buying.

Direct Trading and Discounts.

Recommendations 4 and 5 deal with "direct trading," which is to be limited at once, and eventually eliminated. Meanwhile, manufacturers supplying direct to the user should charge him the full retail price. Recommendation 6 states that the Association should support any moderate scheme of price maintenance put forward by the manufacturers.

Recommendations 7, 8 and 9 are as follows:—

7. It shall be an object of the Association to secure the general principle of discount upon quantity buying, in addition to a trade discount reserved exclusively for resellers, so as to eliminate the wasteful expense attached to small parcel buying. Quantity discount can be based upon:—

(*a*) Quantity of any single order, and
(*b*) Quantity taken in a stated period.

The Committee recommends the adoption of a large discount under (*a*) as compared with a smaller discount under (*b*).

8. The Association shall, in framing its policy, aim at attracting capital and the best men to the contracting and retailing side of the industry.

9. It shall be an object of the Association to secure from manufacturers and wholesalers cash discounts upon all purchases on a strict basis of prompt payment.

Recommendation 10 provides that contractors shall not compete with manufacturers and wholesalers, and recommendation 11 states that it shall be an object of the Association to co-operate in any approved scheme for educating the public to appreciate the best and most satisfactory electrical installation work and apparatus.

The Committee proceeds to define the terms "Electrical Wholesaler," "Wholesale Trade," "Retail Trade," "Electrical Contractor," and "Electrical Retailer." The differences between the last two classes are pointed out, and it is recommended that a fresh section of the Association be formed to provide for retailers. The last recommendation states that the Association shall support British industry and give preference in its agreements to British manufacturers and wholesalers of British goods.

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Merchandise to Sell and Profit By.

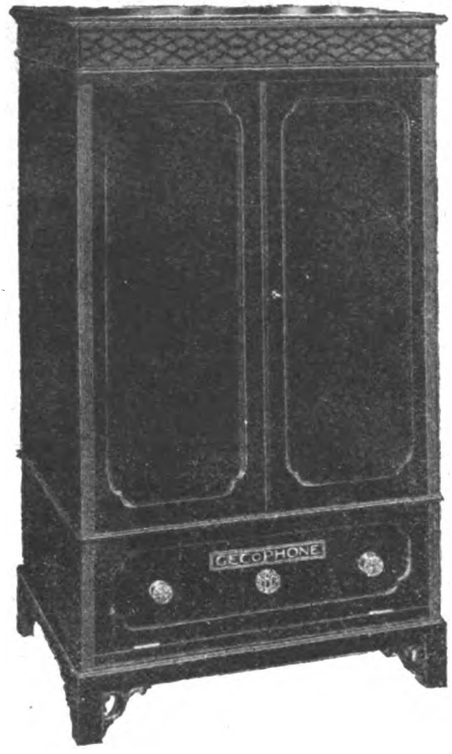
***In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of* THE ELECTRICIAN.**

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

The "Gecophone" Four-valve Cabinet Set.

The Ideal Home Exhibition is already a thing of the past and as an exhibition it has been forgotten. But certain events stand out in the minds of all, and one of these events is the stand of the GENERAL ELECTRIC CO. which was devoted to wireless apparatus. The central feature on the stand was the Gecophone four-valve cabinet *model de luxe* with self-contained loud speaker, which we

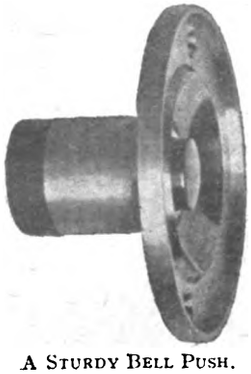


A HANDSOME "GECOPHONE" CABINET.

illustrate. In designing this set the G.E.C. have retained the simplicity of operation and freedom from technical complications which characterises all the Gecophone range of apparatus. We have received from the G.E.C. a copy of leaflet No. BC 2948, describing this cabinet, and we understand that copies and quotations can be obtained from Magnet House on application, or from any of the Company's numerous branches. This set is essentially one meaning "big figure" business. We have repeatedly emphasised (as we do again, because the importance justifies the reiteration) that retailers can get this "big figure" business if they will think up to it. Obviously if the mental outlook is limited to crystal sets there will be no opportunity to develop the selling of "big figure" sets.

A Reputation Maker or Breaker.

It is not in jest that we preface this note by suggesting that a bell push has endangered the reputation of a contractor on more than one occasion. There are many classes of electrical apparatus that have been scamped in quality to get down to a price, but it is questionable whether there is a worse example than that of bell pushes, or in fact of most bell ringing devices. In them too often everything has been sacrificed to price.

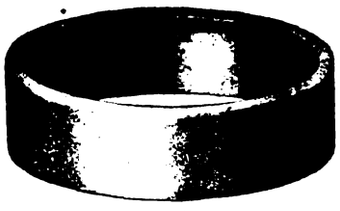


A STURDY BELL PUSH.

A range of these small accessories is manufactured by the GATH ELECTRICAL ENGINEERING CO., and it merits the attention of buyers. The whole of the many patterns and sizes are soundly made, and a sincere effort has been made to raise the standard in this class of apparatus. We illustrate a simple type bell push.

A "Finishing off" Device by Crabtree.

Many otherwise excellent installations are spoilt by the appearance of the switches. Even when distinctively finished covers are used the effect is marred by china bases. J. A. CRABTREE & CO., have

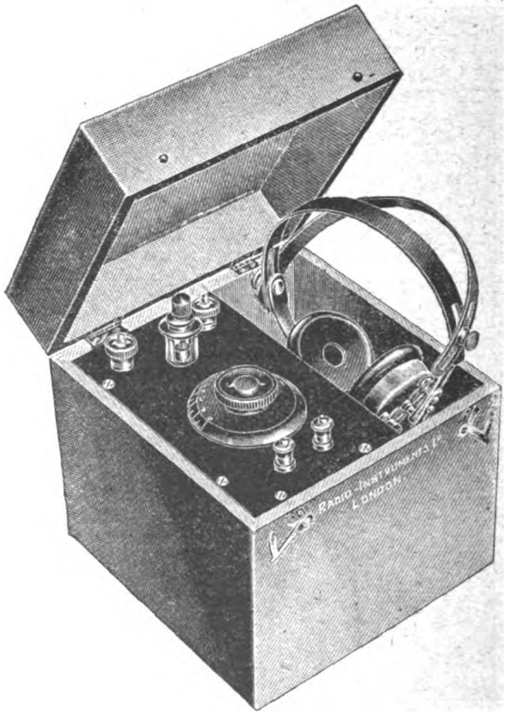


THE CRABTREE SWITCH RING.

developed a simple accessory known as a base ring which will give a finishing touch to the job at a very insignificant cost. These rings can be finished any colour, either in harmony or contrast with the switch cover. They will appeal strongly to the contractor who prides himself on distinctive work.

A "Radio Instruments" Set for 97s. 6d.

Although it is but a short while since the wireless boom commenced certain manufacturers have already taken their place in the front ranks as the makers of the best apparatus. One of such manufacturers is RADIO INSTRUMENTS, LTD. Recently we commented on one of the more ambitious sets made by this Company. As we pointed out, these handsome sets are "big business." Radio



A CHEAP AND GOOD WIRELESS SET.

Instruments are, however, fully alive to the demands of the retailer for the lower priced apparatus and their recent catalogue proves this. We advise all retailers to secure a copy and give it exhaustive study. For the benefit of those who doubt that Radio Instruments can offer a first-class crystal set at a popular price we illustrate their No. 1 set which is listed at £4 17s. 6d. complete with one set of head phones.

A Water Gauge Illuminator.

We illustrate the "National" patent water gauge illuminator which has recently been placed upon the market by the NATIONAL

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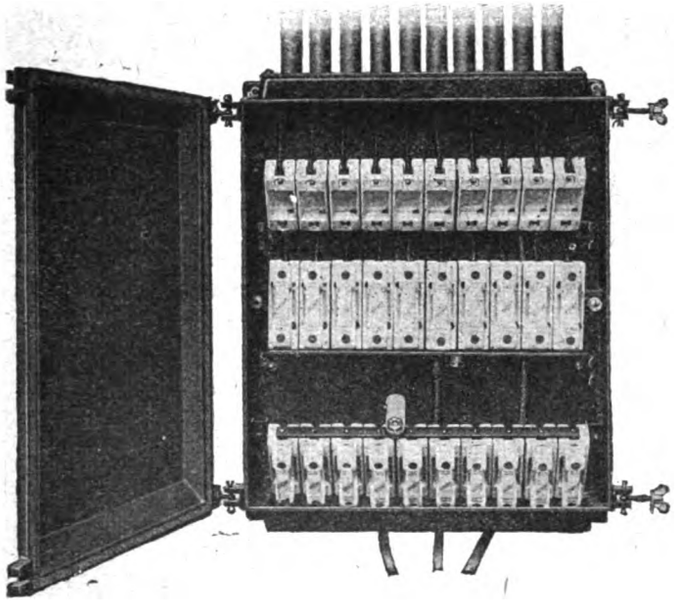
Boiler and General Insurance Co. It should prove a most useful and serviceable device; in fact, the number that are in satisfactory operation is such that the usefulness and serviceability of the device is already well established. The value of a water gauge as a safeguard against shortness of water, is often largely discounted by the difficulty of seeing where the water level actually is. With many boilers of the water tube type this is in part due to the fact that the gauges are placed at a considerable height above the floor. The "National" patent illuminator has been designed to overcome this difficulty; it lights up the gauge glass in such a way as to cause the water column to glow, making the height of the column clearly visible from the stokehole floor, and preventing any misreading of the water level in the glass. The device is quite a simple one and can be readily attached to most types of water gauges. It is sold complete for 50s.

The National Water Gauge Illuminator.

Apparatus that will Save Labour Costs.

Contractors who are continually seeking the best method by which they can reduce their labour charges need to know the best apparatus on the market. The essential basis of the design of all apparatus must be the reduction of labour charges. It is for this reason that we illustrate one of a range of distribution fuse boards manufactured by the Midland Electric Manufacturing Co. From a study of the details of this design it is obvious that the M.E.M. have progressed with the problem of producing apparatus that is a labour saver. The problem is not so simple as it would



A Simplification in Distribution Boards.

appear. Obviously, apparatus (particularly distribution fuse boards) must be made at competitive prices, and what is still more important, the apparatus must be a sound electrical proposition. Since the introduction of this equipment, some twelve years ago, various improvements have been made, but none of such importance as the new "Universal cradle" support for the fuse banks. This cradle, whilst supporting the weight and leaving both hands free for wiring, enables the entire bank to swing freely on its horizontal axis, giving ready access to either end or back of the fuse unit for wiring or inspection purposes. The banks may be entirely removed if necessary by the withdrawal of two screws. The saving in cable over the "gate" pattern board is in itself a great advantage. The M.E.M. advise us that a large number of these boards have been sold and are in use. Such a fact is a sure testimony to the efficiency of these boards.

The Arora Cooking Equipment.

We illustrate a new cooking equipment which the Arora Co. are just about to place upon the market. The design is at once a departure from patterns which manufacturers in this country usually adopt. It has all the appearance of being a thoroughly "kitchenlike" piece of apparatus, built for hard service. It is an equipment that will appeal to the woman buyer.

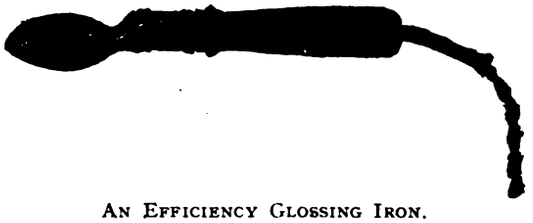
As will be seen from our illustration, the complete equipment consists essentially of four units consisting of (*a*) sheet metal table, (*b*) oven, (*c*) two boiling plates. Each piece can be purchased separately, but the price for the equipment of four units totals

The Latest "Arora" Cooker.

£16 5s. This is a most attractive price for such a comprehensive set and is a price on which a good turnover can be built up. The manufacturers will be happy to send a copy of the new list to all applicants.

A Device for the Shoemaker.

Many contractors have the foresight to cater for particular trades. This is a most excellent plan on which to build up a business, because by doing so they acquire an intimate inside knowledge of what particular trades require. Among the manufacturers who offer what might be called "trade appliances" are Electric Fires, Ltd. We illustrate an electric glossing (or treeing) iron which, as all will appreciate, is a device which will sell readily among boot and shoe manufacturers, and the leather trades generally.



An Efficiency Glossing Iron.

The "Heatrae" glossing iron has been specially designed for putting a finished surface on the leather, and as it is an article that is used all day long, mostly by girls, it has been made light and handy so that the use of it will not be found tiring to the operator. The handle is of convenient size; it is made in two parts, the top end being removable for the easy attachment of flexible cable, which passes through a spring, thereby reducing the wear and tear on the flex at the point of entry to the handle. A special heat baffle is inserted between the sole and the handle. This is very effective for keeping the handle cool for convenience in working.

Higgs Bros. (manufacturers of H.B. apparatus) announce the publication of a new price list No. 8 on A.C. and D.C. motors and dynamos.

A. H. Hunt, Ltd., have kindly sent us copies of two new leaflets. Both merit the attention and study of buyers of wireless apparatus. Leaflet No. 140 describes the H.A.H. combined wander plug valve protector and battery tester; leaflet No. 141 describes the H.A.H. variable grid leak.

Engineers who are interested in railway signalling apparatus will note with avidity that the General Electric Co. have just published a most excellent and descriptive list on this apparatus. Custom dictates that the publication must be described as a descriptive list, but the list is really an electrical treatise of high merit.

Buyers who have need to know all the possible buying markets for recording meters will be interested in the descriptive list just issued by Societe Industrielle pour la Fabrication d'Appareil de mesure de Paris. The agency for this country is held by Thomson and Co., who will be pleased to submit the lists on application, to readers of The Electrician.

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Private Bills.

New Electricity Undertaking at Oakham.

The Unopposed Committee of the House of Lords, presided over by the Lord Chairman, the Earl of Donoughmore, last week ordered to be reported for third reading the OAKHAM GAS AND ELECTRICITY BILL, subject to the approval by the Lord Chairman of a number of clauses which have been added.

The Bill provides for the change of name of the Oakham Gas Co. to the Oakham Gas and Electricity Co., and empowers the company to supply electricity for all public and private purposes in the area which is now supplied with gas by the company. This comprises the urban district of Oakham, and the parishes of Barleythorpe, Langham, Whissendine, Ashwell and Braunston, and part of the parish of Burley, all in the rural district of Oakham, in the county of Rutland. Provision is made for the erection and working of a generating station on lands on which the Gas Company are now authorised to manufacture gas, subject to the company obtaining the consent of the Electricity Commissioners.

The company is to lay mains in the urban district of Oakham within three years of the passing of the Bill, and in the rural districts where it has powers within five years, otherwise the powers conferred upon it by the Act may be revoked. The maximum price to be charged is fixed at 1s. per kWh, with a minimum of 15 kWh in winter and 10 kWh in summer.

Further share capital up to £9 000 is authorised, and loans up to £6 500. Separate capital and revenue accounts are to be kept of the gas and electricity undertakings. The dividend on the original capital of £8 000 is not to exceed 10 per cent., and that on all other ordinary shares is not to exceed 7 per cent. Preference shares created after the passing of the Act are not to carry a higher rate of dividend than 7 per cent. The local authority has power to purchase the electricity undertaking at the end of 42 years or at the end of any subsequent period of 10 years. If such power is exercised, the gas undertaking must also be purchased.

City and South London Railway Extension.

The Bill promoted by the CITY AND SOUTH LONDON RAILWAY Co. for the extension of the line from Clapham Common to Morden, Surrey, was considered by a Committee of the House of Commons, presided over by Sir Park Goff, on Wednesday, April 25th, and has been considered daily since.

Sir LYNDEN MACASSEY, K.C., who (together with Mr. E. Shortt, K.C., Mr. W. E. Tyldesley Jones, K.C., and Mr. Szlumper) appeared for the promoters, said that it was proposed by this Bill to extend the line southwards from Clapham Common, through Balham, Tooting and Merton, to Morden, forming a junction there with the Wimbledon and Sutton Railway, and to confer on the City and South London Railway Co. running powers over the Wimbledon and Sutton Railway from Morden to Sutton. The latter railway had been authorised by Parliament in 1910, between Wimbledon and Sutton, there being, from Wimbledon towards London, a service of the District Railway.

After outlining the improvements now being carried out on the City and South London Railway, counsel said that the present scheme, if sanctioned by Parliament, would provide employment for some 20 000 men for a period of two years. It was proposed to raise by this Bill £4 550 000 additional capital which, together with the additional capital which it was proposed should be raised by the London Electric Railway Co., which has a Bill before Parliament for the construction of new extensions, would amount to seven millions sterling, and 75 per cent. of that would be spent on the remuneration of labour—i.e., £4½ million. The City and South London Co. was a constituent company of the Underground Group, and the present scheme was an exemplification of the principles advocated so strongly by the Royal Commission on London Traffic, of extending the underground railways of London to the suburban districts fringing the Metropolis.

Details of the New Line.

The length of the proposed new railway, from Clapham Common to Morden, would be about 6 miles, roughly 5 of which would be constructed underground in the form of a tube, and one mile would be on the surface. The tube portion would run under a main road right down to Merton, where the railway would come to the surface. There would be 7 stations in those 6 miles. From the point at which the line would join the Wimbledon and Sutton Railway to Sutton the distance was 3 miles. Certain clauses were introduced into the Bill to enable close working and close association to be obtained between the constituent companies of the Underground Group and the Wimbledon and Sutton Railway, and also in respect of the extension of the City and South London Railway, giving effect to the principle of the Common Fund Agreement, which was arrived at in 1915 under the London Electric Railway Companies' Facilities Act.

Counsel then explained briefly, with the aid of a model, the extensions which it was proposed to carry out by the London Electric Railway Bill (which is to come before the same Committee) in order to show how existing lines will be linked up thereby and the inter-working of those lines effected. By means of the new extensions proposed in the London Electric Railway Bill there would be a great system authorised, it was hoped, for the extension and development of travelling facilities between the suburban districts which would be served by the City and South London Railway and the central districts of London.

There were four petitions against the Bill when it reached the Committee, a number of others having been disposed of as the result of the parties concerned having come to terms. The first was by the Southern Railway Company, who opposed on the grounds of competition, holding that they would be prejudiced by the provisions of the Bill. The next was the South London Hospital for Women, which was concerned mainly with the position of the stairways from the railway in relation to the hospital, but the company hoped to meet the petitioners. Mr. G. E. Hatfield, of Morden Hall, part of whose property it was proposed to acquire for erecting car sheds, etc., petitioned on the ground that this would destroy the amenities of the district.

Lord Ashfield's Evidence.

A large number of witnesses were then called in support of the proposals of the Bill, including Lord Ashfield (chairman and managing director of the company), Mr. Frank Pick (assistant managing director of the Underground Group), and Mr. Basil Mott (the engineer responsible for the extension scheme). These were followed by representatives of a number of local authorities in the area which would be served by the proposed extension, who urged the necessity for the improved travelling facilities which would be given as a means of developing the area. In the course of the cross-examination of these witnesses it was urged on behalf of the Southern Railway Co. that electrification schemes which that company had in hand would meet the requirements, and that therefore they should be given a chance, rather than that the present scheme should be proceeded with, because this would not be completed for a number of years, and could not be made to pay for a number of years afterwards. The local witnesses, however, were of the opinion that, although the Southern Railway developments might go some distance towards meeting the requirements of the area, the City and South London scheme was needed, and Lord ASHFIELD, in reply to questions, agreed that, whatever the Southern Railway might do, by extension or electrification, they would not give anything like the service which would be provided under this scheme. The work, he said, would be proceeded with as soon as the necessary powers were obtained.

Southern Railway's Opposition.

On Monday, Sir HERBERT WALKER, general manager of the South-Western Section of the Southern Railway, stated, in answer to counsel, that he regarded the proposed extension as an incursion into an area served by his group of railways, and in which comprehensive schemes of electrification were shortly to be introduced. The proposed underground line would undoubtedly divert traffic from his group's lines to those of the Underground, and that would be against the public interest, for the reason that any serious loss by his group in revenue would necessitate an application to the Railway Rates Tribunal for a readjustment upward of the fares of the Southern Railway group.

Sir WILLIAM FORBES, general manager of the Brighton section of the Southern group, said that in the event of the proposed extension coming into existence the Southern group of railways would be at a serious disadvantage if a competition in cutting fares was started by the Underground. Whereas the latter had liberty of action, his group were controlled by the Railway Rates Tribunal.

Decision of the Committee.

In the course of his address to the Committee on behalf of the Southern Railway Co., Mr. MCMILLAN, K.C., said that the proposal was an adventure which could not be attended with success except at the cost of the existing railways, which were serving the area with the sanction of Parliament. He did not dispute the suitability of the Balham and Tooting districts for an underground railway, but he maintained that, for the trains to come to the surface at Morden and run for four miles through undeveloped country, introduced a principle which would threaten the whole of the suburban services of the main line railway.

Sir LYNDEN MACASSEY, K.C., replied on behalf of the City and South London Railway Co., and reiterated that the proposed extension would give valuable facilities to the people in the districts through which it was proposed to run it; it was significant that nobody had suggested during the inquiry that it would not.

On Wednesday, the Committee expressed the opinion that, in the public interest, and as a matter of public policy, the preamble of the Bill was proved.

Legal Intelligence.

B.T.-H. Patent Litigation.

In the Chancery Division on April 25th, Mr. Justice SARGANT was informed of the settlement of the action brought by the British Thomson-Houston Co. against Goodmans (Leeds), Ltd.

Mr. TREVOR WATSON, for the plaintiffs, said the defendants consented to judgment in the ordinary form according to minutes agreed between the parties. The action was brought on the plaintiffs' gasfilled patent.

Mr. DRAPER, for the defendants, said it was a case of innocent infringement and he must consent to the injunction. Defendants were jewellers and had taken a few lamps from a tenant for rent.

His Lordship entered judgment on the terms agreed.

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Electricity Supply.

Extensions and Developments.

BRIGHTON Town Council is to spend £500 on the electric lighting of the Old Steine Gardens.

Electric lamps are to be erected at 27 selected points in DUNDEE streets where careful driving is necessary.

BELFAST Electricity Committee proposes to rent ground from the Harbour Commissioners for the erection of a sub-station.

MAIDSTONE Town Council has received sanction to a loan of £9 065 excess expenditure in connection with extensions at Snodland, Tovil and Cherry Orchard.

KINGSTON-ON-THAMES Town Council has received sanction from the Commissioners to a loan of £9 624 in respect of a turbo-alternator and auxiliary plant, for the electricity works.

ILFORD Urban Council has instructed the electrical engineer to prepare and submit a scheme for linking up to take a supply of electricity from the West Ham Corporation, owing to the absolute necessity of an increased supply being available to meet next winter's load.

Alterations in Charges, Proposed and Actual.

The lighting charge at STOKE-ON-TRENT has been decreased by 10 per cent. and the power charge by 20 per cent.

DOVER Town Council has reduced the charge for electricity for lighting to 8d. per kWh, for power to 3d., and for cooking and heating to 1½d.

The Streets Committee of the City of LONDON Corporation is to consider and report as to the charges for electric light and power in the City as compared with those in other large cities, and as to the steps, if any, which might be taken to reduce them. Both the City of London Electric Lighting Co. and the Charing Cross, West End and City Electricity Supply Co. charge 8d. per kWh for lighting.

In the House of Commons last week, Sir P. Pilditch asked the President of the Board of Trade if he is aware that the cost of electricity for lighting was 1s. and 11d. per kWh in TWICKENHAM and TEDDINGTON, while at Fulham and Wandsworth it is only 5d., and at Richmond, Surrey, 7½d.; and would he take steps to lower the cost of electricity in Twickenham and Teddington to a more reasonable figure? In the course of his reply, Col. Ashley said that owing to the differences in the conditions under which the supply of electricity is given in different localities, there is no necessary relation between the prices charged in such localities.

Tapping New Areas.

ANDOVER is considering the taking of a bulk supply of electricity from Southampton.

CARDIFF Electricity Committee is considering the extension of the electric light supply to Llanishen.

MAIDENHEAD Electricity Committee has decided on extensions along the Bath Road and to Maidenhead Thicket.

The Commissioners have sanctioned a loan by HASLINGDEN Corporation to carry out the electricity scheme in Ewood Bridge district.

SAFFRON WALDEN Town Council has formally decided to apply to the Commissioners for a special order enabling the Corporation to supply electricity for public and private purposes within the borough.

CUCKFIELD (SUSSEX) Rural Council has decided to rescind its previous resolution against the use of overhead wires for electric lighting at Lindfield, and the Council will assent to the scheme of the Haywards Heath and District Electric Supply Co.

RETFORD Town Council is to apply to the Commissioners for a special order for the generation and distribution of electrical energy within the area of the Town and Rural District Councils. Retford Traders' Association supports the scheme. A bulk supply may be taken in connection with North Midlands scheme.

COOKHAM Rural Council has decided to withdraw its opposition to an application for an order to supply electricity to Cookham. The Bourne End Co. has effected an amalgamation of two interests, and will be known as the Berks and Bucks Electricity Co. This action will enable the Electricity Commissioners to proceed with the matter as soon as possible.

At a public meeting at PICKERING, held last week, a committee was appointed to go into the question of an electric lighting scheme for the parish, prior to approaching the Urban Council on the matter. The proposed scheme is to have a power station constructed in the centre of the town, and to supply by underground cables. The cost of a scheme for 100 consumers in the central portion of the town is estimated at £3 730, and if extensions are made to other parts of the town, the cost will be just over £5 000.

BILLINGHAM Urban Council has received from the Electricity Commissioners a communication relative to an application by the Cleveland and Durham County Electricity Power Co., for a special order to supply electricity within the area of the Council. The Commissioners intimated that they were prepared to give favourable consideration to the application, and enquired if the Urban Council had any objections to offer. The Council has referred the matter for full consideration to the General Purposes Committee.

EAST SALTNEY Parish Council has received proposals from the Hawarden Rural Council for a scheme of street lighting. It was roposed to supersede the powers of the parish councils if permission were obtained. It was estimated that in Hawarden, Shotton and Caergwrle about eleven miles would be lighted, requiring in all 230 lamps. It was suggested that the lamps would be controlled from a transformer station to avoid the men having to light and extinguish the lamps. The Rural Council would provide and maintain the lamps, in addition to providing the supply of electricity, and they proposed an annual charge of £3 10s. per lamp. Saltney Council opposes the scheme.

Inquiries and Orders.

LEYTON Urban Council has decided for its protection, so far as the laying and maintenance of mains is concerned formally to object to the application of the Walthamstow Urban Council for an Order to supply electricity to Wanstead, Woodford, and other districts.

The Minister of Transport proposes to confirm the Special Order made by the Electricity Commissioners for the supply of electricity by the Electric Supply Corporation in EXMOUTH Urban District. Any objections must be sent to the Secretary, Ministry of Transport, Whitehall, London, by May 12th.

MORECAMBE Corporation are applying to the Electricity Commissioners for a Special Order to extend the Corporation area of electricity supply under the Morecambe Electric Lighting Order, 1897, so as to include Heysham urban district and portions of Lancaster rural district. Any objections must be sent to the Secretary, Electricity Commission, Whitehall, London, by May 11th.

Greenock Town Council has lodged a petition against the application of GOUROCK Corporation for an Order to obtain electricity from Greenock, on the grounds that the agreement between Gourock Town Council and Greenock Corporation had not been mentioned in the Order, and also that the maximum prices were lower than those which Greenock Corporation were entitled to charge under the Act of 1909.

The representatives of the Urban and Rural Councils in WEST WILTS affected by the application of the Western Electric Distributing Corporation, Ltd., for a Special Order for the supply of electricity, have recommended that formal objection be made in order to gain time for fuller investigation on the following grounds: That the power to take over existing undertakings in Chippenham, Trowbridge, and Melksham, at expiration of existing agreements, would be interfered with; that fuller information is required as to the source of supply; that no information is available as to how capital is to be raised; that the Order should contain a provision that the undertakers shall place all cables underground in the areas of the Borough and Urban Councils affected; that the streets and parts of streets mentioned in the third schedule to the Order are too restricted. Provided that if these objections are satisfactorily met or disposed of, the respective Councils offer no objection to the scheme as a whole.

Boilermakers Locked Out.

Work at Shipyards Seriously Affected.

The shipyard employers' lock-out notices to the members of the Boilermakers' Society, who have refused to accept the overtime and night-shift agreement signed by the Federation of Engineering and Shipbuilding Trades Unions, became operative on Monday. Boilermakers at North and South Shields were already on strike, and in all it was stated that about 10 000 men are idle.

The Boilermakers' Society on Saturday decided upon steps for taking a ballot of their members on the question of the observance or continued rejection of the disputed agreement. The two unions of the plumbers and woodworkers, at first sharing the rejection of the agreement with the boilermakers, last week decided to work the agreement pending a ballot of their members, and the lock-out notices against them were accordingly suspended until May 7th.

The "Manchester Guardian" states that 600 boilermakers at the works of Cammell Laird and Co. are affected and that at Hull and Sunderland other classes of workers are affected as a result of the stoppage.

Personal Items.

Mr. C. FURNESS, Blackpool's electrical engineer, has been co-opted a member of the Evening Schools Special Sub-Committee.

Prof. LORENTZ has been appointed a member of the Commission of Intellectual Co-operation by the League of Nations, in succession to Prof. Einstein.

For the eighteenth year, Mr. W. T. UPTON, electrical engineer, has been nominated to the position of Vicar's warden at St. Mary Magdalene Church, Oxford.

The marriage was solemnised on April 25th, at St. James's Church, Spanish Place, London, W., of Major S. UTTING, and Ethel, eldest daughter of the late D. C. Jennings and Mrs. Jennings of Dublin.

OBITUARY.—Although not an engineer himself, Mr. JOHN WILLIAMSON, who died at Nice on Friday last, will be remembered for his pioneer work in connection with the Parsons turbine. At a time when none too much confidence was felt in the invention, he saw its possibilities and had the "King Edward" built in 1901 for service on the Clyde. The boat was fitted with Parsons turbines and, proving herself one of the fastest steamers then afloat, did much to show the possibilities of the turbine. The "King Edward" is still in service, although her machinery has been modernised.

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Imperial Notes.

AUSTRALASIA.

Sydney Electricity Supply Department.

Sydney (N.S.W.) City Council have approved the recommendations of the General Purposes Committee for the reorganisation of the electricity supply department. Mr. Forbes Mackay, the general manager, is to have full control of the undertaking, with power to dismiss employees and to promote or appoint men to the higher ranks of the service. The keeping of accounts will continue under the control of the Town Clerk. A sum not exceeding 1 per cent. of the capital expenditure is to be devoted out of profits to reduction of rates.

A Year's Electric Progress at Melbourne.

The annual report of the Melbourne Electric Supply Committee states that during last year 53 846 526 kWh were sold, an increase of 8 581 686 kWh compared with the previous year. The revenue amounted to £403 750, an increase of £47 304, general expenditure was £243 626 2s. 5d., increase £8 971, and gross profit £160 124 2s. 9d., increase £38 333 3s. 7d. After the capital and other charges had been provided for there remained net profit £40 755, of which £1 755 has been transferred to make up deficiency in lighting rate, and £39 000 to town fund. Capital expenditure for the year was £139 927 19s. 2d., including mains, £40 125 16s. 3d.; machinery, £32 241 14s. 4d.; switchboards, £30 559 14s. 7d.; buildings, £15 107 15s. 5d.; sub-stations and transformers, £12 698 19s. 8d.

CANADA.

Power Equipment for Lake St. John Scheme.

The contract for the electrical equipment of the Quebec Development Company's power project at Lake St. John has been secured by the Canadian Westinghouse Co., of Hamilton, Ontario. The equipment will consist of eight 40 000 H.P. hydraulic turbo-generators, 13 200 V, 112 revs. per min., three-phase, 60-cycle, direct connected. The entire equipment is to cost about 1 990 000 dollars, and will take three years to complete.

INDIA.

Electricity in the Tea Districts.

A company has been formed to supply electricity in the tea districts in and near Kalimpong and Kurseong. The preliminary survey has been completed, the area selected being one of those recommended in the preliminary report on the hydro-electric power resources of India. There are about 200 tea factories in the district for which the company has obtained the licence.

Andhra Valley Power Supply Co.'s New Issue.

An issue of £1 000 000 7½ per cent. ten years secured sterling notes of the Andhra Valley Power Supply Co. was made during the week-end at 98. The notes will be secured on £1 333 333 of 8 per cent. first mortgage debentures of the company, being two-thirds of the total issue of £2 000 000, which debentures are secured by first specific mortgages and a floating charge on the whole of the assets of the company, present and future. The company operates under licence from the Government in Bombay, and over certain neighbouring municipal areas. The total capital cost of the undertaking is estimated at £3 400 000. The issue was over-applied for.

Punjab Hydro-Electric Schemes.

From a reply to an interpellation regarding the hydro-electric schemes in the Punjab, it is understood that certain tentative proposals have been made to the Government by English financiers that they are given concessions in connection with the hydro-electric schemes now under investigation in the province. Investigations into the most suitable methods of finance are still in progress, and it is not yet possible to say what method will finally commend itself to the Government. Generally speaking, however, it is considered that provincial ownership of hydro-electric schemes will prove more profitable to the Province and more expeditious as a whole than private enterprise.

Electrically-Driven Pumps in Calcutta.

The supply of unfiltered water in Calcutta has been totally inadequate for some years, owing to the fact that the old steam pumping plant was worn out after 46 years' service and is subject to breakdowns. Some time ago, the Corporation of Calcutta, on the advice of their chief engineer, decided to replace the old steam plant with modern electrically driven pumps. One unit was put in as a trial, and was found so satisfactory that a contract was placed for two more, which have now been installed. The three pumps only occupy the space of one of the old steam engines, and each pump is capable of supplying 3 500 gallons of unfiltered water per minute against a head of 140 ft., or practically as much as the two old steam engines combined. The cost of installing the new pumps, including alterations to buildings, etc., was about Rs.1 36000. Current to work the pumps is supplied at 6 000 V transformed down to 400 V. It is intended to replace the remaining steam engine with three similar pumps.

TOMLINSON-LEE *v.* PEEL.—This action for alleged slander was down for hearing in the King's Bench Division yesterday (Thursday). A full report will appear in our next issue.

Foreign Notes.

EUROPE.

French Telephone Charges Raised.

The charge for telephonic messages from France to Great Britain, Holland, Germany, Italy and Spain was trebled as from May 1st, in accordance with the law passed on February 28th extending to international telephone communications the measure actually in force for foreign telegrams, by which the charge is multiplied by a coefficient according to the rate of exchange. The charge for messages from Great Britain to France has not been altered.

Electric Locomotives for French Lines.

Particulars from the "Information Financière" appeared in our issue of March 30th regarding the progress made with the electrification of the Culoz-Modane section of the Paris-Lyons-Mediterranean Railway. The "Railway Gazette" now states that an order has been placed with French firms for 30 electric locomotives for operation on this line. They are to be used to haul goods trains of 4–500 tons, and each will have six driving axles in order to enable them to negotiate the steep gradients between Sainte-Jean-de-Maurienne and Modane, attaining as much as 300 mm. per m. For hauling passenger trains the design of the locomotives has not yet been fixed, but there is talk of the adoption of a gearless model such as that which is to be tried out by the Orleans on the Paris-Vierzon section and which is capable of a speed of 100 to 120 km. per hour. The Société d'Etudes pour l'Electrification des Chemins de Fer, which is responsible for this model, has obtained a share in the contract for the goods train locomotives above mentioned, with which, indeed, the proposed passenger locomotives are identical, apart from the gears. It is building 80 locomotives for goods traffic on the Paris-Vierzon line. Another participant in the Paris-Lyons-Mediterranean contract, the Société des Constructions Electriques de France, has turned out 50 locomotives for the Midi system, and is engaged on another order for 40.

THE FAR EAST.

German Electrical Machinery and Japan.

The American Commercial Attaché at Tokyo states that German competition in heavy electrical machinery sold in Japan has entirely disappeared. Public statements made some time ago to the effect that Japanese buyers were inclined to place orders for this class of machinery with German manufacturers appear to have been only partly true, and it is now stated that no reliable Japanese company is either quoting for or endeavouring to secure the business for this sort of equipment of German manufacture.

LATIN-AMERICA.

Argentine Tramways and Power Results.

The report of the Argentine Tramways and Power Co. for the year to September 30th, 1922, is now available, and states that the gross receipts of both the light and power and the tramways departments showed a satisfactory increase. The net revenue, after providing reserve for renewals, was £37 697, plus interest and transfer fees, making £38 372, from which there falls to be deducted loss in exchange amounting to £4 249. After charging interest and sinking fund on debenture stock, expenses of scheme of reorganisation of capital and London expenses, there remains £18 836, plus £245 brought forward. The item "Discount on issue of debenture stock" has been extinguished by the transfer of £4 250 from revenue and £12 000 from reserve. The directors recommend a final dividend of 7 per cent. per annum, subject to tax, on the preference shares, carrying £832 forward.

Electric Locomotives for Mines.

£1 000 Offered for the Best Vehicle.

Lieut.-Col. G. R. Lane Fox, Secretary for Mines, announces that in order to encourage the production of a safe and efficient type of electrical storage-battery locomotive for use underground in coal mines, and with a view to displacing pit ponies in deep and hot mines, Mr. Charles Markham, colliery director of Ringwood Hall, Chesterfield, has placed at his disposal the sum of £1 000 to be offered as a prize for the best vehicle. Judges representative of the Coal Mining Industry of Great Britain, the Institutions of Mining and Electrical Engineers and the Mines Department have been appointed to lay down the conditions under which the competition is to be conducted and to adjudicate upon the merits of competing designs.

The competition will be open to manufacturers of any nationality and the competition will remain open for an adequate period to allow competitors in foreign countries and the Dominions to submit their designs. Working trials, in England, will subsequently be arranged of those vehicles selected for test.

The preliminary details in connection with the competition are approaching completion and a formal announcement will shortly be made of the conditions.

Articles on Continental railway electrification, hydro-electric schemes, and transmission of power at high voltage over long distances are now appearing in the "Journal" of the ITALIAN ELECTRICAL ASSOCIATION. Particulars may be obtained from Mr. G. Martinez, Pirelli General Cable Works, Southampton.

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Electric Traction.

Tramway Extensions and Developments.

The Minister of Transport has made an order authorising the construction by NEWCASTLE-UPON-TYNE Corporation of an additional light railway.

The conversion of the Slateford route of the EDINBURGH tramway service from cable to electric working has now been completed, and electric cars commenced running on Sunday.

The Minister of Transport has made the LEEDS CORPORATION LIGHT RAILWAYS ORDER, authorising the construction of light railways in the city of Leeds and the rural district of Hunslet.

WEST HARTLEPOOL Corporation has obtained the sanction of the House of Lords to the late deposit of a Bill empowering the Corporation to acquire and work trolley vehicles within the borough.

SUNDERLAND and SOUTH SHIELDS Corporations are jointly considering a proposal to link up their respective electric tramway undertakings. At present, the intervening distance between them is four miles, and the suggestion is that each should extend so as to meet midway at Cleadon village.

An agreement having been arrived at between EDINBURGH Corporation and the Musselburgh Tramway Co. with regard to the through running of electric cars from Waterloo Place to Port Seton, arrangements are now being completed for the connecting of the two systems at Joppa. It is hoped to have through running on June 1st.

Asked by the Electricity Commissioners for its opinion on their intention to revoke the West Cumberland Electric Tramways Act, HOLME CULTRAM Urban District Council has decided that a tramway to Silloth from West Cumberland was very desirable, as there was no railway communication between the places, and therefore it was undesirable that the powers for the supply of electricity should be revoked.

Fares, Receipts and Passengers.

LONDON County Council is to consider at an early date the issue of season tickets between the Council's tramways and the Underground Railways in South London.

MANCHESTER Tramways Committee finds that the estimated receipts for the coming year do not show a sufficient margin to justify any reduction in the present fares.

LIVERPOOL trams are now carrying 300 000 more passengers each week compared with the corresponding period of last year. Since the introduction of the penny fares the increase has been most marked.

BRADFORD Tramways Committee has appointed a sub-committee to consider and report on the suggestion that during certain hours of the day reduced fares should be in force, and that weekly transferable tickets should be issued.

The annual returns of BLACKPOOL tramways show that during the year 31 540 788 passengers were carried against 28 864 290, an increase of 2 676 498. The receipts were £269 678 against £251 409. The cars travelled 2 465 440 miles, an increase of 210 921 miles. Since January, 1920, when the Fleetwood tramroad passed into the control of the Corporation, receipts and passengers have shown huge advances. During the last four years the number of passengers carried on Blackpool trams reached the large figure of 126½ millions.

Electric Railway Items.

During the week ending April 21st, receipts on the MERSEY RAILWAY amounted to £4 392. The total to date for the year is £73 063.

As a result of a subsidence in the soil near Stockwell Station, due to tunnelling operations in the widening of the CITY AND SOUTH LONDON RAILWAY, the line between Clapham Common and the Oval was temporarily closed last week.

The "North Mail and Chronicle" states that the LONDON AND NORTH EASTERN RAILWAY Co. contemplates the construction of a new electrified line from Newsham through Blyth to Bebside. It is intimated that differences between the railway company and the local Urban Council are holding up the scheme.

The first electric locomotive to be used on the CITY AND SOUTH LONDON RAILWAY has been placed in the Science Museum, at South Kensington, in the vicinity of the "Rocket," "Puffing Billy," "Sans Pareil," and other railway relics. The C. and S.L.R. locomotive was the first electric locomotive operated on the first tube railway in the world, and has been in service since 1890. It was designed and constructed by Mather and Platt.

Reporting on the collision which occurred near Retford on the L. & N.E.R., on February 13th, and in which three men on the engine of the colliding train were killed, Col. J. W. Pringle states that "this case is typical of the class of accident PREVENTABLE BY AUTOMATIC TRAIN CONTROL." He adds that all the passenger stock was electrically lighted, and no fire started in the wreckage caused by the collision.

No less than 2 000 SIEMENS traction type electric lamps were used to illuminate a decorated tramcar at West Ham on Saturday night, in honour of the local team's participation in the F.A. Cup final tie. The lamps, which were red, white and blue, were wired five in series, being of the 105 V, 30 W type on a 500-525 V supply. The wiring was run to four 60 A fuse boxes, the maximum load in any one circuit not exceeding 35 A.

Wireless News.

Broadcasting Committee Gets to Work.

The first meeting of the Committee appointed to consider the agreement between the Post Office and the British Broadcasting Co., and the future of broadcasting, was held on Tuesday at the General Post Office. Major-General Sir Frederick Sykes presided, and there were present:—

Major the Hon. J. J. Astor, M.P., Mr. F. J. Brown (Assistant Secretary, G.P.O.), Sir Henry Bunbury (Comptroller and Accountant General, G.P.O.), Lord Burnham, Mr. W. H. Eccles (president of the Radio Society), Sir Henry Norman, M.P., Mr. J. C. W. Reith (general manager, British Broadcasting Co.), Field-Marshall Sir William Robertson, and Mr. C. Trevelyan, M.P. The Postmaster-General attended at the opening and welcomed the members of the Committee, who later discussed procedure.

A second meeting was held on Wednesday, when evidence in explanation of the present position was given by representatives of the Post Office. The Committee is communicating with the various interests concerned, and evidence will be taken from all points of view. It is proposed that the Committee shall in future hold two meetings a week. The proceedings will be private.

The Postmaster-General was asked in the House of Commons last week whether he would arrange for the Radio Association and the British Radio Manufacturers' and Traders' Association to have representation on the Committee. In each case he replied that the size of the Committee could not be increased, but that all interests affected would be at liberty to give evidence.

Lord Gainford on the B.B.C. Plans.

The new "Studio" of the London Station in Savoy Hill was inaugurated on Tuesday night, and the B.B.C. is to be congratulated on the improvements in transmission which have resulted. LORD GAINFORD spoke with reference to the present position of the Company and its future plans. He frankly admitted that the construction of home-made sets on a large scale had not been foreseen, but was quite confident as to the Company's future. Already, he said, they had made contracts for their London programme as far ahead as next December. Though many interests, such as the theatrical profession, were afraid that their position would be prejudiced, and had accordingly determined to boycott the Broadcasting Company, the latter had not given up the hope of an amicable understanding with them all. The company were sure that, so far from prejudicing them, they could be helpful to these interests. In about six weeks the new Manchester and Birmingham stations would be operating, and the difficulty of securing performers, owing to the inaccessibility of the present stations, would be removed.

It may be noted that a Conference was held on Wednesday in an endeavour to secure some settlement of the deadlock between the theatrical and wireless interests.

Use of Wireless in Emergencies.

A striking proof of the possibilities of wireless was given on Sunday night, when a message was broadcast from London asking any listener-in to inform Mrs. Carr, of Flitwick, Ampthill, Beds., that her son was lying seriously ill at the Middlesex Hospital. The hospital authorities had found that there was no other means of communicating with Flitwick, and sought the aid of the B.B.C. as a last resource. Within ten minutes of the broadcasting of the message, a car had been sent to bring Mrs. Carr to Luton, whence she travelled to London by train. Subsequently, several other listeners-in in the locality went to inform her.

The Wireless Year Book.

The 1923 edition of "The Year Book of Wireless Telegraphy and Telephony," which has just been published by Marconi's Wireless Telegraph Co., is more corpulent than ever. This may be ascribed to the advent of broadcasting which has caused an interest in radio matters to be generated in a number of new places. Though there has been no marked progress in scientific development during the year that most useful feature, the "Record of Development," still makes interesting and informative reading, and the value of this is much enhanced by Mr. Platt's Historical Survey. On the other hand, large power wireless stations are being constructed in every part of the world and in many ways "wireless" is becoming more and more a part of our daily life. All this is reflected in the Year Book by an enlargement of the existing features and by the publication of fresh matter relating to Direction Finding. A map section shows the position of every wireless station in the world.

Miscellaneous Wireless Items.

The Merchant Shipping Advisory Committee is recommending to the Board of Trade that MOTOR LIFEBOATS FITTED WITH WIRELESS TELEGRAPHY should be carried by foreign-going steamships in certain cases.

In the House of Commons last week, the POSTMASTER-GENERAL informed Lieut.-Colonel FREMANTLE that he could not grant wireless licences to schools on more favourable conditions than those applicable to other licences. He also intimated that he thought it undesirable that the broadcasting service should be used for the dissemination of speeches on controversial matters. This referred to a speech made from the London Station on the subject of the threatened building lock-out.

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Companies' Reports, Dividends, etc.

VICKERS, LTD.—Dividend declared of 5 per cent., less tax, for 1922 on the ordinary shares, the same as for 1921.

EVER READY CO. (GREAT BRITAIN).—Final dividend recommended of 6½ per cent. on both the ordinary and preference shares, making 10 per cent. for the year ended March 31st in each case.

The STOCK EXCHANGE COMMITTEE have granted official quotations to £350 000 5½ per cent. electric power extensions debentures, 1922, of the Auckland Electric Power Board and £300 000 6 per cent. redeemable general mortgage debenture stock of the Melbourne Electric Supply Co.

The STOCK EXCHANGE COMMITTEE have granted official quotations to 150 000 £1 fully paid ordinary, 75 000 £1 fully paid 4½ per cent. cumulative preference, and 175 000 £1 fully paid 6 per cent. cumulative second preference shares of the Bournemouth and Poole Electricity Supply Co.; 290 310 £1 fully paid ordinary shares of the Brompton and Kensington Electricity Supply Co.; £200 000 7 per cent. second (registered) debentures of the Madras Electric Supply Corporation; and 260 000 £1 fully paid ordinary shares of the South London Electric Supply Corporation.

Supply and Lighting.

ELECTRIC SUPPLY CORPORATION.—Dividend recommended of 5 per cent., less tax, on the ordinary shares, making 8 per cent. for the year, placing £10 000 to depreciation fund and carrying £3 363 forward.

Cable and Telegraph Companies.

CRAIGPARK ELECTRIC CABLE CO.—The accounts for the year to March 31st show a net profit of £10 842, after making provision for corporation tax, to which is added £1 797 brought in, making £12 639. Dividend recommended of 12½ per cent. on the ordinary shares, placing £1 000 to depreciation, £2 000 to reserve and carrying forward £2 102.

DIRECT UNITED STATES CABLE CO.—The accounts for the period from April 1st, 1922, to April 3rd, 1923, show a total income of £41 884, making, with the balance brought in, £45 800. After providing for income tax and corporation tax, directors' fees and administration expenses, the net balance was £27 903, out of which was paid an interim dividend at the rate of 4 per cent. per annum for the six months ended September 30th. The report states that the directors, having given careful consideration to suggestions made by shareholders that the company should be continued in the form of an investment company, have come to the conclusion that in the best interests of the shareholders the assets should be realised and distributed. Accordingly, at the annual general meeting, to be held at Winchester House, E.C., on May 9th, a resolution for the voluntary winding-up of the company and the appointment of a liquidator will be submitted. The balance sheet shows an estimated capital deficiency at April 3rd of £412 862. The issued capital amounts to £1 214 200.

Traction Companies' Results.

CORK ELECTRIC TRAMWAYS AND LIGHTING CO.—The revenue and expenses for 1922 were £133 660 and £92 561 respectively, leaving a balance of £41 099. To this is added £2 800 brought in, making £43 899. The directors recommend payment of the dividend on the preference shares up to the end of 1922, placing £15 000 to depreciation and renewals, £2 500 to contingencies and carrying forward £3 100. The engineer's report states that a frequent service of trams has been maintained as far as possible during the year.

DUBLIN AND LUCAN ELECTRIC RAILWAY CO.—The report states that after providing for debenture interest to date and transferring £3 500 from the amount received under the provisions of the Irish Railways (Settlement of Claims) Act, 1921, there is an available balance of £904 9s. 3d., which the directors recommend should be carried to next account. The directors regret that owing to the uncertain conditions of trade in the country at the moment they cannot recommend that the usual dividend for one half-year on the preference shares be paid, thereby leaving the cumulative preference dividend seven years in arrears.

New Companies.

NOX ELECTRIC LAMP CO., LTD.—Private. Reg. April 20th. Cap., £2 000 in £1 shares. To take over the business carried on by W. Ellis and H. Wooldridge at 82, Albion Street, Leeds, as the "Nox Electric Lamp Co." Reg. office: 82, Albion Street, Leeds.

MIDLAND RADIOTELEPHONE MANUFACTURERS, LTD.—Private. Reg. April 18th. Cap., £1 000 in £1 shares. Manufacturers and merchants of all kinds of telegraphic, telephonic and wireless apparatus, etc. Reg. office: Brettel Lane Works, Stourbridge, Worcs.

J. B. SAUNDERS (1923), LTD.—Private. Reg. April 23rd. Cap., £3 000 in £1 shares. Electrical, mechanical and general engineers, metal workers, founders, manufacturers of and dealers in electric, wireless and other apparatus, etc. Reg. office: 10, Park Lane, Cardiff.

WHOLESALE EQUIPMENTS, LTD.—Private. Reg. April 24th. Cap., £2 000 in £1 shares. Electricians, mechanical engineers, suppliers of electricity for light, heat, motive power or otherwise, engineers, brassfounders, gas and electrical meter manufacturers, etc. Solicitor: R. W. Nicholas, 31, Queen Street, Cardiff.

NORTHERN RADIO CO., LTD.—Private. Reg. April 19th. Cap., £5 000 in £1 shares (2 500 7½ per cent. cumulative participating preference and 2 500 ordinary). Electrical, mechanical and general engineers, manufacturers of and dealers in electrical and other machinery, radio instruments and wireless apparatus, etc. Reg. office: 19, Hopwood Avenue, Market Place, Manchester.

JOHN ARMSTRONG AND CO. (MANCHESTER), LTD.—Private. Reg. April 17th. Cap. £2 500 in £1 shares. To adopt an agreement with John Armstrong, and to carry on the business of electrical engineers and contractors, and dealers in all kinds of material, apparatus and appliances connected with the use of electricity, etc. Reg. office: Lancaster Buildings, Barton Square, Manchester.

S.S. WIRELESS CO., LTD.—Private. Reg. April 16th. Cap., £100 in £1 shares. To establish, work, manage, control and regulate wireless and line telegraph and telephone exchanges and works for the supply of electric light, heat and motive power, and to transmit and facilitate the transmission of telegraphic and telephonic communications and messages, etc. Reg. office: 95, Deansgate, Manchester.

ARMSTRONG CONSTRUCTION CO., LTD.—Private. Reg. April 20th. Cap., £250 000 in £1 shares. To acquire the property referred to in a certain agreement, the parties to which are not named; and to carry on the business of constructional, mechanical, civil, electrical, chemical, hydraulic, pneumatic, gas, aerial, mining, railway, tramway, naval, marine, heating, lighting, ventilating, and consulting engineers, etc. Reg. office: 8, Great George Street, Westminster, London, S.W.

TECHNICAL INSTRUMENT CASE MANUFACTURING CO., LTD.—Private. Reg. April 23rd. Cap., £1 500 in £1 shares. To take over the business of technical instrument case and box manufacturers, carried on as a subsidiary business by the Re-Echo Electrical Manufacturing Co., Ltd., at 45, Johnson Street, Westminster, and to carry on the same and the business of cabinet makers, joiners, carpenters, etc. Reg. office: 43, Johnson Street, Horseferry Road, London, S.W.

Business Items.

The HOTPOINT ELECTRIC APPLIANCE CO. has notified the trade of further reductions in the price of the "Premier" Vacuum Cleaner.

JOHN HUNTER AND CO. have removed from Paradise Street to new premises at 22, Rodney Street, Liverpool, where their telephone numbers are Royal 3273-4.

The RELAY AUTOMATIC TELEPHONE CO. has acquired new offices and works at Relay House, 27, Streatham Hill, London, S.W.2, to which address all correspondence should now be sent.

Mr. J. S. PLUMTREE informs us that he is no longer connected with the firm of Marshall and Plumtree. He is now in business at 90-91, High Holborn, London, W.C.1, as an electrical engineer and wholesale factor.

It may be noted that the D.P. BATTERY CO. recently erected a battery of nearly 1 000 Ah capacity for electric lighting purposes, at Polesden Lacy, where the Duke and Duchess of York have spent the first part of their honeymoon.

A Vancouver firm desires quotations from British manufacturers of rods to be used for ELECTRIC ARC and also OXY-ACETYLENE WELDING. Particulars may be obtained from the office of the Canadian Government Trade Commissioner, 73, Basinghall Street, London, E.C.2.

Messrs. R. C. C. Green and P. H. Jackson have been appointed representatives of the CONCORDIA ELECTRIC WIRE CO. for the Midland counties. A representative stock of the company's supplies will be carried at 12, Cherry Street, Birmingham. Mr. John L. Green will continue to call on his old friends.

Mr. A. Quaife, proprietor of the "J. L." Electric Co., informs us that he has made arrangements for the "J. L." UNIVERSAL WIRING CLIP to be exclusively manufactured for and distributed by Mr. Walter Balmford, "Electric House," Whittall Street, Birmingham, to whom all orders and correspondence concerning this article should in future be addressed.

John Armstrong and Co. inform us that they are arranging to convert their business into a private limited company under the name of JOHN ARMSTRONG AND CO. (MANCHESTER), LTD. Notwithstanding this change of name the business will be continued on the same lines as at present and the management and conduct will not be in any way affected. Mr. Armstrong, as the governing director of the company, will retain full control.

We are informed that the ST. HELENS CABLE AND RUBBER CO. will shortly leave Warrington for new works at Slough, where new machinery is now being installed. When the new plant is in full swing it is intended to shift the existing machinery from Warrington. The new site at Slough consists of a factory which was built by the Government during the war, and has hardly been used so far. The area, including the land adjoining, amounts to about 200 000 sq. ft., a considerable increase over the area of the present works. Excellent railway facilities are available. It is expected that the whole of the works will be transferred during the next two or three months.

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Company Meeting.

British Electric Transformer Co.

The twentieth ordinary general meeting of the British Electric Transformer Co., Ltd., was held at Winchester House, London, E.C., on Tuesday.

Mr. A. F. Berry (chairman of the company), who presided, said, in dealing with the balance-sheet, about £62 114 of the available cash, which totalled £131 098, had been invested, and the investments represented by this sum, which included £50 000 in 5 per cent. War Loan, could be quickly realised when the necessities of the business required it. The gross profit on trading for the past year was about £78 000 less than that for the previous year, due to slackness of trade generally and the very low prices ruling for the company's products. The net profit showed a reduction of about £71 000. The results, poor as they might appear, were really not so very disheartening to those who, although they had to forego any dividend on their ordinary shares, knew how great had been the difficulties with which the company had had to contend. Not only had there been a shortage of work—which shortage, in turn, had forced down prices to an unremunerative limit—but they had had a lock-out of one month's duration. As a result of this stoppage, orders, output, supplies, etc., had suffered, and even to-day the company had not fully recovered. Owing to the conservative policy adopted by the board in the allocation of profits for the previous year, they were able to bring into the available balance this year no less than £12 708, bringing the total available to £33 137.

Ample Provision for Reserve.

This enabled them to pay the 7 per cent. dividend on the preference shares for the past year, to place a further sum of £4 000 to depreciation reserve—which the board considered ample for the purpose—and to carry forward £8 137. Although the present found them, in common with many others in industry, dealing with a most difficult period of their existence, he had no doubt they would win through. They had through the last twenty-five years developed the business steadily, in spite of ups and downs, and it was largely because of their successful past that they were by sheer momentum going forward at the present time. They were now fording a stream of difficulties such as they had never been confronted with before.

He feared that it would take them the greater part of the present year to get on to terra firma, and it would certainly be well into next year before they would be able to reach a profit-earning stage which would permit of any appreciable distribution to the ordinary shareholders, for although the company was able last year to produce a profit, this was rather the result of work carried forward than of the prices obtained in the year under review.

Business Now Growing.

During the present year it would be difficult to produce results even as good as those for the past year, for although the actual volume of business was now growing and orders to date amounted to more than for the first four months of last year, they had virtually come very near to giving two halfpence for one penny. The volume of the world's work having shrunk, buyers had been exigent to an unprecedented degree, and the staff had had particularly uphill work to satisfy purchasers of plant to such an extent as to obtain orders and payment. The position, however, had not been without value, for there was no doubt that right through the industrial community there had been for some years too much inclination, in dealing with work, to say "That is near enough," instead of aiming at the very highest production possible. It might interest shareholders to know that in the opinion of many good judges on such matters, the electrical manufacturing industry of England was before the war perilously near being at the mercy of foreign interests. By hearty co-operation and strenuous endeavour this condition of affairs had been greatly remedied.

Even as those who were responsible for the management of the company pursued the policy of co-operation with their friends in various sections of the industry, so could a numerous body of shareholders, such as that company possessed, help themselves and the company.

For the current half-year to June 30th the company would probably see their low-water mark of profit-making; after that period it was highly probable that the increased demand would have operated to make possible some return on the capital involved in manufacturing, though he wished to warn shareholders that the lifting of prices to a reasonable level followed slowly on the increasing demand.

Hiring "Tricity" Apparatus.

He drew particular attention to the fact that shareholders could now hire "Tricity" products in many towns. We were on the eve—or at the dawn—of greater electrical domestic developments than many people imagined. The sooner shareholders inquired of their electric supply authorities as to what they could do in the way of hiring "Tricity" electric heating and cooking appliances made by this company the sooner they would obtain the additional comfort and cash savings that were now possible in so many houses where a public supply of electricity was available. Each year the board found some shareholders helping themselves much, and the company quite a little, in the directions that he had indicated, and with some three thousand shareholders a co-operative movement of that sort was of great value.

The director's report and accounts were adopted unanimously.

Tenders Invited and Accepted.

UNITED KINGDOM.

NOTTINGHAM CORPORATION.—Two 4-ton refuse-collection electric vehicles. Particulars from the Wharf Superintendent, Eastcroft, London Road, Nottingham.

GLASGOW CORPORATION, May 8th.—Six or twelve months' supply of materials to the tramways department, including brake blocks, wire, castings, ironmongery, oils, paints, rubber and asbestos goods. Specifications from the General Manager.

MANCHESTER CORPORATION, May 10th.—Three-phase 6 600 V sub-station switchgear. Specification from Mr. F. E. Hughes, Town Hall, Manchester.

YORK CORPORATION, May 10th.—1 000 kW motor-generator and switchgear. Specification from the City Electrical Engineer.

ASHTON-UNDER-LYNE CORPORATION, May 14th.—Electric light wiring at the Town Yard and the Borough Hospital. Particulars from the Borough Electrical Engineer.

CARDIFF CORPORATION, May 15th—100 lamp pillars. Specification from the City Engineer.

SALISBURY CORPORATION, May 17th.—Wiring and fitting for electric light, part of the Council House. Forms from the City Engineer, Endless Street, Salisbury.

ST. PANCRAS (LONDON) BOROUGH COUNCIL, May 17th.—E.h.t. switchgear. Specification from the Electricity Department, 57, Pratt Street, N.W.1.

MANCHESTER CORPORATION, May 29th.—Twelve months' supply of cables for the Electricity Department. Specifications from Mr. F. E. Hughes, Town Hall, Manchester.

AUSTRALIA.

POSTMASTER-GENERAL'S DEPARTMENT, SYDNEY, May 17th*.—Telephone switchboard parts (schedule N.S.W.10).

MELBOURNE CITY COUNCIL, May 21st.—(*a*) Rotary converter, with transformer, &c.; (*b*) h.t. three-phase and d.c. switchgear. June 5th—6 600 V switchgear for sub-stations.

SYDNEY CITY COUNCIL, June 11th.—One 10 000 V earthing reactance and resistances. Particulars from Stores Superintendent, Electricity Department, Town Hall, Sydney.

CITY ELECTRIC LIGHT CO., BRISBANE, October 31st.—One 12 500 kW turbo-alternator.

IRELAND.

PORTRUSH CORPORATION, May 19th.—210 b.h.p. semi-Diesel engine, direct coupled to 125 kW dynamo, auxiliary petrol engine for starting, air compressor, pipes, tanks, switchboard extension, etc. Specification can be seen at the Council Offices.

NEW ZEALAND.

DUNEDIN CORPORATION, May 28th.*—Distribution transformers and storage battery. July 16th.*—Switchboard panels.

BEDFORD CORPORATION have accepted the tender of Siemens Bros. and Co. for e.h.t., h.t. and l.t. underground cables for one year.

SPENBOROUGH URBAN DISTRICT COUNCIL have accepted the tender of the Western Electric Co. for cable and trifurcating boxes.

The tender of the Brush Electrical Engineering Co., for a transformer at £209 11s. 11d., has been accepted by MAIDSTONE CORPORATION.

The tender of Bell and Robertson for wiring and fitting the town hall for electric lighting at £340, has been accepted by ELGIN CORPORATION.

Barnes and Son have secured a contract for the construction of a sub-station at Kemp Town for BRIGHTON ELECTRICITY DEPARTMENT, at £3 616.

The English Electric Co. have a contract for the equipment required for the first portion of the electrification of the GREAT INDIAN PENINSULA RAILWAY.

Tenders accepted by WALSALL CORPORATION include those of Callender's Cable and Construction Co. for supply and laying of main to Aldridge Colliery, £7 886 7s. 11d., and Ferguson, Pailin Ltd., switchgear, £109 11s. 6d.

The UNDERGROUND ELECTRIC RAILWAYS COMPANY OF LONDON have placed a contract with W. T. Henley's Telegraph Works Co. for h.t. cables for the Edgware and Hampstead Railway. The amount of the contract is £9 720.

The Electricity Committee recommend CHESTER CORPORATION to accept the tender of the Metropolitan-Vickers Electrical Co., at £2 808 10s., for two transformers for use in connection with the supply of electricity from Queen's Ferry.

BELFAST ELECTRICITY COMMITTEE recommend the City Council to accept the tenders of Hurst Electrical Plant, Ltd., of Belfast, for d.c. switchgear for three sub-stations, and Drysdale and Co. for a centrifugal pump for the Harbour power station.

The following tenders have been accepted by BIRKENHEAD CORPORATION: W. T. Henley's Telegraph Works Co., 12 miles 1 sq. in. and 3 miles 0.2 sq. in. cable, £3 763 10s., and Edison Swan Electric Co., six miles 0.05 sq. in. cable, £972.

The following tenders have been accepted by STRETFORD URBAN DISTRICT COUNCIL: Wardle Engineering Co., road lighting, £517; W. T. Glover and Co., transmission lines, £13 614 0s. 3d.; Metropolitan-Vickers Electrical Co., switchgear and transformers, £16 450.

* Particulars from the Department of Overseas Trade.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

ATKINSON, J., AND CO., 16, Cecil Court, St. Martin's Lane, W.C., electrical engineers. £21 19s. 2d. March 13th.

BROWN AND CO., 20, Gratton Road, West Kensington, electricians. £28 18s. 2d. March 19th.

COLLINS, W., AND SONS, 12 and 14, Mill Row, Kingsland Road, N., electrical engineers. £16 16s. 4d. March 2nd.

MILES, N. (late trading as HOWARD AND CO.), Avenue Works, Avenue Road, Willesden, electrical engineers. £14 18s. 4d. March 13th.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Bankruptcy Information.

PILBROW, Frederick Arthur (trading as H. AND J. WEST), 78, Stoke Road, Gosport, Hants., electrical engineer. Receiving order, April 20th. Debtor's petition. First meeting, May 9th, 3 p.m., and public examination, May 14th, 11.30 a.m., Court House, St. Thomas's Street, Portsmouth.

Notices of Intended Dividends.

DENNIS, Frederick Hungate, lately carrying on business at 20, High Street, Chelmsford, electrical engineer. Last day for receiving proofs, May 9th. Trustee, T. Gourlay, 29, Russell Square, London, W.C.1.

ROWE, Edward George, 119, Dunraven Street, Tonypandy, Glamorgan, under the style of DAVIES AND ROWE, electrical engineer. Last day for receiving proofs, May 12th. Trustee, E. Owen, Official Receiver, 34, Park Place, Cardiff.

Partnerships Dissolved.

A. E. HUNT AND SONS (Arthur Edward HUNT, Emmie HUNT, Daisy Emmie HUNT, Arthur John HUNT, Arthur Wilfred HUNT and Arthur George HUNT), electrical engineers and contractors, Herne Bay Electricity Works, Herne Bay, Kent, by mutual consent as from February 1st, 1923, so far as regards A. E. Hunt. The other five partners will continue the business. Debts received and paid by the said five continuing partners.

H. L. WOOD, SON AND CO. (Henry Lunnon WOOD and Henry Guy STANTON), electrical engineers, 2, Palmerston Arcade, Grove Road, South Southsea, Southampton, and at 36, Russel Street, Portsmouth, by mutual consent as form April 24th, 1923. Debts received and paid by H. C. Rabbidge, of 3 and 4, Clement's Inn, Strand, Middlesex, Chartered Accountant.

WINCH AND HOLROYD (Charles Francis WINCH and George Wilfred HOLROYD), electricians, 110, Churchill Road, Dollis Hill, N.W. 2, by mutual consent as from February 23rd, 1923. Debts received and paid by C. F. Winch.

Receivership.

ARROWSMITH (H.) AND CO., LTD. H. Sharp, of 30, Brown Street, Manchester, was appointed receiver on April 13th, 1923, under powers contained in debenture dated August 9th, 1922.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

CONCORDIA ELECTRIC WIRE CO., LTD., Burton-on-Trent.—Registered April 10th, debenture securing £9 500 and further advances, to E. J. Knight, Woodlands Cottage, Burton-on-Trent; general charge (subject to £25 000 debenture dated January 25th, 1923). *Nil. July 25th, 1922.

EXPERT ELECTRICAL CO., LTD., London, S.W.—Registered April 16th, £1 350 debentures; general charge.

PALMER, RILEY AND CO., LTD., Accrington, electrical manufacturers.—Registered April 14th, £300 further charge, to O. Clegg, 93, Doury Street, Accrington, butcher; charged on 90 and 94, Abbey Street, etc., Accrington. *£900. March 2nd, 1923.

RADIO APPLIANCES, LTD., London, E.C.—Registered April 16th, £1 000 debentures; general charge.

ROBINS ELECTRICAL AND WIRELESS DEPOT AND INSTITUTE, LTD., Cardiff.—Registered April 18th, £2 148 debenture, to R. W. Robins, Wallbrook, Cyncoed Road, Cardiff, engineer; general charge.

SCOTT (JAMES), LTD., Bootle, electrical engineers.—Registered April 18th, £600 charge, to C. H. Thompson, The Laurels, Withernsea, and another; charged on 48, Hedon Road, Hull. *£12 000. September 1st, 1921.

SPICER AND CO., LTD., London, E.C., electrical engineers.—Registered April 17th, £5 000 debentures; general charge; also registered April 17th, £5 000 (not ex.) charge, to E. R. Jones, 411, Tower Buildings, Liverpool, grain merchant, and others, general charge (subject to debentures). *——. August 13th, 1922.

TEIGNMOUTH ELECTRIC LIGHTING CO., LTD.—Registered April 20th, £100 debentures, part of £5; general charge.

Satisfactions.

EDMUNDSONS' ELECTRICITY CORPORATION, LTD., London, S.W.—Satisfaction registered April 13th, £75 000, registered May 4th, 1920.

TRIUMPH ELECTRIC MANUFACTURING CO., LTD.—Satisfaction registered April 18th, £1 000, part of amount registered February 26th.

VAN RADEN AND CO., LTD., Coventry, electrical engineers.—Satisfaction registered April 24th, £1 000, registered October 15th, 1920.

Edinburgh Gazette.

AYRSHIRE ELECTRICAL CO. (Daniel W. CLOSE, trading as), New House, Kilbirnie. Estates sequestrated April 19th.

Bankruptcy Proceedings.

CONTAMIN, Louis, electrical engineer, 9, Wingate Road, Hammersmith, W. The statutory first meeting of creditors was held last week. Debtor was born in Paris but has been naturalised in this country. For a time he was in the employment of a carburettor company, first as clerk, next as salesman, and finally as buyer. In March of last year he formed an electrical supplies company with a nominal capital of £6 000, and he acted as its managing director at a remuneration of £10 a week. In the name of the company he made purchases from another company which went into liquidation, and he was held liable for debts amounting to £500 contracted on their behalf. He received £50 from the liquidator and he had since paid the whole of those debts with the exception of £97 to the petitioning creditors and £20 to another firm. These, he says, represent his only liabilities. On the other hand he possesses furniture of the value of £1 300. The meeting resulted in a resolution for bankruptcy being passed.

FARNELL, Henry, 183, Higher Hillgate, Stockport, plumber and electrician. According to the statement of affairs the liabilities amounted to £865, against assets of £41, a deficiency of £624. Debtor attributed his failure to sickness in family, and losses on contracts. It appeared that he commenced business in 1908 at Heathland Terrace and continued there until 1910. Later he removed to his present address. In 1912 when the liabilities amounted to £250 and assets £200, debtor made an arrangement with his creditors. He recommenced business in 1918 and executed a deed of assignment on January 29th last.

SMITH, Archibald, trading as SMITH AND GILL, 57, Albion Street, Nelson, Lancs, electrician. The adjourned public examination, after adjournment *sine die*, of this debtor was held at Burnley recently. Debtor commenced business in December, 1920, he and his partner each putting in about £20. In the following year the partnership was dissolved, but debtor continued the business until March, 1922, when the premises were burnt down and the stock destroyed. He received £440 from the insurance company. Subsequently he took an office in Cross Street, Nelson, and continued until September last, although he had no stock. He was aware of his position just before August, 1922, and later a meeting of the creditors was held, when he made them an offer of 9s. in the £, which was refused. In December last debtor went to South America as trade was bad, but after staying about six weeks, he returned to England.

THE ASSOCIATED ELECTRIC TRADERS, LTD., 2, Percy Street, Tottenham Court Road, W. In this compulsory liquidation the Official Receiver has now issued to the creditors and to the shareholders, a summary of the company's statement of affairs which shows liabilities £8 219, of which £5 719 are expected to rank, and estimated assets £4 042, of which £2 500 are required to meet the claims of debenture holders. A deficiency of £4 176 is accordingly disclosed with regard to the creditors while in relation to the shareholders a total deficiency of £9 653 is shown. On September 30th last, Mr. T. J. Wilson, 59-60, Old Bailey, E.C., C.A., was appointed by the Court receiver and manager on behalf of the debenture holder. Steps have been taken at the request of the petitioning

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creditors to contest the validity of the charge created by the debentures. Wenzel says that he is unable to agree to certain of the figures shown in the statement of affairs. The Receiver recently reported that he had realised about £1 160 including the proceeds of the sale of the business, and he estimated that the outstanding debts would produce about £800. The failure and insolvency of the company are attributed by Russell to depreciation of stock and to the slump in trade generally. The Official Receiver continues to act as liquidator.

WEEKS, William Edward, 59, Victoria Street, and 12, Filton Avenue, Horfield, Bristol, wholesale electric dealer. The public examination of this debtor was held on April 27th, at the Guildhall, Bristol. According to the statement of affairs the liabilities amounted to £1,693 3s. 8d., and there was a deficiency of £715 9s. 2d. Debtor attributed his failure to slump in trade, bad debts and want of capital. The examination was adjourned.

Institution Notes.

Mr. J. A. Brodie has been elected president of LIVERPOOL ENGINEERING SOCIETY, which celebrates its Jubilee this year.

The summer meeting of the WESTERN CENTRE OF THE INSTITUTION OF ELECTRICAL ENGINEERS has been postponed from May 25th—28th to June 1st—4th.

The secretary of the INSTITUTION OF THE RUBBER INDUSTRY informs us that Mr. W. S. Flight will read his paper on "Rubber as a Dielectric" on June 4th instead of on May 7th.

On Friday last Mr. C. H. Plant lectured before the SHEFFIELD SECTION OF THE JUNIOR INSTITUTION OF ENGINEERS on the electric theory of iron. The annual outing of the Section will be to Buxton on June 23rd.

Further consideration of the proposal to alter the name of the DIESEL ENGINE USERS ASSOCIATION has been deferred, pending the report of a sub-committee of the British Engineering Standards Association, which is considering the definition of a heavy oil engine.

At the annual meeting of the ASSOCIATION OF OFFICERS and STAFF MEMBERS of ELECTRICITY (POWER AND SUPPLY) COMPANIES last week, it was stated that the Association had now £1 000 invested in Conversion Loan. The accounts showed a credit balance of £678. It was stated that the membership was increasing and now stood at 250. Sir A. B. W. Kennedy continues to act as president, and the retiring members of the committee, the hon. treasurer, the hon. secretary, and the hon. assistant secretary were all re-elected.

The annual general meeting of the newly formed MERSEY AND NORTH WALES (LIVERPOOL) Centre of the INSTITUTION OF ELECTRICAL ENGINEERS was held on Friday last, when the following officers were elected for 1923–24: Chairman, Mr. E. M. Hollingsworth; vice-chairman, Messrs. H. H. Harrison and A. E. Malpas. Committee: Messrs. L. Breach, J. Hamilton, W. Lang, P. Priestly, A. J. Eames, J. A. Morton, E. Moxon, F. J. Teago, S. E. Britton, H. C. Hazel, W. Holttum, R. Harrison-Watson; hon. secretary and treasurer, Mr. O. C. Waygood. The meeting was followed by a smoking concert.

The annual general meeting of the SOUTH MIDLAND CENTRE of the INSTITUTION OF ELECTRICAL ENGINEERS was held on Wednesday. The report of the chairman and committee showed that the past session had been a successful one, the outstanding event being the annual dinner on October 16th. Steps are now being taken for the establishment of a local library, conjointly with the Institutions of Civil and Mechanical Engineers. The membership increased during the year from 796 to 854. The following are the officers for 1923–24: Chairman, Mr. J. D. Morgan; vice-chairmen, Messrs. W. Lawson and J. Anderson; past chairmen, Messrs. R. A. Chattock and W. Cramp, D.Sc.; ordinary members of the committee, Messrs. W. Brew, F. W. Carter, W. E. Groves, W. F. Higgs, S. H. Holden, R. Jakeman, E. J. Jennings, C. Jones, W. J. Line, T. A. G. Margary, E. A. Reynolds, and G. Richardson. Hon. secretary, Mr. H. Hooper.

The NORTH WESTERN CENTRE of the INSTITUTION OF ELECTRICAL ENGINEERS held its final meeting of the session on April 10th. The secretary's report gave particulars of the membership before and after the formation of the new Liverpool Centre. The membership of the Centre was 1 214 in 1920–21, 1 343 in 1921–22, 1 395 at February 1st, 1923, but there was then a drop of 465 owing to the formation of the Liverpool Centre. The membership is now 965. It will be seen that before the depletion the total membership represented an increase of 52 on that of the session of 1921–22. The past session, during which the general meetings have been held, has been both interesting and successful. The average attendance has been 120 per meeting as against 115 of the previous session, and an average of 7·4 members have taken part in the discussions. The arrangements for the summer visits of the Institution to this Centre during the first week in June are now completed and circulated. The Engineers' Club was accorded the thanks of the Committee and members for the privilege of using the club rooms for meetings. Votes of thanks were also given to Mr. A. S. Barnard, the retiring chairman, and to Mr. A. B. Mallinson, the hon. secretary, who continues to hold this office for the next session. Mr. G. A. Juhlin was elected as chairman, and the ballot was completed for the new Committee, resulting in the election of Messrs. L. H. A. Carr, H. E. O'Brien, S. J. Watson, G. S. Corlett, and G. F. Sills. Mr. Corlett, being incapacitated through illness, Mr. W. R. Addison was elected in his stead.

Forty Years Ago.

"The Electrician," May 5th, 1883.

AN ELECTRIC RAILWAY AT WIMBLEDON.—The National Rifle Association have entered into a contract with the Electric Motor Syndicate to lay down an electric railway at Wimbledon on their improved system, and to work it during the meeting of the Association in July next. The train will consist of six carriages, carrying twenty-four passengers each.

* * * *

SOCIETY OF TELEGRAPH ENGINEERS.—At the meeting of the Society, to be held at 25, Great George Street, at 8 p.m., on Thursday, May 10th, the following papers will be read: "The Electric Holophote Course Indicator, for the Prevention of Collision at Sea," by J. H. A. MacDonald, Q.C., Associate; "Electro-Motors and Their Government," by Professors W. E. Ayrton, F.R.S., and John Perry, Members.

* * * *

ELECTRIC LIGHTING AND THE BOARD OF TRADE.—The Greenock Town Council sent a deputation to wait upon Mr. Chamberlain the other day to urge the necessity of amending the permissive powers of local authorities as to electric lighting, or, at all events, to extend the time allowed for experiments within a compulsory area from two to five years. Mr. Chamberlain being otherwise engaged when the deputation called at the Board of Trade, they saw Mr. T. H. Farrer, permanent secretary. This gentleman promised that the matter should receive attention, but did not think that there was any hope of the period during which experiments could be made being extended.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"Contemporary Continental Craftsmanship—Furniture Design at Brussels Exhibition"; "Bedroom Furnishing"; "The Standish Hall Library."

THE CHEMICAL AGE.—"The Accuracy of Volumetric Analysis"; "New Chemical Text Books"; "British Progress in Fur Dyeing."

THE EUROPEAN COMMERCIAL.—"Analysis of the Cutlery Industry of Great Britain, Germany and U.S.A."; "A Snapshot View of Jugo-Slavia"; "Bulgaria's Financial Problems."

THE FRUIT GROWER.—"Merchandise Marks Bill in Committee"; "Protest Against Plant Quarantine"; "Sir Douglas Newton's New Office."

GARDENING ILLUSTRATED.—"The Yellow and Copper Austrian Briars" (illustrated); "Early Pruning of Roses"; "Ferns for Rooms."

THE GAS WORLD.—"Special Monthly Coking and By-Product Section"; "The Standard of Gas Supply"; "Gas in Steam Raising."

THE HARDWARE TRADE JOURNAL.—"Travelling Requisites for 1923"; "The Art of Soldering"; "Chats on Silver and Plate."

Prices of Metals, Chemicals, etc.

TUESDAY, May 1.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£74 0 0	—	£2 10 0
Electro Wirebars	„	£80 0 0	—	£1 10 0
H.C. Wire, basis	per lb.	11½d.	—	⅛d.
Sheet	„	11¾d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 3⅛d.	—	⅛d.
Brass 60/40—				
Rod, basis	„	7¾d.	—	—
Sheet, basis	„	10¼d.	—	—
Wire, basis	„	10¾d.	—	¼d.
Pig Iron—				
Cleveland Warrants No. 3	per ton	£6 10 0	—	2s. 6d.
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 10 0	—	—
Lead Pig—				
English	„	£27 0 0	—	5s. 0d.
Foreign or Colonial	„	£25 15 0	—	5s. 0d.
Tin—				
Ingot	„	£211 0 0	—	£2 0 0
Wire, basis	per lb.	2s. 9d.	—	¼d.
Aluminium Ingots	per ton	£110 0 0	—	—
Spelter	„	£32 5 0	—	£1 12 6
Mercury	per bottle	£10 0 0	2s. 6d.	—

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2¾d.
„ (Roll-Brimstone)—„ £8 5s. *Sulphuric Acid* (Pyrites, 168°) per ton, £7 10s.
Copper Sulphate.— „ £26 10s.
Boric Acid (Crystals). „ £55 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 3d.; plantation 1st latex, 1s. 3⅛d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd, and the rubber prices by W. T. Henley's Telegraph Works Co.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

192 095 P. FREEDMAN. Electric rectifiers. (25/10/21.)
178 404 AKT.-GES. BROWN, BOVERI ET CIE. High-voltage switch plant. (15/4/21.)
168 884 D. J. B. KOOLHAAS. Maximum automatic cut-out. (30/8/20.)
192 129 SPEEDY AND EYNON and P. SPEEDY. Switches or contacts. (18/10/21.)
192 133 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Radio-signalling systems. (20/10/21.)
192 140 H. ST. J. DE A. DONISTHORPE. Thermionic valves. (24/10/21.)
192 141 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Radio-transmitting systems. (24/10/21.)
172 933 C. M. SANCHE. Electro-therapeutic apparatus. (17/12/20.)
192 160 W. M. BARRINGTON, W. E. BOTTOM, and M. H. GOLDFARB. Circuit couplings. (27/10/21.)
192 171 H. M. DOWSETT. Arc generators of electric oscillations. (28/10/21.)
192 183 F. W. HAMPSHIRE. Means for audibly signalling upon sounds being reproduced in a telephone receiver. (2/11/21.) (Cognate Application, 1339/22.)

APPLICATIONS FOR PATENTS.

April 16.

10 231 A. C. BROWN. Telephone receivers.
10 241 G. TURNOCK. Telephone cord terminals.
10 242 SOC. CERAMICA RICHARD-GINORI. Suspension insulators. (20/4/22, Italy.)
10 243 SOC. CERAMICA RICHARD-GINORI. Suspension insulators. (15/11/22, Italy.)
10 252 H. BAILEY. Inductance tubes.
10 254 A. J. EVANS. Hydrometers for testing electrolyte in batteries.
10 255 A. J. EVANS. Treating sulphated plates of batteries.
10 269 A. C. GUNSTONE. Gramophone device for wireless reception.
10 271 H. CARTIER. Circuit breaker. (9/5/22, France.)
10 273 H. E. HARRISON (ZSCHOCKE-WERKE KAISERSLAUTERS, A.G.). Connector for making contact between telephone tags and terminal.
10 289 R. H. BUXTON and C. M. CROFT. Electrically-controlled door fastenings.
10 290 J. L. BEGIN. Radio telephony.
10 291 B. JACKSON. Crystal detectors.
10 292 B. JACKSON. Inductance and resistance coils.
10 295 G. CAILLER. Electric pocket lamps. (15/4/22, Switzerland.)
10 297 METROPOLITAN-VICKERS ELECTRICAL CO. Circuit interrupters. (18/4/22, U.S.)
10 298 METROPOLITAN-VICKERS ELECTRICAL CO. Radiators. (29/4/22, U.S.)
10 303 P. CLARK AND CO., P. R. CLARK, E. E. EDWARDS and G. G. COOP. Automatic cut-out for electric boiling vessels.
10 308 W. T. SAUNDERS. Wireless telephone apparatus.
10 315 GENERAL ELECTRIC CO. and C. G. EDEN. Electric discharge tubes.
10 318 C. A. BAKER. Electric ovens.
10 324 R. C. ARTER. Telephone exchange systems. (17/4/22, U.S.)
10 321 E. L. PEASE. Electric radiators.
10 333 BRITISH THOMSON-HOUSTON CO., A. P. YOUNG and J. H. BUTCHER. Sound-emitting instruments.
10 343 J. GUILLOT. Collecting and utilising terrestrial electricity.
10 345 N. OBOUKHOFF. High frequency alternators.
10 351 BRITISH ELECTRIC PLANT CO. and A. W. MAUDLING. Dynamo-electric machines.
10 352 AUTOMATIC TELEPHONE MANUFACTURING CO. Telephone systems. (11/9/22, U.S.)
10 353 AUTOMATIC TELEPHONE MANUFACTURING CO. and F. TENCH. Telephone systems.
10 359 A. HELFENSTEIN. Forming continuous electrodes.

April 17.

10 364 A. DREW. Mast for wireless aerials.
10 373 W. PARKINSON, R. S. BUNTING, E. A. and L. E. TAYLOR. Switching for multi-circuit radio receivers.
10 374 J. WALTON. Telephone receivers.
10 382 A. FORD-LLOYD and W. H. BROWN. Crystal cups for wireless receivers.
10 385 H. E. V. BRUCKNER. Fuse plug. (19/4/22, Germany.)
10 388 G. A. MORRIS. Sound amplifying and directing appliances.
10 414 A. S. CUBITT. Electric terminals.
10 427 WESTERN ELECTRIC CO. and S. T. BUER. Wireless receiving circuits.
10 432 SIEMENS BROS. & CO. and A. E. FOSTER. Joints in electric cables.
10 433 ENGLISH ELECTRIC CO. and E. H. H. HASSLER. Commutators for electric machines.
10 435 P. A. GARRETT and G. W. IRWIN. Sound amplifying devices for telephone receivers.
10 436 T. CLARKE. Support for incandescent lamps.
10 439 BRITISH THOMSON-HOUSTON CO. Automatic reclosing circuit breakers. (12/5/22, U.S.)
10 441 A. R. BRADMAN. Telephone receivers.
10 437 E. J. TOOMEY and S. WISEMAN. Tuning wireless telephone circuits.
10 445 T. K. BARNARD. Variometer inductances.
10 452 A. T. COOPER. Maximum demand indicator and recorder.
10 456 A. KARN. Phototelegraphs.
10 471 F. L. HOLLIXTER. Wireless telephone receivers.
10 479 E. L. WIEGAND. Terminals for electric conductors.
10 480 E. L. WIEGAND. Electric heating devices. (1/2/23, U.S.)
10 482 M. P. PEDERSEN and N. F. PRASS. Incandescent lamps. (28/7/22, Germany.)
10 488 F. A. JOHNSON. Arrangements for detecting small variations of current.
10 490 WIRELESS EQUIPMENT CO. and B. M. J. DAVIS. Reproducing d.c. of required tension from d.c. supply of different tension.
10 491 IGRANIC ELECTRIC CO. (CUTLER-HAMMER MANUFACTURING CO.). Potential control apparatus.

April 18.

10 500 J. N. HUNTLY. Pocket wireless receiving apparatus.
10 503 J. DUTSON. Electric light attachment.
10 512 J. H. WILLIAMS and A. MARR. Tuning inductance coils.
10 519 B. M. GRACE-WHITE. Magnetic compass for relaying.
10 522 SUDBURY AUTO ELECTRIC SERVICE and P. J. GATES. Apparatus for localisation of faults in battery cells.
10 524 A. W. SHARMAN. Loudspeakers for radio telegraphy.
10 525 A. T. HUTCHINSON. Connecting plug for radiators, etc.
10 528 J. A. CRABTREE. Switches.
10 532 S. SHELDON. Pad for head telephones.
10 537 ST. HELEN'S CABLE AND RUBBER CO. and W. HEUGHAN. Switches.
10 540 S. H. SERSHALL. Electric terminals.
10 545 CALLENDER'S CABLE AND CONSTRUCTION CO. and F. J. COOPER. Cables.
10 551 WESTERN ELECTRIC CO. Oscillation generators. (18/4/22, U.S.)
10 552 W. H. SUMNER and G. W. COTSWORTH. Combination connector for electric fittings.
10 559 S. G. JONES, W. K. BARKER and J. W. GOODMAN. Lighting arresters, etc.
10 562 C. J. COLEMAN. Rectifier crystals for wireless telephony.
10 565 L. H. PADDLE. Electric water heaters.
10 568 W. R. MICKELWRIGHT. Gripping device for crystals for wireless telegraphy.
10 570 A. H. S. MACCALLUM. Wireless receiving apparatus.
10 572 and 10 585 W. S. STEPHENSON and G. W. WALTON. Electrically transmitting scenes, etc.
10 575 N. N. OGLOBINSKY. Magnetic compass deflectors. (10/6/22, France.)
10 579 ENGLISH ELECTRIC CO., H. BARNES and J. C. WILSON. Electric converting apparatus
10 594 A. C. NEAL. Tramway, etc., rails.
10 595 F. G. GALLEY and G. P. KENT. Flashing electric signs.
10 615 E. A. GRAHAM. Cabinets for wireless apparatus.
10 616 F. A. CAM and E. P. LIDDELL. Thermionic valves.
10 623 W. C. DAVEY. Receiving apparatus for wireless telegraphy.
10 624 R. LINSE. Resistance. (18/4/22, Sweden).

April 19.

10 642 P. PRIESTLY. Trucks for electric tramcars.
10 654 W. LAWRENCE. Trolley poles.
10 668 J. E. WATKINSON. Wireless coil-holders, etc.
10 671 A. R. UPWARD. Voltaic cells and batteries.
10 675 A. BOURGAIN. Electric radiator. (15/5/22, France.)
10 676 C. OLIVER. Distance operated mechanism having tuned oscillating members.
10 681 R. DOYLE. Filaments in thermionic valves.
10 682 D. SUCHOSTAWER. Electrical machines.
10 693 J. M. BURNETT and W. HADDON. Accumulator grids.
10 700 A. K. COOLEY. Headpieces and telephone mountings.
10 706 F. M. F. SAMMARCELLI. Glow-lamp bulbs.
10 711 RADIO COMMUNICATION CO. and N. LEA. Reception of wireless signals.
10 712 RADIO COMMUNICATION CO. and N. LEA. Wireless reception apparatus.
10 714 BRITISH THOMSON-HOUSTON CO. and J. H. BUTCHER. Sound emitting instruments.

April 20.

10 724 A. W. WILLIAMS. Multi-core cables.
10 754 S. H. GRANT and D. D. WALKER. Electric signs.
10 756 WESTERN ELECTRIC CO. Telephone systems. (6/6/22, U.S.)
10 761 C. H. CHAMPION AND CO. Control of arc light.
10 763 IGRANIC ELECTRIC CO. (CUTLER-HAMMER MANUFACTURING CO.). Regulation of electric circuits.
10 776 L. SYRETT and C. TOPLEY. Electric clocks.
10 794 P. O. DORER. Switches.
10 798 ELECTRO-MECHANICAL BRAKE CO. Drum controllers, etc.

April 21.

10 822 R. GORDON and C. BARCLAY. Machine for coating electric lamps, etc.
10 858 W. LANGDON-DAVIES. Alternating current utilisation.
10 869 T. C. DAVIS. Lead-in insulator for wireless apparatus.
10 875 R. W. PYNE. Three electrode valve.
10 880 BRITISH RADIO-WIRELESS MANUFACTURING CO. and H. A. M. READ. Terminal connections for electric circuits.
10 882 F. M. VAN GELDEREN. Insulating cap for cable joints.
10 890 N. L. BOYDEN and C. M. LEWIN. Plug connectors.
10 896 D. A. SOULIER. Electrical installations comprising condensers. (17/5/22, Belgium.)

Arrangements for the Week.

FRIDAY, MAY 4th. (To-day.)

INSTITUTION OF CIVIL ENGINEERS.

6 *p.m.* At the Institution, Great George Street, London, S.W.1. James Forrest Lecture on "The Interdependence of Abstract Science and Engineering," by Sir Richard Glazebrook.

JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At 39, Victoria Street, London, S.W.1. Lecturette on "A.C. Neutral Point Earthing," by Mr. S. A. Stigant.

EDINBURGH ELECTRICAL SOCIETY.

8 *p.m.* At the Philosophical Institute, 4, Queen Street, Edinburgh. Annual Meeting and Prize Distribution.

SATURDAY, MAY 5th.

LONDON ASSOCIATION OF FOREMEN ENGINEERS.

6.20 *p.m.* At Cannon Street Hotel. Seventieth Anniversary Festival.

MONDAY, MAY 7th.

INSTITUTE OF TRANSPORT.

5.30 *p.m.* At the Institute, 15, Savoy Street, Victoria Embankment, London, W.C.2. Lecture on "Investigation of the Return on Capital Expenditure resulting from Electrification," by Sir Philip Dawson.

SOCIETY OF ENGINEERS.

5.30 *p.m.* At the Geological Society, Burlington House, London, W. Paper on "Pneumatic Handling of Petrol and other Inflammable Liquids," by M. Pierre Mauclère.

ROYAL SOCIETY OF ARTS.

8 *p.m.* At John Street, Adelphi, London, W.C.2. Second Howard Lecture: "The Development of the Steam Turbine," by Mr. Stanley S. Cook.

WEDNESDAY, MAY 9th.

ROYAL SOCIETY OF ARTS.

8 *p.m.* At John Street, Adelphi, London, W.C.2. Lecture on "Recent Developments in Surface Combustion," by Prof. Wm. A Bone.

THURSDAY, MAY 10th.

ROYAL INSTITUTION OF GREAT BRITAIN.

10 *a.m.* At Great George Street, Westminster, London, W. Annual Meeting. Selection of certain papers to be read and discussed.
2.30 *p.m.* Afternoon Session. A selection of papers to be read and discussed.
3 *p.m.* At the Institution, 21, Albemarle Street, Piccadilly, London, W.1. Lecture on "Modern Electric Lamps," by Prof. J. T. MacGregor-Morris.

INSTITUTION OF ELECTRICAL ENGINEERS.

6 *p.m.* At the Institution, Savoy Place, Victoria Embankment, London, W.C. The Fourteenth Kelvin Lecture on "Problems in Telephony, Solved and Unsolved," by Dr. J. A. Fleming.

FRIDAY, MAY 11th.

IRON AND STEEL INSTITUTE.

10 *a.m.* Annual Meeting at Great George Street, Westminster, London, W. A selection of certain papers to be read and discussed.
2.30 *p.m.* Afternoon Session. A selection of Papers to be read and discussed.

INSTITUTION OF ELECTRICAL ENGINEERS.

7 *p.m.* At the Institution Building, Savoy Place, Victoria Embankment, London, W.C.2. "Electrical Measuring Instruments," by Mr. C. A. Wilck.

INSTITUTION OF ENGINEERING INSPECTION.

7.30 *p.m.* At the rooms of the Royal Society of Arts, John Street, Adelphi, London, W.C. Paper on "Some Notes on 'Ciment fondu'—a cement of high initial resistance—with Results of Chemical Analysis," by Mr. Harley F. Knight.

JUNIOR INSTITUTE OF ENGINEERS.

7.30 *p.m.* At 39, Victoria Street, London, S.W. Durham Bursar's Lecture, "The Theory of Resistance to the Flow of Gases and Fluids in Pipes," by Mr. W. F. C. Cooper.

THE ROYAL INSTITUTION OF GREAT BRITAIN.

9 *p.m.* At the Institution, 21, Albemarle Street, Piccadilly, London, W.1. Lecture on "Gaseous Combustion at High Pressures," by Prof. Wm. A Bone.

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THE ELECTRICIAN

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CONTENTS.

Notes of the Week	497	Joint Engineering Council	517
Auxiliary Driving	499	Glasgow Electricity Department Sports Ground	517
Notes on Wireless Matters. By Prof. G. W. O. Howe	500	N.A.S.E. Prize Competition	517
An Improvement in Speech Amplifiers. By H. A. Hankey	501	West Midlands Industrial Council	517
Studies from a Wireless Laboratory. By W. H. Eccles, F.R.S. Illustrated	502	Birmingham Electrical Golfing Society	517
The Magnetic Drum and Wireless Apparatus. By N. W. McLachlan, D.Sc. Illustrated	505	Imperial Notes	518
"James Forrest" Lecture on The Interdependence of Science and Engineering. By Sir Richard Glazebrook	506	Foreign Notes	518
The Electrician "All-Electric" House Competition	507	Electricity Supply	519
New Single Phase Meter. Illustrated	510	Personal Items	519
Correspondence	511	Private Bills	520
"Safety First." Two Notable Safety Devices. Illustrated	512	Tenders Invited and Accepted	520
The "Eye Restolite." Illustrated	512	Electric Traction	521
Mersey and West Lancs Electricity District	513	Local and National Expenditure	521
Parliamentary Intelligence	513	Wireless News	521
The Duddell Memorial Fund	513	Reference Index to Wireless Publications	522
Insulating Oils Specification	513	Companies Reports, Dividends, etc.	523
E.D.A. Slogan Competition	513	New Companies	523
Merchandise to Sell and Profit By. Illustrated	514	Commercial Intelligence	524
Catalogues, Price Lists, etc.	515	Institution Notes	525
Tomlinson Lee *v.* Peel	516	Business Items	525
		Forty Years Ago	525
		Patents in the Irish Free State	525
		British Empire Patent	525
		Prices of Metals, Chemicals, etc.	525
		Patent Record	526
		Arrangements for the Week	526

Notes of the Week.

The Interconnection of Science and Engineering.

As will be seen from the abstract which we publish on another page of this issue, Sir Richard Glazebrook in the "James Forrest" lecture, which he delivered before the Institution of Civil Engineers last Friday, repeated an oft told tale. In the first James Forrest lecture delivered thirty years ago Sir William Anderson pointed out that scientific and engineering progress could not proceed on parallel lines but must converge and be interwoven. In the interval since 1893 the realisation of that truth is reflected in the increasing number of students taking scientific engineering courses at our Universities and technical colleges, in the greater demand by employers for men whose experience is not only practical but theoretical, in the care bestowed by Trade Unions on the inauguration of proper apprenticeship systems and above all in the money, time and brains that is being spent in research. All this Sir Richard aptly illustrated by a wealth of detail making an interesting story which will repay careful study. If we are to progress we must do all in our power to ensure the acquirement of more and more knowledge and to obtain an answer to Goethe's prayer for more light.

What Science Has Done for Engineering.

To the sceptic who may enquire what is the good of education and research, Sir Richard has a cogent answer. The history of wireless communication is a clear-cut example of how pure scientific research undertaken with no ulterior object can help technical and commercial development. To those who do not believe this (if there be any) we can only recommend a study of Sir Richard's survey. If that will not convert them they are hopeless. In other fields the interdependence of science and engineering, whether it be the mechanical or the aeronautical branch, is equally marked. We need only mention the steam turbine as a case in point. The lesson to be learnt from all this is therefore clear: that the engineer and above all the commercial man must not neglect the scientist. The latter working in his laboratory on problems whose solutions seem to be widely detached from anything connected with bread and butter may almost unconsciously throw a light across some dark path or other. Not the less may the research worker, as Mr. Atkinson has shown, save money and time to those whose business it is to design, to manufacture and to sell. More education and more money for research are therefore much to be desired.

Complicated Canadian Tariffs.

British electricity supply engineers who are blamed for the multiplicity and complication of their tariffs should take heart of grace when they see what the Toronto Electric Commissioners are doing in this direction. To begin with supply is given on three systems, alternating current at 25 and 60 cycles and direct current; and there are different tariffs for all three systems under the headings residence service, commercial lighting, power and street lighting. Under the first of these headings, on the 25 cycle supply, the floor area determines the service charge, the rate being 3 cents per 100 sq. ft. of floor area per month, with a minimum of 1 000 sq. ft. and a maximum of 3 000 sq. ft. There is a running charge of 2 cents per kWh for the equivalent of 3 kWh per 100 sq. ft. of area charged, and 1 cent per kWh for additional units consumed. A discount of 10 per cent. is allowed if the bill is paid within ten days, and the minimum bill is 75 cents per month. On the 60 cycle residence supply the running charge is 5 cents per kWh for the first 5 kWh per room per month, with 2 cents per kWh for additional consumption. A penalty, not a discount, of 0·5 cent per kWh is charged for non-payment within ten days, and there is a minimum charge of 1 dollar

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per month. Neither of these systems are on the side of simplicity, but on the direct current supply the charges are even more complicated. Six cents per kWh for the first 5 kWh per room per month is charged, followed by 4 cents per kWh for the next 4 kWh per room per month and 2 cents per kWh for additional consumption. The penalty and the minimum bill are the same as for the 60 cycle supply. The best that can be said for these tariffs is that the prices are low. Nevertheless we hope that no attempt will be made to introduce them in this country.

A Three-Way Maximum Demand.

FOR commercial lighting a sort of three-way maximum demand system is used on the 25 cycle supply with discounts and minima as before, and on the 60 cycle and direct current systems a two part maximum demand, also with penalties and minima as before. The charges for power are equally complicated. On the 25 cycle system three-phase current at 550 V is supplied. The service charge is $1.25 per month for the first 10 H.P. of maximum demand and $1 per month for all excess. The running charge is 1.5 cents per kWh for the first 50 hours' use of maximum demand, 0·75 cents per kWh for the next 50 hours, and 0·4 cents per kWh for the rest. A discount of 10 per cent. is allowed. On the 60 cycle system the supply is the same, but the charges are different. For demands under 100 H.P. the basis of charge is 100 per cent. of the connected load for the first 10 H.P., 90 per cent. for the next 10 H.P., and 60 per cent. for the next 80 H.P. Above 100 H.P. the demand is determined by meter. The charge is $1.5 per H.P. per month on demand with an energy charge of 2 cents per kWh for the first 50 hours' monthly use of demand, 1 cent per kWh for the next 50 hours' monthly use, and 0.5 cent per kWh for the rest. In Canada the electricity consumers must be either more intelligent or more complacent than they are in this country. The extraordinary thing is that anybody uses electricity at all.

Electric Miners' Lamps.

WE notice that in a recent paper which he read before the Manchester Geological and Mining Society, Sir HENRY HALL took up a singular attitude in regard to the use of electric miners' lamps. He doubted whether the disease of nystagmus was really due to inadequate lighting and enquired if it was true that " the miner had ever suffered from want of light for his purpose." On these points he is certainly at variance with expert opinion. The discussion before the Illuminating Engineering Society in 1920 showed a consensus of opinion that inadequate lighting is the main cause of nystagmus, and this view was completely confirmed by the report of the Miners' Nystagmus Committee last year. Sir HENRY suggests that the disease is due to volatile gases from the coal seam. But in the discussion referred to Dr. J. S. HALDANE, who is one of the foremost authorities on the subject, explicitly stated that in his opinion the condition of air in mines had little to do with the disease. It requires little imagination to understand that the extremely low illumination and abnormal conditions as regards contrast in coal mines may have a prejudicial effect on vision; and the evidence available leaves little room for doubt on this point. Another striking confirmation of the importance of better light in mines is afforded by an instructive series of experiments recorded in a recent issue of the Journal of the National Institute of Industrial Psychology. Volunteers were asked to work for eight week shifts, first by the light of the ordinary miners' lamp and then by a special lamp, which, though heavier, furnished four times as much light. It was found that the increased illumination led to an improvement in output of over 14 per cent. There can be no question that the better light afforded by modern electric lamps is badly needed; in fact, if miners could be induced to accept a somewhat heavier lamp, enabling a bigger battery and a still more powerful light to be used the drawback of the increased weight would be more than compensated by the better illumination. Naturally the mere provision of more light is not the only problem. There is room for experiment on better methods of distribution and we are glad to note that investigations in this direction are being made.

Playing the Game.

WE hear that a specially shabby kind of behaviour is being exhibited by some employees of electricity supply undertakings. These men are not paying their weekly subscription to their Trade Union regularly, and are thus causing the maximum trouble over a simple matter. The question has been mooted in District Councils as to whether undertakings could not take some steps to assist the Trade Unions in the direction—but the obvious difficulties in the way have prevented anything being done. Meanwhile these defaulting members are deriving the full benefit of the rates obtained through the efforts of their Trade Unions. So although undertakings can do nothing officially, no harm would be done by employers letting it be known that such shirkers have no sympathy from them. This indication is the more necessary since in some cases the defaulters are not above currying favour by pretending they are only Trade Union members by *force majeure*, and are really not at all anxious to support their union. Now we hold no brief for the Trade Unions, but so long as there are Trade Union " shops " and the employees therein are benefitting by the Trade Union rates, then the only honest course is for every member to pay his subscription. The most practical way perhaps in which employers can help is by giving every facility and even encouragement to the shop stewards to inspect periodically all the cards and to report thereon. Publicity here as in many other instances will of itself work wonders. The advantages for the employer is that in the first place it will show Trade Unions that the employer is not only playing the game himself but will not tolerate anyone in his employ doing otherwise. It will set a better moral tone by insisting on honesty in all dealings. The man who is not loyal to his union cannot be depended on to be loyal to others and will be all the better finally for being kept up to the mark.

" The Electrician " " All-Electric " House.

ON another page of this issue we publish the scheme for an " All-Electric " House which gained the second prize in our recent competition. This scheme is due to Mr. W. M. CRAUFURD. Commenting on it the judges make the following remarks: This competitor allows for two two-wire systems, one for power and one for lighting, but he does not explain how he proposes to meet the supply authority's requirements with regard to balancing. He has assumed that any arrangement of service and voltage would automatically meet the case and has ignored the expressed condition that the house was in the Hackney area. It will be noted that Mr. CRAUFURD'S literature is much more expansive than that of Mr. PERONNE. This is largely due to the introduction of controversial and irrelevant matter, matter which is in fact out of place in such a document. From the technical point of view the scheme is weak owing to the inadequate number of lighting plugs provided. One of the greatest advantages of the " All-Electric " House will be the flexibility of its arrangements, but that flexibility cannot be attained unless the number of " outlets " errs on the side of generosity. On the other hand, this competitor has taken great care on the literary side of his production in which respect he far outdistances all the other entrants. Once again we suggest that these criticisms should be marked and digested.

The German Note and British Trade.

IT is not going too far to say that the issues raised by the recent German Note are vital to British trade. Germany

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is not only an important direct customer, but by being able to purchase from distant markets, including our own Overseas Dominions, she would create the power in those lands to buy from us. This, it is becoming to be recognised, is a most important factor in international economics, but it is not too generally recognised that this power to purchase is being steadily destroyed by the failure to settle the interlocked questions of Allied Debts and Reparations. As regards the trade situation in the Rhineland the difficulties of transport ships and manifests still remain, and the new order as to permits for motor transport still further blocks a way which had appeared open. Sixty per cent. of the coke ovens in the Ruhr are now reported closed. The one advantage of this was that during March British coal to the value of £2 250 000 was purchased. The situation therefore remains one of exceptional difficulty and we hope that no effort will be spared to bring about a solution.

Water Cooling of Cables.

THREE sections of 35 000 V cable, each 12 000 ft. long, are to be installed in Los Angeles to relieve the system in the business section of the city. Two of these lengths will be of the belted type, and the other of the Hochstadter type. Both types will be three-conductor, 400 000-circ. mil. lead-covered cable. One of the noteworthy features of this cable is that the conductors will be of sector shape. Both types of cable will be paper-insulated, the thickness of insulation on the belted type being $\frac{3}{64}$ in., and that on the Hochstadter type $\frac{27}{64}$ in. The capacity of the two types will be 12 000 kW and 15 000 kW respectively. An ingenious method of installing the cable to dissipate the heat will be used. Fibre ducts 4½ in. in diameter will be cast in a U-shaped concrete block, and a 6-in. water main will be laid in this concrete trough. Running water in this main will serve to dissipate the heat more rapidly. The manholes will be constructed with a concrete partition through the centre, and four of the cables will pass through one half of the manhole and four through the other. The water main will pass through the concrete partition. This concrete wall will be an effective fire barrier and will permit of the cables in one half of the manhole being shut down while workmen are engaged, without danger of accident. The use of water for cooling is now so universal in our power stations that both logically and for economic reasons there seems a case for extending its employment to the distribution system. But it is an added complication and distinct complication.

Auxiliary Driving.

Recent developments in power-station design have led to close consideration being given to the methods of supplying and driving the auxiliary plant used both in the boiler-house and the engine-room. It is natural enough that this should be so for more than one reason. This plant, though a necessity, is not "useful" in the economic sense so that methods for saving money on its purchase, operation and upkeep are worth consideration. On the other hand it is an important factor in the maintenance of the continuity of supply, and that importance has rather increased than decreased as power station design has become at once more simple and more complicated. The interconnection of supply systems also has a bearing on the problem—a bearing which sometimes assists matters and sometimes makes them more difficult.

What the Problem Is.

The presentation of the Paper on "The Drive of Power-Station Auxiliaries" by Messrs. L. BREACH and H. MIDGLEY before a recent meeting of the Institution of Electrical Engineers was, therefore, opportune. The authors considered the various types of auxiliaries that can be used, and the suitability of these various types for the various conditions of station working. That their communication was somewhat inconclusive is only to be expected. For many cases there is no one system which is obviously better than the others and the choice, therefore, becomes a matter of personal predilection. Moreover, we have not reached any state of standardisation, blessed or otherwise, in this matter, and conditions may arise which will modify views now held one way or the other. As the authors came to no definite conclusions, the discussion was also inconclusive and we are unable to say which of the many schemes proposed by the authors is the most popular.

The Importance of Continuity of Supply.

But, as the authors rightly point out, whatever system is chosen the importance of continuity of supply must be kept in the forefront. For this reason they group the auxiliaries usually employed into two divisions, depending on their relation to the necessity for keeping the station on load and to the necessity for keeping a particular turbo-alternator on load. Loss of vacuum must at all costs be avoided, and the circulating water supply, air extraction and station lighting must, therefore, be maintained. The boiler-feed pump and the power-control circuits may be allowed to stop for 60 seconds; water extraction, individual stokers and fans for five minutes; and coal and ash conveyors, pumps for water-softening and economiser scrapers for 24 hours. This predicates that for the first-class duplicate plant and an independent supply are necessary, and that in the second and third classes duplication to some extent and alternative supplies are desirable.

Cost *v.* Reliability.

That brings the authors to the question of the system, and here they rightly remark that cost must be kept subservient to absolute reliability, especially as the cost of the auxiliary plant is only about 5 per cent. of the total cost of the station. Their comments on the various systems of drive available are exhaustive and to some extent unnecessary. It is now generally agreed that each modern station must have within it another power station to provide the necessary power should a complete shut-down occur. In other words, a set of the most important auxiliaries must be steam driven. The critical might argue that there is no end to such an arrangement; that auxiliary power stations must be completed with sub-auxiliary power stations, and so on. But here the law of probability comes, and if sufficient flexibility in the arrangements is provided, as has been done at Dalmarnock and as is, we are told, being done at Barton, little is to be feared on this score. In addition, the less important auxiliaries can be driven electrically in any way the station engineer best prefers. We hardly think that one of these ways need be direct current motors, whose advantages and disadvantages the authors discuss at some length. As they seem to favour this course, they might apply their own remarks on cost and reliability, to say nothing of convenience, an exercise which might make them come down rather more definitely on the side of alternating current.

To use alternating current is the more advisable owing to the increasing tendency to interconnect power stations—a matter which the authors do not consider. And if one power station can help another with its load there is obviously no reason why it should not help to start its auxiliaries. This, of course, does not preclude the use of direct current, but to employ alternating would make the arrangements more simple.

A Personal Matter.

The authors, with some success, have attempted to prepare a *vade-mecum* on this matter for designers of power stations. They have discussed every possible combination of plant and indicated in tabular form the advantages and shortcomings of each. As the discussion showed, however, this is not likely to be a matter which will be approached without prejudice and though the designer will no doubt study and criticise the information, he will continue happily to put his own ideas into practice.

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Notes on Wireless Matters.

The Marconi-Mullard Valve Patent Litigation.

By Prof. G. W. O. HOWE.

The patent situation with regard to the thermionic valve and its applications bristles with uncertainties; in this country, in America, France and Germany there has now been ten years of intensive research, accompanied by a very natural effort, to obtain protection for anything that had a shadow of practical utility. During half this time the usual channels of communication between various countries were either closed or disorganised and, moreover, the results of the researches had such possibilities of national importance that they were regarded as secret and confidential. Now that the various secret patents are being published, and we can compare the specifications and attempt to sort out the wheat from the chaff and decide which inventions should be given priority and what we can do or cannot do without infringement, we are faced with the usual difficulty in all such cases of interpretation of transporting ourselves back in imagination to the date of the alleged invention and deciding the correct construction to be put upon the wording of the specification in the light of the "state of the art" at the time.

The Valve Situation and the Recent Judgment.

The valve situation has been cleared to a slight extent by the recent judgment of the Court of Appeal in the action brought by the Marconi Company against the Mullard Radio Valve Co. for the alleged infringement of H. J. Round's Patent No. 28 413 of 1913 and of Péri and Bignet's Patent No. 126 658 of 1916. The defendants denied the infringement, and also disputed the validity of the patents. In the result the Court of Appeal upheld the decision of Mr. Justice Lawrence that the Mullard Co. had not infringed the patents. Mr. Justice Lawrence had decided, however, that the patents were valid, but in view of their decision that there had been no infringement, the Judges of Appeal did not consider it necessary to deal with the question of validity. Mr. Justice Lawrence's decision may be summed up by saying that the patents are valid if interpreted in a certain narrow sense, but that when so interpreted the Mullard valve does not infringe them.

The Round Patent.

The Round patent, which is the more important of the two, embraces two distinct inventions, one a certain circuit arrangement for beat reception, the other a certain detail of valve construction; it was only the latter with which the alleged infringement was concerned. The relevant claim reads as follows:—"A vacuum tube containing a hot filament, a grid formed as a closed cyclinder completely surrounding the filament and a third electrode in the form of a cylinder surrounding the grid substantially as described." The battle raged mainly around the words "a closed cylinder completely surrounding." The Fleming two-electrode valve invented in 1904 had a metal cylinder surrounding the filament but open at the top and bottom. In 1908 de Forest introduced the grid, but used the parallel plane construction. In 1911 von Lieben entirely separated the filament space from the anode space by making the grid as a perforated disc occupying the whole cross-section of the glass bulb. In his patent Round aimed at obtaining the same complete separation in the cylindrical type by employing a completely enclosed cylindrical grid. Mr. Justice Lawrence held that, from the wording of the specification, the grid must be in the form of a closed cylinder, whatever that may mean, but that the anode may be either in the form of a closed or open cylinder. The plaintiffs maintained that a "closed" cylinder meant one electrically closed, but the defendants maintained that the word "closed" referred to the ends of the cylinder and must be interpreted in the usual way.

At the time of the invention the filaments of the valves made by the Marconi Company were of the hair-pin type with the hottest part at the top and Round actually closed the grid by thimbling it over at the top; although of less importance the bottom was closed by fastening it down to a glass foot. In 1913 most valves were of the soft type, that is, the vacuum was not nearly so good as in the modern valve, and their correct operation was very dependent upon accurate adjustment to a particular point on the characteristic. If the inside of the glass bulb was subject to electrification by bombardment from the filament and if the charge so accumulated could produce an electric field at the filament, it was necessary to readjust the grid potentiometer at frequent intervals to counteract the effect of this charge. In the specification Round refers to the fact that although in the von Lieben valve the grid completely separates the filament from the anode, yet the glass is exposed to the cathode stream and becomes electrified, and his invention undoubtedly consisted in so forming the grid that it should present in all directions a physical barrier to the passage of the electrons, except through the interstices of the grid itself. With the introduction of the hard valve this became of less importance, and, moreover, with the introduction of linear filaments the hottest part of the filament was removed from the end to the middle of the cylinder; for these reasons the need for Round's completely enclosed or thimbled grid passed away. Referring to the Mullard Valve, the Master of the Rolls said: "There is no closed cylindrical grid in the sense in which I interpret the words in the defendant's valve. I am inclined to doubt whether there is any grid at all; there is a loosely coiled wire and I doubt very much whether it can be called a grid formed as a cylinder at all. At any rate it is not formed as a closed cylinder for it has no closed ends."

The Péri Patent.

The Péri patent was regarded as being of much less importance, it claims a combination of five constructional details or elements, viz. (1) the filament, grid and plate must be arranged concentrically; (2) each leading-in wire must come through the same glass foot and must form the support for its particular electrode; (3) the filament must consist of a straight wire stretched between the two branches of its conductor, which branches must be elastic so as to allow for the expansion and contraction of the filament; (4) the grid must consist of a spirally-rolled wire supported at its two ends, or in case of extra length by another spirally-rolled thicker wire with an elongated thread directed in the opposite direction to the spiral of the grid; (5) the cylindrical plate which surrounds the filament and the grid must be attached to its conductor by one or two hooks."

Mr. Justice Lawrence decided that the patent does not cover any forms or shapes other than those particularly described, although such other forms or shapes might operate to bring about the same results, or function in the same manner. The only claim which Péri makes is to a particular method of shaping, arranging and fixing the various well-known parts of a valve of this type so as to obtain a cheap and convenient method of manufacture, whilst at the same time enabling the valve, when assembled, to perform its usual and well-known functions. The Judges of Appeal agreed with this decision and also agreed that the Mullard valve did not infringe. According to Lord Justice Warrington: "Péri's claim is an exceedingly-narrow one and does not cover any forms or shapes other than those particularly described. The defendants' valve differs completely in detail from that described and claimed by Péri.

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On the Nature of Atmospherics.

An important paper on this subject was recently read before the Royal Society by R. A. W. Watt and E. V. Appleton. It is a record of work done under the auspices of the Radio Research Board at their Aldershot Experimental station. It is no exaggeration to say that it is far and away the most important paper yet published on this subject ; it is, however, only a preliminary report and the experiments are still proceeding. The method consists in inserting resistance in the foot of the aerial so that it becomes aperiodic and then examining the transient potential differences between the ends of this resistance by means of the new cathode ray oscillograph recently developed by the Western Electric Company. This instrument is of the hot-cathode type, with an anode potential of 300-400 V and a deflectional sensitivity of 1 mm per V. The screen is fluorescent, so that a single trace executed with a velcoity of 10^4 cm. per second is visible to the naked eye through the "afterglow." The instrument has two sets of deflecting plates at right angles, one set connected across the aerial resistance, either directly or through an amplifier, and the other set being given an alternating P.D. by means of a triode oscillator. The wave form of the atmospheric can thus be observed. Great care was taken that no spurious effects affected the shape of the curve.

Details of Experiments.

The experiments recorded in the paper were made between January 27th and February 12th of this year and generally between 7 p.m. and 11 p.m.

The total number of atmospherics tabulated during ten days was 590 and of these 516 were observed with sufficient accuracy to enable their "wave forms" to be drawn with some certainty. Of the 590 atmospherics observed 292 were aperiodic and of these 254 were negative, that is causing negative electricity to flow down the aerial to earth. The mean duration of these aperiodic disturbances was 4 250 microseconds (ms) but the values ranged from 100 ms. up to 1/20 second. The mean strength of the electric field acting on the aerial was 0·125 V per metre. Generally speaking, the disturbance grows and dies away at about the same rate, the curve being sometimes rounded and sometimes peaky.

In 298 cases the disturbance were quasi-periodic. There is usually only a single reversal of field, but sometimes two or three or even four complete oscillations were observed. The second and succeeding half waves decrease in duration as well as amplitude. The strength of field was about the same as in the aperiodic cases. Calculating the frequency from the duration of the first half-cycle, the mean frequency is found to be 385 cycles per second, a surprisingly low value compared with the frequencies used in radio communication. Contrary to the aperiodic type, the quasi-periodic type is predominantly positive, that is, the direction of the first rush corresponds to a positive current flowing down the aerial.

A Great Hindrance to Radio Communication.

One of the greatest hindrances to the development of long distance radio communication is the interference due to atmospheric disturbances, and all attempts to overcome this difficulty have been largely based on trial and error because one knew practically nothing of the nature of the enemy against whom one was fighting. Now for the first time we are permitted to look at the atmospherics and study its growth and decay ; surely we are justified in the assumption that this knowledge will make it a much simpler matter to devise methods of overcoming the difficulty and making receiving devices which will respond to the desired signals whilst remaining unresponsive to the atmospheric electric field.

An Improvement in Speech Amplifiers.

By H. A. HANKEY.

In order to get distortionless amplification, two things are necessary. Firstly, the valve should be worked on the straight part of its characteristic curve ; and secondly there should be no grid current. If the characteristic curve of an *R* valve is plotted it will be seen that if a low plate voltage of, say, 50 V is used, the middle point of the straight part of the characteristic will correspond to a grid potential of some 8 V positive, and that such a voltage causes an appreciable grid current flow. Should, however, the plate voltage be raised to 90 V, the straight

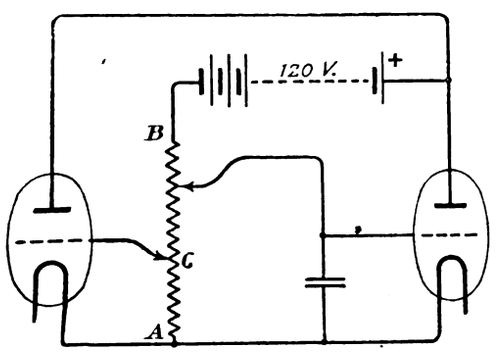

FIG. 1.

part of the characteristic is brought back approximately to the zero point of grid potential. A still further increase of voltage to 120 will move the middle point of the characteristic to the left, namely to about 3 V negative. When this has been done, it is possible to put quite a large oscillation potential on the grid without the grid ever becoming positively charged and grid current flowing. This negative potential to the grid is of paramount importance if distortion is to be avoided. Of course it is possible to incorporate a dry cell battery in the grid of an amplifier, but this is not to be relied upon, and is incidentally inconvenient. Certainly it cannot be termed an engineering proposition.

The method of operation recommended, by which the grid potential is automatically maintained at the correct value, will be most easily understood by reference to the simplified theoretical diagram below.

In the plate circuit is a resistance *R* of 2 400 O, which is connected between the h.t. negative and the negative end of the filament. Taking the h.t. negative terminal as a fixed potential, there is a drop of potential right round the plate circuit from the h.t. positive, equal to the voltage of the h.t. battery. Thus whilst the end *A* on the resistance is at the same potential as the filament negative, the other end *B* is at a potential lower than that of the filament negative. As the grid of the valve is connected to point *B* it follows that the grid is maintained at a negative potential relative to the filament negative, the amount of this negative potential being equal to the potential fall across *R* which depends on the currents flowing in the plate circuit. The grid of the first valve is connected to point *C* so that the value of the negative potential impressed on the grid is only one quarter of that on the grid of the second valve. Referring again to the characteristic curve of the receiving valve it is seen that as the plate voltage is increased, so the grid negative is increased, and this state of affairs is brought about automatically in the method described, thus each valve is worked at a point giving minimum distortion. In an actual instrument, the grids would be connected to the resistance via the secondaries of transformers and the resistance shunted by a 2 mfd. condenser.

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Studies from a Wireless Laboratory.*

By W. H. ECCLES, F.R.S.

The studies pursued in a wireless laboratory are mainly of two kinds, firstly those directed to the solution of problems that have arisen in the development or use of practical apparatus, and, secondly, those aiming at the application of novel principles or novel physical phenomena to the invention of new methods or apparatus. This discourse has to do with the latter. Attention will therefore be devoted to some possibilities of wireless telegraphy—possibilities tested in the laboratory but not yet tried on the large scale.

Some Vibration Phenomena.

The new methods to be first described are based upon the phenomena, not yet fully known in detail, which occur when one vibrating thing is caused to influence the vibrations of another thing. Consider the case of a simple pendulum consisting of a weight tied to the lower end of a string whose upper end is held in the hand, and suppose it is of such a length that it would vibrate freely to and fro in a period of two seconds, when the hand is held still. Then it is easily seen that by moving the hand horizontally to and fro with periodic motion of, say, one second, the pendulum will follow

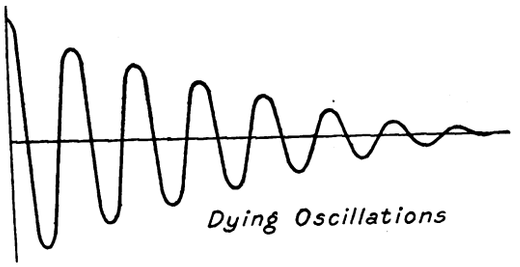

FIG. 1.

the hand and likewise vibrate with a period of one second. Similarly, when the hand vibrates with a period of, say, three seconds the pendulum will again follow and take the same period. This experiment is familiar, and is known to students of mechanics as an example of the subject of " forced vibration."

A pendulum forced in this manner may be said to vibrate " in time with " the hand, but the experiment shows that it is not " in step with " the hand. It would not be correct to say that it is " in tune with " the hand, since this term is reserved—in electrical physics, at any rate—to indicate that the natural period of the free and unpropelled pendulum is the same as the period of vibration of the hand. We may, however, express the state of affairs by saying that the pendulum is forced into accord with the hand, and that it is then in the " accordant state." A simple example of this relationship between two alternating movements is seen when a dog, for instance, is walking along the road ; his hind legs are in time but not in step with his fore legs.

Modern Wireless Oscillations.

The vibrations of a simple pendulum left free to vibrate with its own period gradually die down as indicated in Fig. 1. The vibration is a dying oscillation, and in such a case the theory of the forced vibrations is easily understood. In a

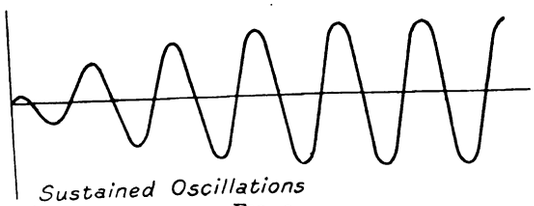

FIG. 2.

modern wireless laboratory, however, we have to deal with sustained vibrations of the type shown in Fig. 2, and in such cases the theory of the accordant state is rather different. This is to be expected, for it is like comparing a living thing to a dying one. Usually the vibrations are sustained by aid of the triode valves so well known, and the rates of vibration are very high. In order to lead up to an understanding of the accordant state at these high frequencies it is best to study low frequencies first.

A New Type of Oscillator.

For the study of vibrations slow enough to be followed by the eye a new type of oscillator has been designed and constructed, and is here exhibited for the first time. The sketch of Fig. 3 is a diagrammatic plan of the apparatus. The horizontal magnet has a horizontal ebonite rod fixed to it at right angles, and the whole is suspended from a vertical torsion wire passing through the centre of gravity. The poles of the magnet confront two horizontal solenoidal coils connected in series with each other and with a battery and diode valve, that is, a thermionic valve of the type invented by Prof. Fleming in 1904 and containing only two electrodes, namely a filament and a plate. Such a valve possesses the property that the electron current across the vacuum is sensitive to outside electrical influences if the electrodes have suitable relative positions—an ebonite rod charged by rubbing causes a diminution of the electron current when it approaches the diode and allows the current to increase again when it recedes. The action of this diode-sustained pendulum is now easily explained by supposing it swinging and noticing that the ebonite rod as it moves to and from the diode causes an alternation of magnitude of the currents in and magnetic fields of the coils which is automatically in correct time relation to assist the motion of the magnet. By means of a small mirror fixed to the magnet, and

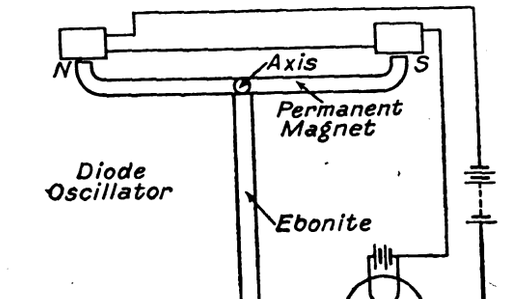

FIG. 3.

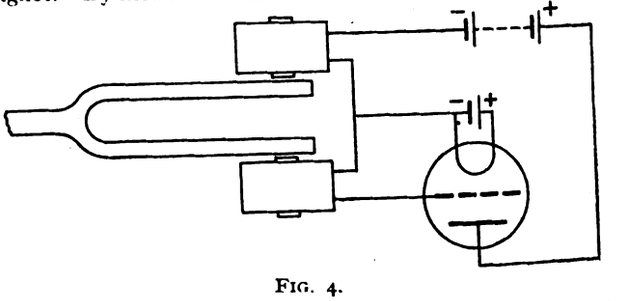

FIG. 4.

a lamp and scale, the building up of the motion from a small initial amplitude is easily seen.

With two such pendulums the accordant state can be studied by eye observation. Dr. Winifred Leyshon, who has kindly set this apparatus up for exhibition, is engaged upon this task. As arranged for the investigation one of the pendulums is made the master by sending some of its current through an auxiliary winding influencing the magnet of the other pendulum. The frequency of either the master or of the servant pendulum can be varied by aid of a movable permanent bar magnet placed near the oscillating magnet. Then it is seen that as one natural period becomes nearly the same as the other the master catches hold of the servant, compels him to abandon his own natural period and to move in time with the master's—though not necessarily in step. The amount by which the servant is out of step depends upon the difference of the natural periods and therefore can be regulated.

The Master Oscillator.

These slow vibrations are seen and not heard, but it is also possible to use vibrators of acoustic frequency and so make the

* The substance of an Evening Discourse delivered at the Royal Institution.

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according process evident to the ear. A tuning fork sustained by a triode is very effective as the master oscillator. The circuit is seen in Fig. 4, from which it will be seen that when the fork is vibrating the induced electromotive force acting upon the grid controls the anode current so as to sustain the motion.*

On the other hand an electrical oscillation, which is independent of moving matter, makes a good servant oscillator. Its circuit is shown in Fig. 5.

The linkage between the two oscillators is effected by passing some of the current from the fork coils through an auxiliary winding on the electrical oscillator. The fork is audible when oscillating because it agitates the air; the electrical oscillations can be made audible by inducing currents in another circuit containing a loud speaking telephone, and their frequency can easily be altered through a semitone or more by varying slightly the capacity of the condenser shown in Fig. 5. Now as the natural frequency of the electrical oscillator is approached to that of the fork loud throbbings (called "beats") are heard, which become gradually slower until at a certain point the master suddenly drags the servant into time and the throbbings cease. If the movement of the condenser is continued the natural period of the electric oscillator is carried through resonance and then beyond and finally the servant breaks away from the master and the throbbings indicating their difference of frequency begin anew.

This experiment is reminiscent of that of the two air-blown organ pipes discussed by the late Lord Rayleigh many years ago.† Rayleigh showed that two organ pipes nearly in unison dragged each other into a common frequency if brought into propinquity.

High Frequency Vibrations.

The preceding experiments have carried us from vibrations at two per sec. to vibrations at 200 per sec.; we now pass to the problem of accordance when the vibrations are of

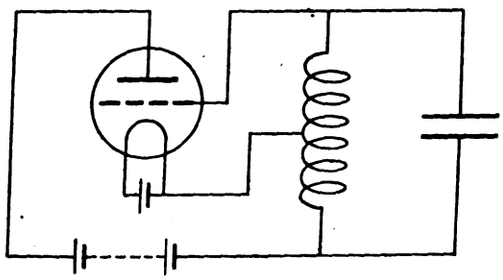

FIG. 5.

frequency 200 000 per second, such as are commonly used in wireless telegraphy and telephony. Such high frequencies are neither seen nor heard, but can be detected by special methods. The electrical oscillator exhibited comprises a triode and an inductance and capacity substantially, as in Fig. 5, though of very different magnitudes. The detecting apparatus is an inductance coil and variable condenser connected to a crystal detector just as in many a household crystal apparatus used for listening to the broadcasting stations. Here a galvanometer is connected to the crystal and a spot of light moves on the screen when the condenser is varied while the triode apparatus is in action. A maximum deflection is soon found and then the receiver is in tune with the triode oscillator. Another triode oscillator is now substituted for the first and varied in frequency until in tune with the crystal receiver. Clearly both triode oscillators are now of approximately the same frequency. Let them both be put into action simultaneously so as to act upon the crystal circuit, and let a pair of auxiliary coils, connected in series, be placed confronting the respective triode oscillators in order to establish a linkage. The crystal circuit is receiving energy from both of the triode oscillators and actuates the galvanometer. The accordant state is then easily found by varying one of the oscillators very slowly and watching the spot of light. At the moment when the two oscillators come within a certain frequency difference, they suddenly pull into time and the spot of light gives a sudden kick. This phenomena was discovered by Dr. J. H. Vincent and described in the "Physical Society Proceedings," p. 84, Feb., 1920. One of his curves is reproduced in Fig. 6.

This curve shows that as the condenser of one triode oscillator is increased the galvanometer in the crystal circuit shows first an increase and then a very sudden decrease of deflection. The nearly vertical parts of the curve are due to the establishment of accordance. In a rough way one may explain the phenomenon by saying that at the lowest point of the curve, where there is a sharp cusp, the two oscillators though vibrating in time with each other are oscillating oppositely. In fact one oscillator is moving like the front legs and the other like the hind legs of the dog cited already. The curve or the experiment shows that a very minute variation of the condenser of either oscillator makes the deflection increase enormously.

Applications to Wireless Telegraphy.

There are several ways of applying this novel phenomenon to wireless telegraphy. Two of these may be illustrated here.

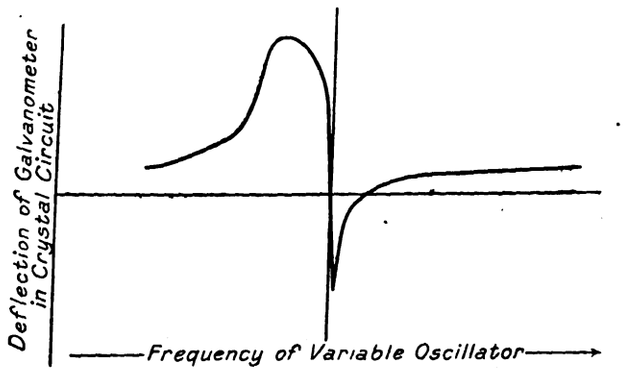

FIG. 6.

Suppose one of the two oscillators to be a distant transmitter from which electric waves are proceeding, and that these waves are picked up by the antenna at a receiving station. Let the antenna be coupled to a local oscillator in the relationship of master, and let a tuned detector circuit be acted upon by both the antenna and the local oscillator. Then suppose the local oscillator adjusted until it is in the accordant state with the antenna oscillations, and, in fact, adjusted until the detector current is at the minimum value corresponding to the cusp of Vincent's curve (Fig. 6). It then follows that a very minute variation of the frequency of the oscillations emitted by the distant station will give rise to a deflection of the galvanometer. It is suggested that signals could be transmitted by up and down changes in frequency—such changes would be far smaller than the changes of frequency employed by the accepted methods of the present day, and thus the interference between stations would be minimised. There are

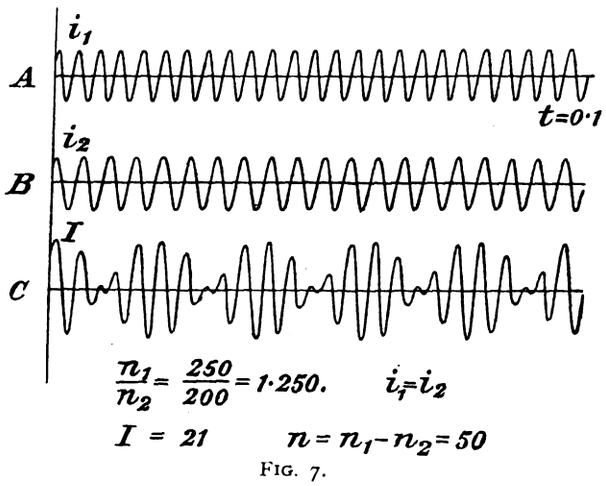

FIG. 7.

many easy ways of producing small changes of frequency at the transmitting station.

Another and very different method of signalling may be illustrated by this same apparatus, after again adjusting the receiving apparatus to the minimum deflection obtained in the accordant state. On trial it is found possible to bring the spot of light to any desired point of the scale—that is to any desired point on the vertical portion of the Vincent curve—by appropriate adjustments of the frequency of the transmitting unit. These latter adjustments are for this purpose conveniently effected by the motion of a short-circuited coil of wire

* See Eccles and Jordan, "Sustaining the Vibration of a Tuning Fork by a Triode Valve," THE ELECTRICIAN, June 20th, 1919.

† "Phil. Mag." 1879, "Collected Papers," vol. 1, p. 409.

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near the inductance coil of the transmitting oscillator. Therefore to every position of the auxiliary movable coil at the transmitter there corresponds a position on the spot of light actuated by the receiving apparatus. It might even be possible to mark the scales at each place with an alphabet and so communicate intelligence without the aid of the Morse code.

Application of the Accordant State.

The above described methods of signalling are based on the discovery and application of the accordant state. Another distinct series of methods will now be suggested and experimentally illustrated. These depend on the fact that the combination of two high frequency electrical vibrations of slightly differing frequencies yields a throbbing amplitude which may be made of audible frequency and of any desired pitch by adjusting the frequency of either of the original vibrations. The formation of relatively slow throbbings from two quicker oscillations is shown diagrammatically in Fig. 7. The existing modern method of receiving continuous waves known as the heterodyne method utilises this principle in the following way:—The transmitting station emits long and short trains of waves corresponding to Morse dashes and dots and of frequency, say, 200 000 per sec. These waves produce in the receiving antenna feeble oscillations which are combined with locally generated oscillations of about the same strength and of frequency, say, 200 500 per sec. The result is a compound high frequency current with 500 throbbings in it per second. These when rectified can be heard in a suitably connected telephone. The long and short trains of waves from the transmitting station thus give rise to sounds of long and short duration and of constant pitch. The pitch is adjustable by altering the local frequency from 200 500 to other values.

By altering this frequency from, say, 199 300 per sec. to 200 000 and then to 200 700 the sounds in the telephone run through a continuous scale of notes as represented in Fig. 8 which starts on the left with a note of 700 which falls in pitch to about 40 and becomes inaudible passes through resonance, becomes audible again and ascends a scale in opposite order to the first scale. Thus a note of any desired pitch can easily be obtained, but the intensity varies on account of the varying sensibility of the ear and the apparatus. This possibility of variation of pitch makes a number of new methods of wireless signalling feasible.

New Methods of Wireless Feasible.

One of the easiest resembles a very old kind of moving needle telegraph apparatus called Bright's bells in which the needle moved to one side and struck a bell in order to indicate a dot, and moved to the other side and struck a bell of different tone to indicate a dash. This method was faster than the dot and dash sounder and apparently easier to learn. In its proposed wireless form the transmitting station would emit equal wave

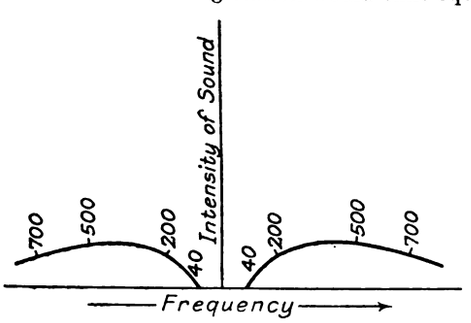

Fig. 8.

trains to represent dots and dashes of, say, 200 200 frequency to represent the dots and 200 500 frequency to represent the dashes. Each Morse sign is then heard at a receiving station using a local oscillator of 200 000 frequency as a little melody. Besides the advantages mentioned above there is a likelihood that these signals would be less distorted by atmospheric discharges than longs and shorts of constant pitch are.

Still another simple method consists of utilising three very close high frequency oscillations at the transmitting station, say, 200 200, 200 100, 200 050, and by making a new code for the alphabet out of permutations of these. The local oscillator would have a frequency of 200 000, and therefore the sounds heard in the telephone would be short tunes. The method would be faster than Morse, but might demand that the operators should have musical ears. Still another method can be imagined in which chords of three notes instead of arpeggios are used for the letters of the alphabet, but this might require an even more musical ear.

Analysis of Vowel Sounds.

But there is one kind of chord which everyone can recognise without special training, which even the horse can discriminate in the sounds of "whoa" and "gee." The vowel sounds are in fact chords. Lately Sir Richard Paget has given* a list of the chief tones occurring in the English vowels. For instance, the vowel sound in the word "calm" contains the tones of frequency 1 360 and 810 per sec. Suppose, therefore, a transmitting station is arranged to emit simultaneously electric waves of frequencies 201 360 and 200 810, and suppose these waves when received at a great distance are combined

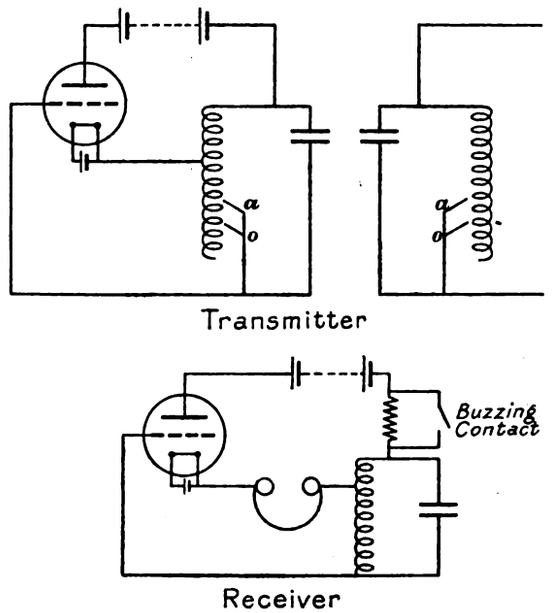

Fig. 9.

with local oscillations of frequency 200 000 per sec., then the tones 1 360 and 810 are perceived simultaneously as a chord in the operators' telephones. But this chord by itself is scarcely, if at all, recognisable as a vowel. Recognition is ensured by superimposing a larynx note by aid of a buzzing contact included in the receiving circuit. Then whenever a train of two waves leaves the sending station the vowel is pronounced by the receiving apparatus. This is easily illustrated to an audience by aid of a loud speaking telephone. Lecture apparatus for producing and detecting the two vowel sounds represented by *o*, *a*, is shown in Fig. 9. The change of radio frequency necessary for passing from one vowel to another is provided by the tappings on the inductance coils. In this apparatus the transmission occurs across a short distance; in practical telegraphy the transmitter would be more powerful and would be provided with an aerial, and the receiving apparatus would also have an aerial.

A Vowel Sound Apparatus.

The apparatus exhibited was constructed to produce six vowels, namely, those heard in the words eat, all, hate, shoe, calm, and earth. These six vowels taken in pairs yield thirty-six symbols, which, together with the five vowels, *a*, *e*, *i*, *o*, *u*, representing themselves, amount altogether to forty-one symbols. An alphabet formed in this manner is much briefer than the Morse code, that is to say, there are fewer efforts of the sending key in making the same message. For instance, the word London there are seventeen efforts when Morse is used, but only eight when the vowel code is employed. Besides the gain in speed there is a possibility of reception through atmospheric disturbances being easier with the vowel code than with the customary dots and dashes of constant pitch, but this can only be tested by actual trials.

Blackburn Electricity Committee, in a special report on the recent inquiry by the Commissioners as to extensions in the industrial area of N.E. Lancashire, states that the evidence of Mr. Wm. Birtwistle, Lancashire's largest spinner and manufacturer, and Mr. J. R. Williamson, of the Amalgamated Cotton Mills Trust, as to the ascertained results of the APPLICATION OF ELECTRICITY TO THE TEXTILE INDUSTRY, and its advantages to both employers and employed, greatly impressed the Commissioners.

* "Vowel Resonances." International Phonetic Association.

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The Magnetic Drum and Wireless Apparatus.*

By N. W. McLACHLAN, D.Sc.

The essential components of the device described in the Paper are (1) a revolving soft-iron drum having a recess in which are situated one or more coils coaxial with the drum, the ends of the coils being brought out to slip rings; and (2) a soft-iron or steel shoe which rides on the periphery of the drum. When current circulates in the coil, the magnetic attraction between the drum and shoe causes the latter to cling to the drum, and a considerable force is required to cause relative movement between the two surfaces. The drum is made to revolve at about 200 revs. per min. In order to minimise wear, two cast-iron rings are fixed over the drum, and these form the rubbing surfaces for the shoe. The latter is made of Swedish iron, Lowmoor iron or steel. When the revolving part is magnetised by the signal current, the shoe presses on the cast-iron rings and is carried round (see Fig. 1).

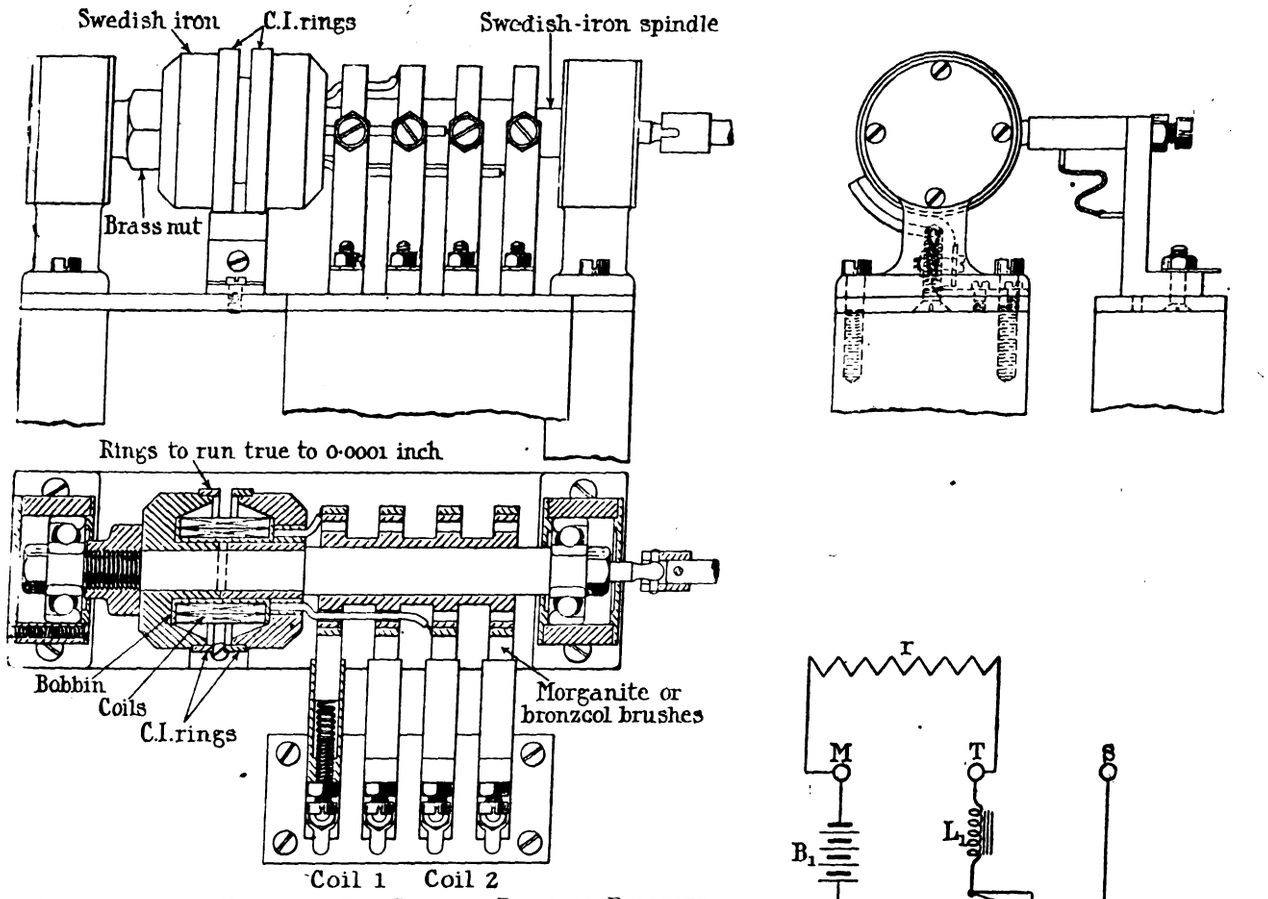

FIG. 1.—ARRANGEMENT OF DRUM AND SLIP RINGS OF RELAY OR RECORDER.

In its relay form the instrument is identical with the recorder.

The magnetic properties of the drum and spindle call for careful consideration to obtain optimum results. The life of a shoe varies from 3 000 to 5 000 hrs., according to its initial thickness.

When the recorder is operated from a relay, and single current is used, the connections are as shown in Fig. 2.

If an alternating current is supplied to the recorder, it will function in such a way that all the alternations appear above the datum line.

So far as magnitude of the current is concerned there is considerable latitude. The pull on the lever increases with the current.

The number of turns on the signal coil depends on (*a*) the speed of working; (*b*) the current, and (*c*) the voltage. A coil of 4 000 turns is satisfactory for all commercial speeds, provided an adequate voltage is applied.

For double current working one coil of the recorder carries the signal current, whilst the other coil is connected to a battery B_2 and rheostat R_2.

The highest speed yet attained with a working voltage of 100 is 280 words per min. 320 words per min. have been obtained by augmenting the battery voltage and decreasing the inductance of the drum. The highest speed in valve circuits tried on actual traffic is 100 words per min. Up to 50 words per min. almost any of the usual recording valve circuits are applicable, but for speeds in excess of this figure, the circuit requires careful choice.

It is essential to smooth out the alternating current as far as possible and for this purpose the recorder is shunted by a condenser.

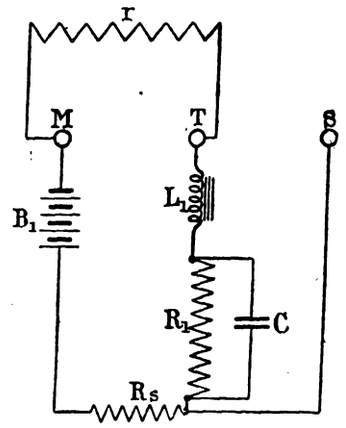

FIG. 2.—RECORDER CIRCUIT FOR WORKING SINGLE CURRENT FROM A RELAY USING A BACK CIRCUIT.

M = marking contact.
L = left contact.
T = tongue.
S = spacing contact.
CR_1 = shunted condenser combination.
R_1 = 25 000 to 30 000 Ω.
C = 0·5 μF.
B_1 = 100 V.
r = resistance to prevent sparking at contacts, 40 000 to 60 000 Ω (use optional).
Rs = safety resistance to prevent battery being short-circuited through contacts.

Some features of the apparatus are:—

(1) Robustness.

(2) Insensitive to change of speed, no adjustment for speeds of 20 to 200 words per min.

(3) Working current is very small.

The operation as a transmitting key is the same as in the relay, parts being made heavier.

* Abstract of a Paper on "The Application of a Revolving Magnetic Drum to Electric Siphon Recorders and Radio Transmitting Keys," read before the Wireless Section of the Institution of Electrical Engineers.

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The Interdependence of Science and Engineering.

Sir Richard Glazebrook on the Need for Education and Research.

The 1923 " James Forrest " lecture was delivered before the Institution of Civil Engineers on Friday last by Sir RICHARD GLAZEBROOK. Taking as his subject " The Interdependence of Abstract Science and Engineering." Sir Richard said: In delivering the first " James Forrest " lecture thirty years ago, Sir William Anderson said he had endeavoured to show how the history of abstract science had had its reflex in the records of the engineering profession, and how the most recondite investigations apparently unlikely to have any direct influence on our practice, had in the course of time become of cardinal importance. Even in those days it was necessary for the engineer to banish from his mind the idea that anything can be too small or too trifling to deserve his attention. Mr. Forrest himself had remarked that " you cannot touch anything in natural science which will not, sooner or later, prove of advantage to the members of this Institution, and which the engineer will not, in time, turn to moral as well as the material advantage of the human race."

Thirty Years' Experience.

The experience of the last thirty years had tended to confirm those views, and it was the task of the present lecturer to give some few illustrations of the truth of the principles advocated by Sir William Anderson, and to trace some of the effects those principles had had on engineering practice. These effects had shown themselves in many forms. The education of the engineer had been greatly modified. Institutions devoted to the application of science to industry had grown and multiplied. The State had realised something of its responsibility, and private persons, public men, and industrial associations had given many proofs that their importance had been at least in part realised.

Progress in Education.

Sir Richard, turning first to the subject of education, noted that Sir William Anderson had deplored the fact that " except in the noble endowments of the City and Guilds Schools and the Government institutions at South Kensington " in London the movement to secure the necessary engineering training had languished for want of adequate support.

Sir Richard gave a number of interesting statistics of the progress that had been made at the City and Guilds College, the Imperial College of Science and Technology, the University of London, and in the engineering schools controlled by the London County Council, showing the growth that had occurred since 1893. The same growth was equally noticeable at the Royal Technical College, Glasgow, at the Manchester Technical College, and at Cambridge, and he quoted Prof. Inglis to the effect that there was no doubt that employers in all directions were attaching increased importance to a university training. Some firms went so far as to say that they would not take a man on their staff unless he possessed a University degree. This attitude was growing steadily, and it has become accelerated since the war.

Since 1893, therefore, a serious attempt had been made to import more than the slender amount of theoretical knowledge asked for by Sir William Anderson.

Trades Unions and Education.

The view that science must go hand in hand with practice was not, however, confined to the heads of the engineering profession. At the Trades' Union Congress at Southport in 1922, a report on apprenticeship was presented, in which it was stated that it had been generally accepted that if industry and commerce were to progress the workers engaged therein must be allowed to exercise their intelligence, and a system of training for apprenticeships similar to that in existence in the L.C.C. was suggested. The Whitley Councils had also given special consideration to the problems of education. The Assistant General Secretary of the Union of Post Office Workers had written that his organisation was keenly alive to the interdependence of science and industry, and that the gain due to the introduction of improved machinery should be devoted in part to the improvement of working conditions. This, said Sir Richard, was an essential condition of progress and, as scientific men, they had no desire to deny the workers their fair share in the results due to advance.

Among the agencies doing most valuable work in the introduction of men trained in science and literature to the engineering and other industries must be reckoned the appointments boards of the universities. Special reference was made to the work of the Cambridge University Appointments Board, which showed the close interdependence between exact science and all forms of industry.

Progress in Research.

Turning to the subject of organisation, methods and application of engineering research, the lecturer gave an historical account of the inauguration and development of the National Physical Laboratory, referred to the establishment of the Department of Scientific and Industrial Research, to the Co-ordinating Boards for Chemistry, Physical Engineering and Radio Research, to the British Engineering Standards Association, and to the Research Laboratories of various individual firms which had been established in this country and in America. Such laboratories were, however, only possible to the favoured few, and many small firms could only gain these benefits by some form of co-operation, and it was to meet these cases that the Research Associations of the Department of Scientific and Industrial Research had been evolved.

The last report of the Department of Scientific and Industrial Research had pointed out that there was little basic difference between the fundamental research work required by industry and " pure " research. In the latter the phenomena investigated and the inclinations of the worker furnished the only directive forces. In industrial research the work had a distinct purpose in view which the investigator must constantly bear in mind.

Science and Wireless Progress.

Giving some account of the effect of research on wireless telegraphy development—Preece's early experiments had been referred to by Sir William Anderson—Sir Richard said it was evident that the theoretical work of Clerk Maxwell, Kelvin, Helmholtz, Hertz, Fitzgerald, Edison and Fleming had directly resulted in the production of the valve which was now so widely used in wireless telegraphy, and quoted from the first " James Forrest " lecture: " the engineer must banish from his mind the idea that anything can be too small or too trifling to deserve his attention." For the modern development of the valve had rested on a still smaller entity, the electron, in the discovery and investigation of which the work of Crookes, J. J. Thomson, Millikan and Bragg must be referred to.

Turning to a less abstract branch of electrical science, Sir Richard referred to the work on the heating of buried cables which had been conducted at the National Physical Laboratory by Mr. S. W. Melsom and his assistants. The records of the Engineering Department of the Laboratory were full of other investigations which illustrated the interdependence of abstract science and engineering. Among the most important of these was the development of the steam turbine, and it was common knowledge that practically each step of the progress showed in steam turbine construction was based on abstract investigations. The properties of steam as it expanded through a nozzle, the efficiency of various forms of nozzle, the effect of superheating, the properties of the material of the blades, questions of balancing the form and construction of the gearing and many other details had formed the subject of experiments, started, it was true, in many cases with a view to improving the performance of the turbine, but based in almost all on some fundamental law or principle of abstract science.

As in Watt's steam engine, so in the turbine, we saw the work of a man who was a born mechanic as well as a seeker after physical knowledge. The combination of the two was required in any real advance in engineering science. Modern civilisation was based on abstract knowledge, and all experience went to enforce the dictum of Sir William Anderson that the days were past when an engineer could acquit himself respectably by the aid of mother-wit alone, or of those constructive instincts which in the past led our predecessors to such brilliant results.

Col. D. Howard Gill, Commanding 2nd Air Defence Brigade (T.A.), is appealing for recruits for the Brigade, which comprises Engineers, Signals and Artillery, with co-operating aircraft. The 10th (London) A.A.Battalion R.E., (T.A.), should appeal to members of engineering firms, and all particulars may be obtained from the Duke of Yorks' Headquarters, Chelsea, London, S.W.3.

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"The Electrician" "All-Electric" House.

The Second Prize Winner's Solution.

We give below the plans, bill of quantities and other details of the scheme for THE ELECTRICIAN *"All-Electric" House to which the judges have awarded the second prize of 15 guineas. These were submitted by Mr. W. M. Craufurd, 205, Eglinton Road, Plumstead, S.E., under the pseudonym of "Willett Wynne." The titles and sub-headings have been inserted by us.*

Description of the Installation.

Wiring Details.

We have embodied in this scheme the employment of two "Stannos" wires, using the outer sheathing as protection only. It is, however, often possible to use the "Stannos" system concentrically, which is an ideal arrangement, requiring the use of one wire only, with consequent saving in material and labour. This method is particularly applicable to housing schemes, using a three-phase, four-wire system, with earthed neutral.

We have allowed for two-way switching where considered advisable; more complicated forms, in our opinion, would not be required in a house of this description.

Lighting.

As regards the lighting scheme generally, we have arranged the points in positions which appear to us to be most suitable, but these positions would, in some cases, depend upon the arrangement of the furniture. This particularly applies to bedrooms 3 and 5, in which the points would certainly be dependent upon the positions of the bedsteads.

In the bathroom we would advise a nickel-plated bracket and switch cover—these have been allowed for in our estimate.

We have not included a light in the larder, as we consider that the bracket point in the china cupboard placed just over the borrowed light would be quite sufficient.

Although the illustrations of the fittings proposed * show the plain pendants with opal shades, it is understood that the selection of suitable shades would be left to the occupiers to decide upon, and that these illustrations are typical only.

Power Arrangements.

As this scheme covers an "All-Electric" House, we have included for all the heating and power necessary, irrespective of the fact that it would probably be advisable to use central heating, and top up with electric fires when required. We have allowed for a washing machine, but have not included such apparatus as dish washers, etc., as we do not consider that such refinements would be justified on account of expense.

In order to enable the vacuum cleaner to be used in any room, irrespective of the size of power plug, we would provide an interchangeable adaptor with this apparatus.

With regard to the water heater we advocate the use of a 40 gallon container, consuming up to 2 kW, controlled by a direct acting thermostat switch. This, in our opinion, would always allow for a sufficient supply of hot water. All 5 and 10 A plugs are of the auto-combination type, which automatically open the switch when the plug is removed. Power distribution boards are placed on each floor; this not only simplifies the distribution but is less costly than returning all circuits to the ground floor.

With regard to the special flooring on the first landing, it will be quite unnecessary to disturb this as "Stannos" wires can be threaded under the floor.

General.

In general, our scheme is based on a practical all-electric equipment. Moderation in first cost, combined with utility, has been borne in mind. It would be possible to improve upon the scheme in many minor details, but each improvement would involve additional expenditure. In making these remarks, we have in mind such improvements as a complete bell installation, telephones, burglar alarm systems, and a master switch for controlling all switching, etc. The wiring is, however, of sufficient capacity to allow for the connection of such extras as toasters, kettles, coffee percolator or fans, which may be desired.

Specification of Material Used.

To be wired throughout on the two-wire system, both poles being insulated, the outer casing of the wire acting as a protective sheathing, and forming continuity to earth at all switches, lights, plugs, junctions and outlet points; continuity fixtures to be used.

Conductors to be "Stannos" wire heavy sheathing, consisting of either 3/0·029 or 3/0·036 for sub-circuits, and 7/0·036, 7/0·044 or 7/0·064 for sub-mains, tinned copper wires insulated with pure and vulcanised indiarubber, paper, taped and sheathed with tinned copper.

For sunk work, all wires to be run as far as possible between floors, behind skirtings or buried in plaster, finishing with either flush, semi-flush or surface switches.

Where dropping to switch or plug points in surface wiring, the wire to be carried down in the angles of the walls or architraves.

The wires to be fixed by either the "Stannos" buckle or cushion clips.

If surface work is necessary in any part of the installation buckle clips to be used. Cushion clips to be used for all other fixings.

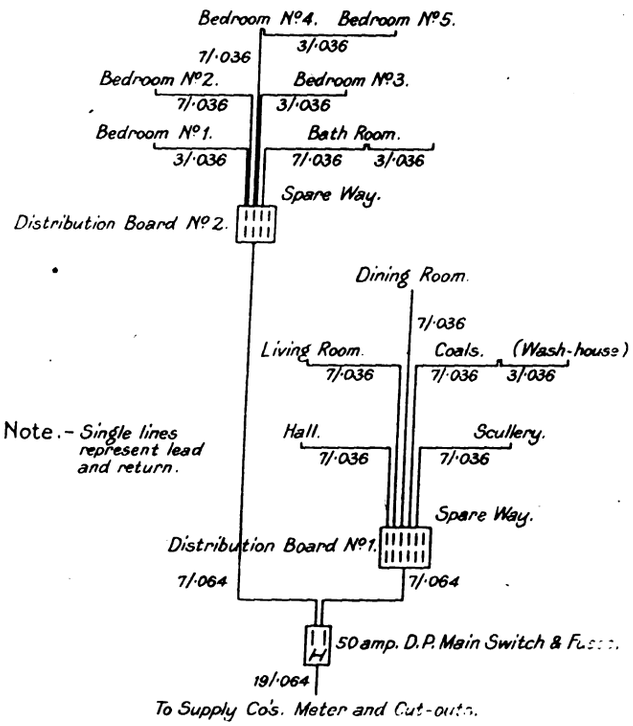
The wiring to be carried out on the loop-in system, and joints not to be made other than at proper junction boxes.

Wiring Diagram.

Lighting.

All circuit wiring from distribution boards to be with 3/·029 Cable. Between distribution board and Supply Company's cut-outs 3/·036 to be used, therefore, a diagram showing sizes of Cables is unnecessary.

Power.



At junction boxes continuity fixtures to be fitted, the inner conductors of the wires then to be married, soldered and insulated with pure rubber and prepared tape, the whole being then covered with a steel cover.

The whole system to be efficiently earthed by means of a tinned copper wire, of a sectional area not less than that of No. 14 L.S.G., run from the busbars at the distribution boards to the nearest water-pipe, soldering all connections.

The distribution boards to consist of two sets of single pole enclosed bridge fuses mounted on battens in polished teak case with hinged glazed lid. A dividing partition of insulating material to be fitted between the two rows of fuses. Also, a continuity busbar for clamping and securing continuity of the outer sheathings to be fixed at the back of the boards.

Separate D.P. main switches and fuses in teak cases to be provided to control independently the lighting and power wiring.

Circuit switches, lampholders, ceiling roses and plugs to be of well-known British manufacture; the latter in accordance with the B.E.S.A. Standards.

* Not given here.

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The lamps to be Siemens vacuum or gasfilled.

The tender includes everything necessary for a complete installation of electric light, heating and power wiring on the "Stannos" system, from the supply company's cutouts and meter to the fittings and outlet points, including main switches and fuses, distribution boards, fuses, switches, plugs, wires and fittings as schedule of fittings herewith. The whole fitted and left ready for a complete working installation. All costs of of delivery, erection and putting to work are included in the tender. All necessary cutting away and making good of walls and decorations is included in this tender.

The work will be carried out by reliable and efficient wiremen, between the hours of 8 a.m. and 5.30 p.m. under our personal supervision.

Any reasonable alterations may be made in the positions of points and witches, provided that notice be given before the actual work is carried out. All wiring to be tested during progress of work, and also on completion. The whole to comply with the Wiring Rules of the Institution of Electrical Engineers, the fire offices interested and to pass their specified tests.

We shall guarantee the work for a period of twelve months after the date of completion, and shall make good, free of charge, any defect due to faulty material or workmanship.

The terms of payments are 80 per cent. of the value of the work on completion, balance in three months after satisfactorily handing over.

The Bill of Quantities.

LIGHTING.

	£ s. d.	£ s. d.
1 10 A D.P. coupled Tumbler Switches and Fuses mounted	12 0	
1 Six-way D.P. teak cased Distribution Fuse Board	1 10 0	
13 Surface (single-way) 5 A Switches	13 0	
7 Do. (two-way) do.	13 7	
1 Two-way Suspension Switch and Ceiling Rose	3 9	
4 3 A auto-combination Switch Plugs	13 4	
7 Type "A" Pendants (see Fittings List) with flexible	1 1 0	
4 Type "B" do. do. do.	1 2 8	
2 " "C" Brackets do. do.	5 4	
1 " "D" two-light Fitting do. do.	1 2 0	
1 " "E" Bowl Fitting do. do.	1 9 6	
1 " "F" Newel Fitting do. do.	1 13 0	
1 " "G" Dining Room Pendant do.	3 3 0	
1 " "H" Table Standard do. do.	1 12 0	
1 " "J" Table Standard or hanging Bracket (see Fittings List) with flexible	1 14 6	
15 20 W Vacuum Lamps	1 15 1	
4 40 W do.	8 6	
1 60 W Gasfilled Lamp	3 5	
	19 15 8	
33⅓ per cent. gross profit	6 11 11	
		26 7 7
Estimated :		
500 yards 3/0·029 S.H.329 "Stannos"	14 18 8	
5 yards 3/0·036 S.H.336 do.	3 3	
Fixing Clips :		
2 gross B.D.		
2 " A.T.		
1 " M.D.	16 4	
½ " C.T.		
Continuity Accessories :		
4 doz. B.P.2		
2 " S.S.4		
1 " B.S.2	19 0	
1 " S.S.2		
1 E.C. Clip		
1 B.B.8	5 0	
2 S.C.2		
Wood Blocks :		
1 W.B.2		
4 doz. W.B.1	16 6	
Sundries, including :		
Earthing Wires		
Screws	10 0	
Nails		
Labour on wiring 25 points including fixing fittings	10 12 6	
Labour on fixing Distribution Board and main switch, etc.	8 6	
	29 9 9	
33⅓ per cent. gross profit	9 16 7	
		39 6 4
Total		£65 13 11

POWER AND HEATING.

	£ s. d.	£ s. d.
1 50 A D.P. teak-cased Main Switch and Fuses	2 18 1	
1 Six-way D.P. teak-cased Distribution Fuse Board	2 2 0	
1 Four-way D.P. do. do.	1 8 0	
2 5 A Combination Switch Plugs	5 0	
7 10 A do. do.	1 7 9	
3 15 A do. do.	1 13 10	
1 20 A do. do	12 2	
1 Type "L" Fire (Hall)	2 0 0	
1 " "K" " (Sitting Room)	2 8 8	
1 " "K" " (Dining Room)	1 18 8	
1 " "M" " (Bedroom No. 2)	2 18 4	
1 " "N" " (Bathroom)	1 5 0	
1 Cooker	13 10 0	
1 Washing Machine	29 12 6	
1 6 lb. Electric Iron	16 6	
1 Water Heater	25 0 0	
1 Vacuum Cleaner with all accessories	11 16 3	
	101 12 9	
33⅓ per cent. gross profit	33 17 7	
		135 10 4
Estimated :		
2 yards 19/0·064	3 4	
12 yards 7/0·064	18 6	
125 yards 7/0·036	5 6 8	
70 yards 3/0·036	2 5 7	
Fixing Clips :		
3 dozen K.3		
2 gross A.T.	7 5	
Continuity Accessories :		
1 dozen B.P.2		
6 S.S.2		
6 C.C.764	14 6	
16 C.C.736		
2 B.B.8		
Wood Blocks :		
1 dozen	3 10	
Sundries, including :		
Earthing Wires		
Screws	10 0	
Nails		
Labour on Wiring	3 4 6	
Labour on fixing Distribution Boards, Main Switch, etc.	14 0	
Labour and Material for connecting Water Supply to Water Heater	8 6	
	14 16 10	
33⅓ per cent. gross profit	4 18 11	
		19 15 9
Total		£155 6 1

ELECTRIC BELL FROM HALL DOOR TO SCULLERY.

	£ s. d.
Material and Labour	1 0 0

Summary.

	£ s. d.
Total Cost of Lighting	65 13 11
" " Power and Heating	155 6 1
Electric Bell from Hall Door to Scullery	1 0 0
Grand Total	222 0 0

The Letter to the Client.

DEAR SIR,—We hereby undertake to supply and erect in position a complete installation of electric wiring for lighting and power, as per enclosed Specification and Schedule, for the sum of £222 (two hundred and twenty-two pounds).

As electrical engineers of many years' standing, we wish to draw your attention to the "Stannos" system of wiring, which we propose installing.

This system not only reduces the first cost of the installation, but has the distinct advantage that it can be installed with a minimum of cutting away and consequent damage to property.

It consists of an ordinary electric light cable protected with a copper sheath, so that it is unnecessary to run tubing or wood casing. This should appeal to you as the owner of property, as the cutting away of joints, etc., when installing tubing is considerable, and is naturally harmful to the structure of the premises.

With regard to the lighting, we have arranged the positions of the lights to give the necessary illumination for practical purposes. From the illustrations you will observe that we have allowed for inexpensive fittings of simple design, but should you decide to furnish any or all of the rooms in period styles we would be pleased to submit for your approval further designs of fittings and fires to suit the period in question.

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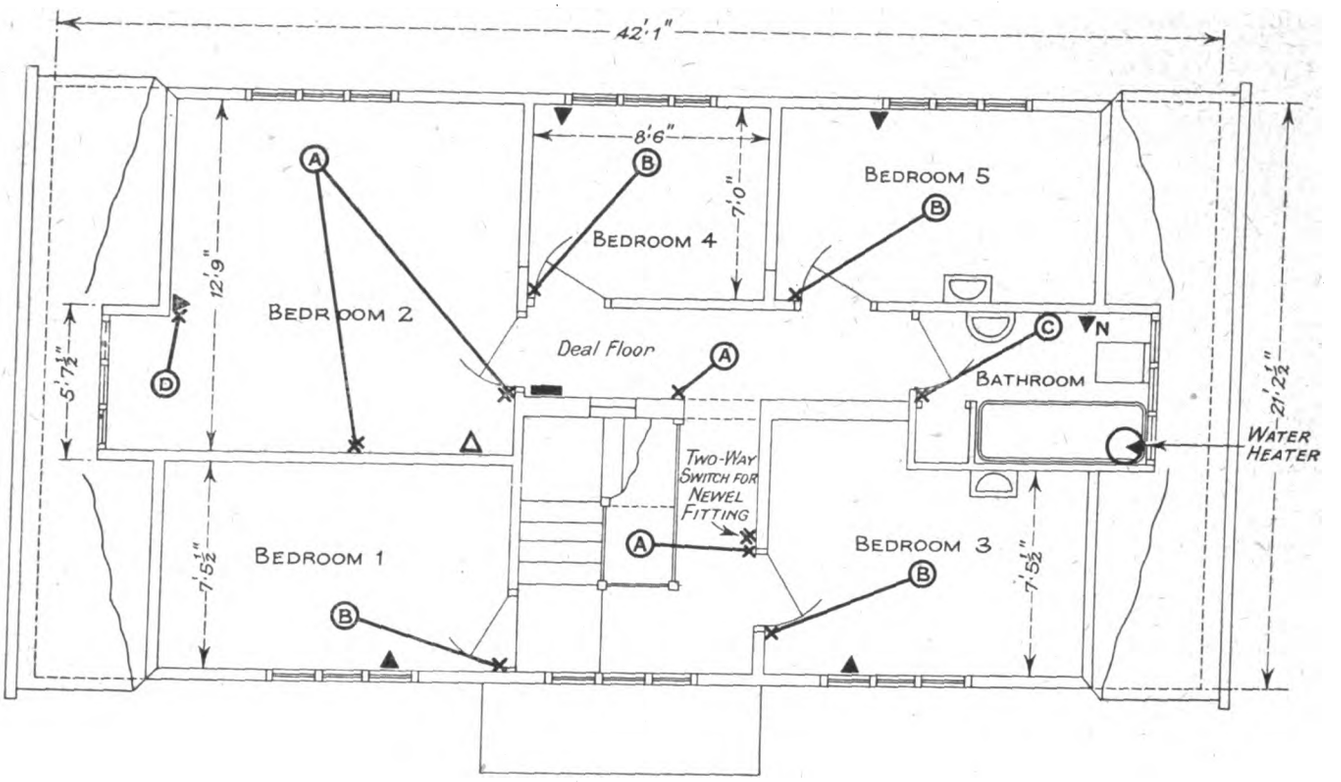
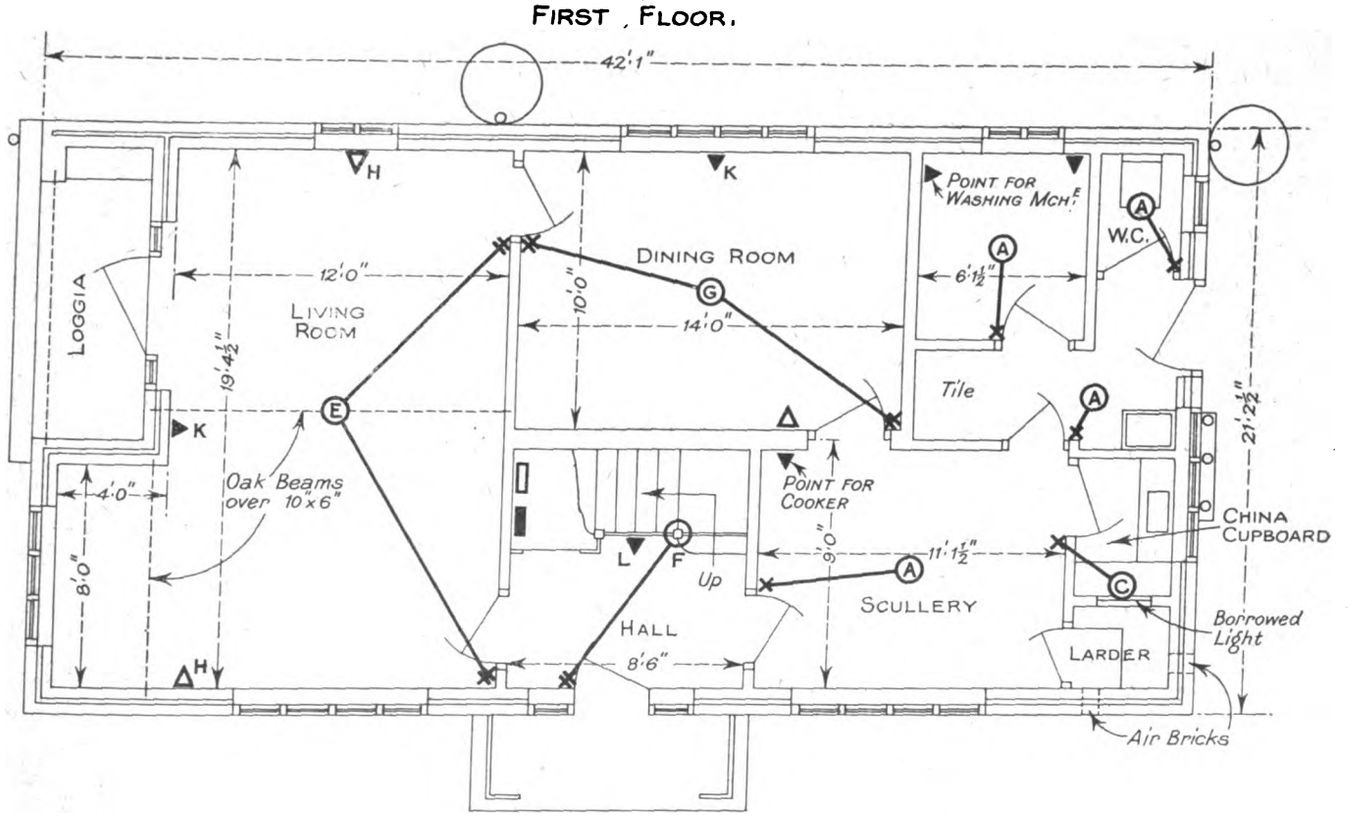
Wiring Plans for "The Electrician" "All Electric House."

Second Prize Winner's Circuits and Arrangement of Apparatus.



FIRST FLOOR.



GROUND FLOOR.

REFERENCE :-

LIGHTING.

LIGHT POINTS SHOWN ..... (B) Δ H
PLUG POINT SHOWN .....
SWITCH (ORDINARY) SHOWN ..... ×
DO. (TWO-WAY) SHOWN ..... ✱
DISTRIBUTION BOARD SHOWN ....

POWER AND HEATING.

COMBINATION SWITCH PLUG SHOWN ..... ▲
DISTRIBUTION BOARD SHOWN .....
THE LETTER INDICATES FITTING, - SEE FITTINGS SHEET.

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We have quoted throughout for surface switches, finished to match the fittings, but flush switches can be provided, if desired, at a slight extra cost.

With regard to power wiring, you will notice that we have included power plugs in all rooms, so that in rooms not having a permanent electric fire, portable heaters can be connected when desired.

Our estimate includes for an electric water heater, with a supply to the bathroom only, but the heater is of sufficient capacity to give service to the bedroom basins and the ground floor if necessary.

We have included for an efficient electric cooker, suitable for a family of four to six persons.

As there appears to be no useful purpose served by the space marked " coals " in the plan of the house, we propose installing a washing machine, and using this space as a wash-house.

We beg to state that we have interviewed the supply authorities, and that they have agreed to bring their service into the cupboard under the stairs, free of charge.

In conclusion, we would point out that we also make a speciality of the installation of radio receiving apparatus, and we should be pleased, therefore, to quote you for the supply and erection of a complete receiving station, should you so desire.

Trusting that our tender will receive your favourable consideration.

We are, dear Sir,

Yours faithfully,

WILLETT WYNNE.

The competitor also included a complete schedule of the electric lighting and power points illustrative of the plans.

Mr. Shaughnessy on Broadcasting.

At the last meeting of the INFORMAL SECTION of the INSTITUTION of Electrical Engineers Mr. E. H. Shaughnessy opened a discussion on " Practical Broadcasting."

Mr. SHAUGHNESSY began his observations with some extracts from American official reports, calling for radical overhauling of the existing confusion, and proposing national control of broadcasting in the U.S.A. He explained the problem our authorities had been faced with owing to the requirements of the fighting services and shipping, which resulted in the allotment to the general public of the range of wave length from 350 to 425 metres—equalling 150 kilo-cycles. The problem therefore was how best to serve the general public, the alternative being one super-station, a number of broadcasting stations of medium power and any number of irresponsible stations. The method adopted was to form eight areas, each to be served by a medium-powered station, using a wave length as different as possible, within the limitations, from that of its neighbour.

The Main Consideration.

The main consideration of the authorities was for the most thickly populated centres, where were located the mass of receiving apparatus, this being the justification for a popular entertainment.

Mr. Shaughnessy dealt with some of the sources of interference and described a tuned anode circuit that eliminated the tendency to oscillation. He was not hopeful of detecting the offenders and appealed for honourable compliance with the regulations by the holders of experimental licences.

The Discussion.

In the course of the discussion Capt. ECKERSLEY thought the wave band allotted was a very good one, but it had a most distinct shielding effect. At longer wave lengths crystal sets would be less successful but we were too considerate of the cheap apparatus and progress demanded that we extended the wave. As microphones improved, taste would expect clearer reception and all tendency to oscillation would be dealt with.

Mr. J. SCOTT-TAGGART thought the present conditions too irksome for the experimenter and amateur enthusiast. If the public were to be satisfied they should be able to switch over to different stations and select their programme.

Mr. P. R. COURSEY agreed that the average receiver wanted to be able to select his programme, and thought the chief obstacle was that stations were too powerful. He thought that instead of catering for the cheapest form of apparatus it would be better to encourage best apparatus. There were, no doubt, amateur experimenters who were a nuisance ; but many were doing much useful work.

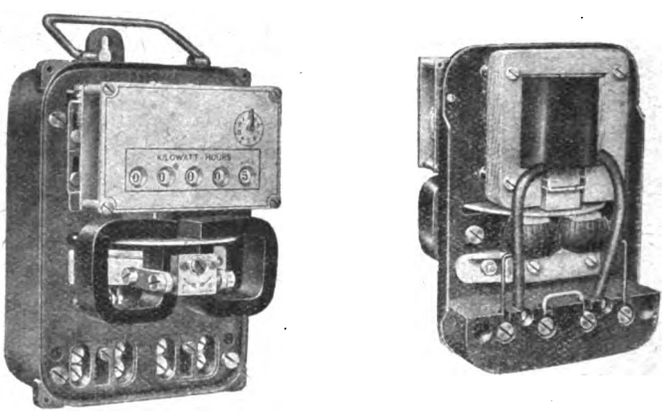
A New Single Phase Meter.

A tendency towards simplification is now evident in all designs. It is not going too far to say that this factor in modern engineering practice is typified in the new single phase house service meter that is being placed on the market by the ELECTRICAL APPARATUS Co.

On the electrical side finality has probably been reached in this class of instrument, but a great deal still remains to be done in simplifying the construction, in making the adjustments easier, and especially in reducing the weight. From the short description we give below it is obvious all these points have been carefully borne in mind and successfully tackled

As will be seen from the illustration, the external appearance of the meter is neat, its size is small, and the weight is only 4½ lb., or approximately one-third that of any ordinary meter. The handle and top fixing lug hinge downwards so as to be out of the way when the meters are packed or stored. Besides the lug, fixing is further effected by two screws at the bottom of the meter which in the normal course of events are covered by the sealed plate. These screws are held in position during transit by leather washers whose main function is to secure a damp and dust-proof joint.

The arrangement of the terminals under the terminal cover is neat, and a particular point to which attention may be drawn is the use of knurled screws which are employed instead of the testing links generally used to facilitate the testing of meters in large quantities. This makes disconnecting for testing a very simple matter. The terminals are fixed in a moulded terminal block.



FRONT AND BACK VIEWS OF NEW SINGLE PHASE METER.

The cover is a substantial steel pressing and the cord with which the joint between the cover and the case is made is concentrically woven, and so ensures air and dust tightness.

The meter case is a substantial stamping with the corners neatly pressed over and reinforced to take the fixing screws. As was amply demonstrated when we inspected the meter, its removal and dismantling from the case are extremely simple matters. The removal is effected by unscrewing two small screws only, when the whole movement can be taken out.

Ease of removal is also a feature of the dial, the unloosing of two small screws being again all that is necessary, while when reassembling, the exact position of the dial is ensured by two slots, no play being allowed at all. To reduce friction, the worm which is usually on the first shaft is placed higher up in the gear train. The rotor can be removed without disturbing the magnets and contains the jewel fixed at its centre of gravity. This jewel is inverted so that it cannot accumulate dirt and dust, and is also easily removable.

The pivot is spring supported, and is carried in the bottom bearing screw. Its renewal is also simple and enables replacement of the jewel and pivot to take place simultaneously.

Only three adjustments are necessary on the meter, and they are all on the micrometer principle and do not require locking after the correct position has been obtained. The speed of the meter is adjusted by a screw which alters the position of a soft iron armature near the end of one pole piece. To effect what is usually known as the low load load adjustment, the series system is moved in either direction by turning the screw under one of the magnets. The power factor loop which consists of a moving copper loop round the centre of the shunt pole can also be adjusted in position by means of a simple screw movement.

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Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

THE RADIATION OF WIRELESS VALVES.

To the Editor of THE ELECTRICIAN.

SIR,—With the exception of one word I entirely agree with Mr. Turner's criticism of my note on the above subject. I set out to show that the commonly accepted idea that some critical change takes place in the magnetic and electric fields at the quarter-wave length distance from the transmitting aerial had no solid foundation, and to illustrate my remarks I took as an example the case in which the fields undergo such sudden changes at this distance as to give some apparent grounds for the commonly accepted belief. Had I chosen any other than an unloaded horizontal aerial oscillating at its fundamental frequency I should have found it difficult to indicate any grounds for the quarter-wave length theory, and, moreover, I should have laid myself open to the charge of avoiding the very case which appeared to support it. For these reasons I do not regard my choice of an example as unfortunate, but I certainly do agree that I might have pointed out that I was acting as devil's advocate in choosing the only example which gave any countenance to the idea that the radiated energy was flicked off at a quarter-wave length.—I am, etc.,

Glasgow, May 3rd. G. W. O. HOWE.

THE BROADCASTING CONTROVERSY.

To the Editor of THE ELECTRICIAN.

SIR.—As the whole matter of the broadcasting controversy is at the moment under discussion by the Committee specially appointed by the P.M.G. it would not be advisable to make any statement at the moment, but it should be pointed out that the policy of the Radio Society of Great Britain has never been antagonistic to that of the British Broadcasting Company. There have been differences of opinion on minor matters, and our representations to the Post Office have not always entirely coincided with the views of the British Broadcasting Company, but we have attempted, and we think we have succeeded, to co-ordinate our views as far as has been possible, at the same time protecting the interests of the general experimenters.

One of the points we have brought forward is that there should be more blank hours of working so that those desirous of carrying out experimental work and testing apparatus can do so uninterrupted by the local broadcasting station. Although specially designed regenerative circuits may be brought into use by the experimenter so that the local broadcasting can be entirely eliminated, it may be that the amateur desires to carry out experiments which will involve an entirely different type of apparatus, but will be held up at the time the local broadcasting is going on. If, for instance, it can be arranged that the London broadcasting ceases for half an hour or an hour, then the London people would have the opportunity of listening in for the other broadcasting stations; and if the Birmingham broadcasting station, for instance, closes down for another period, the Northern and Midland experimenters would be able to listen in for the distant stations.

The writer has been working closely with the British Broadcasting Company with a view to attempting to reduce troubles brought about by the use of reaction, and while the Radio Society of Great Britain do not think that this trouble is so widespread as has in some cases been stated, it has always been their policy to endeavour in every way to abate this nuisance, particularly as those engaged in genuine experimental work are the worst sufferers. It is obvious that the man in the South of England who is attempting to tune in the Glasgow station will be thoroughly put out by reaction being improperly used in his neighbourhood. The Radio Societies in the broadcasting areas have also been asked to co-operate with the engineers of their local broadcasting stations with the view to roping in those who are at present using reaction improperly and educating them by means of lectures and advice. The Radio Society of Great Britain's policy has been, not to prevent the use of reaction by putting down the amateur and making it impossible for him to experiment, but by educating him and getting him to join the Radio Societies where he may do useful work and in turn educate others.—I am, etc.,

LESLIE MCMICHAEL,

Hon. Secretary, The Radio Society of Great Britain.

London, May 1st.

BOILER HOUSE ECONOMY.

To the Editor of THE ELECTRICIAN.

SIR,—The article written by Mr. David Brownlie in your issue dated March 16th has evoked a very interesting correspondence and it is satisfactory to note that some of your contributors at any rate consider that what is described as "super-efficiency" can be obtained under the conditions quoted in the article.

In the last paragraph of his article, Mr. Brownlie sums up the matter by suggesting that the only test of any real value is the practical test of operation week in and week out. This is without doubt a perfectly correct statement, but unfortunately, the conditions of working differ in every power station, and no direct comparison can be made between the efficiency figures obtained in any two types of plant unless the local conditions are identical. Failing such identical conditions of daily operation the only method of comparison of competitive layouts is to take ideal conditions, such as those referred to in Mr. Brownlie's article, and compare plants on that basis. The results obtained on the two plants tested in this manner are directly comparative and can be taken as a fair measure of the commercial value of the plants. Such questions as cost of coal in the locality and capital cost must however be taken into account to arrive at the *true* commercial value to the user.

In the power station in which the boilers under consideration are now being installed, the capacity of the existing boiler plant at the makers' rating aggregates some 440 000 lb. per hr. actual evaporation at 210 lb. per in. working pressure and consists of three groups of boilers all with integral economisers and superheaters, but without pre heat, installed at various periods from 1907 to 1921. The efficiency figures guaranteed by the makers and actually obtained on tests carried out as specified vary from 80 per cent. with the oldest boilers to 82 per cent with the latest group.

The results obtained in normal operation during the first three months of the present year are set out below. The average evaporation of the working boilers was 85 per cent. of the normal makers' rating.

The results show that the efficiency obtained on an eight hour test with special supervision can be obtained in normal day to day operation with a modern system of boiler house control.

kWh generated		17 796 918
kWh to feeders		16 687 310
Turbine consumption per kWh generated	lb.	12·55
Coal burnt per kWh generated	lb.	1·93
Coal burnt per kWh generated, banking deducted	lb.*	1·84
Average calorific value as received	B.Th.U.	11 043
Boiler efficiency overall	per cent.	79·16
Boiler efficiency overall banking deducted	per cent.	83·48
Thermal efficiency (per unit generated)	per cent.	16·01
Overall thermal efficiency (per unit to feeders)	per cent.	15·0

London, May 4th, 1923. I am, etc., H. P. GAZE.

THE "ALL-ELECTRIC" HOUSE.

To the Editor of THE ELECTRICIAN.

SIR,—It was with considerable interest that I read the useful criticism of the judges regarding the recent "All-Electric" House Competition.

There is only one point in which I would have desired a little more constructive criticism, and that is as to the manner of allowing for wall-plug points. I had deliberately installed the 5 A plugs since at 230 V that allows an installation of 1 150 W at each point, quite large enough for all ordinary purposes, whilst, on the other hand, by limiting the number of points per circuit, the cables could not be overloaded as would have been the case if 10 A plugs were installed.

Personally, I am of opinion that if a well made 5 A switch-plug is installed it should suit the majority of everyday needs and only one or two 10 A plugs are needed in the whole of a household, these obviously (to the householder) being for the heavier work.

Whilst on the subject of economical house wiring, I often wonder that progress has not been made with the iron conductors which war conditions suggested to us. Say a central, core iron wire, rubber insulated and armoured with galvanised iron wires forming the earthed return would, where permissible, form a remarkably cheap system. Other variations of this easily suggest themselves.—I am, etc.,

London, May 8th. PHILIPPE E. PERONNE.

* Banking coal is that required to raise boilers to pressure and maintain them ready to work.

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"Safety First."

Two Notable Safety Devices.

"Safety first" is the key-note of the Home Office rule which reads :—"In every place in which machines are being driven by an electric motor, there shall be means at hand for either switching off the motor, or stopping the machines if necessary to prevent danger."

The Letter of the Rule.

The letter of the rule is observed in thousands of cases by the provision of "emergency stop" buttons in convenient positions, but unfortunately many of the buttons are so unreliable as to be really snares instead of safeguards, especially when located at a distance from the motor. This is because they are designed to operate by short-circuiting the no-volt magnet coil of the starting

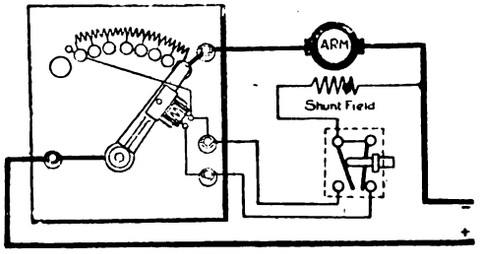

FIG. 1.

switch. A short-circuit is never quite reliable and at a distant point it is always unreliable because the long wires connecting the pushbutton to the magnet coil may easily have a resistance greater than that of the coil itself. Even if the wires are short a dirty contact in the pushbutton may easily make the short-circuit ineffective. To be always positive in its action the "stop" button should actually break the circuit of the no-volt magnet coil and not merely short-circuit it. The reason why the short-circuiting method has been so generally adopted is that it is desirable to place the no-volt magnet coil in series with the shunt field coils of the motor, and it has not been obvious how the magnet circuit could be broken without rupturing the field circuit and thereby risking great damage to the motor.

Solving the Difficulty.

The patent distant stop push button, Fig. 1, which is manufactured and sold by the IGRANIC ELECTRIC CO., solves this difficulty completely and as, in consequence, it is quite positive in its action in all conditions and any situation, it is claimed that it really complies with the intention of the Home Office rule.

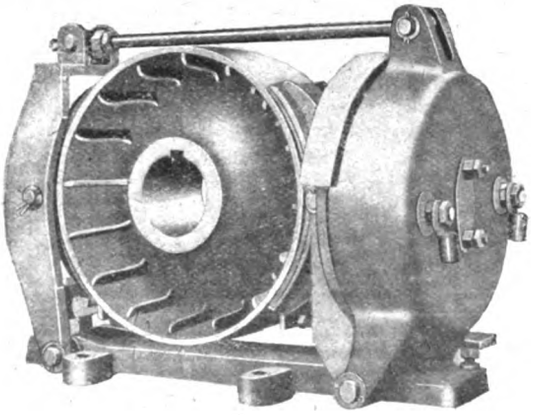

FIG. 2.

The action of this pushbutton is shown in the diagram (Fig. 1). It has two sets of contacts—one set normally closed and the other set normally open. The normally closed contacts place the no-volt magnet coil in series with the shunt field. The normally open contacts, if closed, would provide a path for the field current independently of the no-volt magnet coil. When the button is pressed to stop the motor, it first closes the normally open contacts, thereby providing an independent path for the field current, and then opens the normally closed contacts, thus breaking the circuit of the no-volt magnet coil.

The complement to the distant stop push button is the Igranic "M" type magnetic brake, illustrated in Fig. 2, for in cases where it is necessary to bring heavy machinery to rest practically instantaneously, to avoid serious accidents, it is not sufficient simply to disconnect the motor from the supply, because the rotating parts may continue to run, or coast, for a considerable time before finally coming to rest. In such cases a brake is necessary which will be applied automatically simultaneously with the opening of the motor circuit and as automatically released when the motor is switched on. The Igranic "M" type brake does this if connected in series with the motor and it is a very powerful brake. Moreover, it is simple and robust in construction, consisting of very few parts, and it occupies very little space, which makes it applicable in practically any installation.

The "Eye-Restolite."

A New Illuminating Device.

The purpose and general principle of the new illuminating device, "Eye-Restolite," which the British Thomson-Houston Co. have recently put on the market are identical with those of the "Eye-Rest Adaptor," which was patented in 1914.

In both cases the aim is to provide a general diffused illumination from the ordinary silk shaded floor or table standard, in addition to the downward local light. Both devices are equally satisfactory

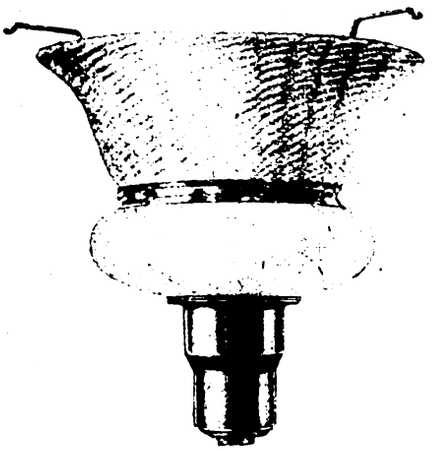

FIG. 1.—VIEW OF THE "EYE RESTOLITE" DEVICE.

so far as lighting results are concerned, the advantage of the "Eye-Restolite" lying in the fact that it needs only a single lamp, whereas the "Eye-Rest Adaptor" needs several.

The "Eye-Restolite" unit (as shown in the illustrations), consists essentially of an X-ray reflector above and a diffusing bowl below, the lamp being held between the two. The major part of the light is thrown upwards by the X-ray reflector, but local illumination, sufficient for reading and close work, is diffused downwards by the glass bowl. This diffused light also serves to illuminate the silk shade.

In effect the "Eye-Restolite" is an indirect and local lighting unit in one—needing only a single lamp for its operation. The framework which secures the lampholder, reflector and diffusing bowl also

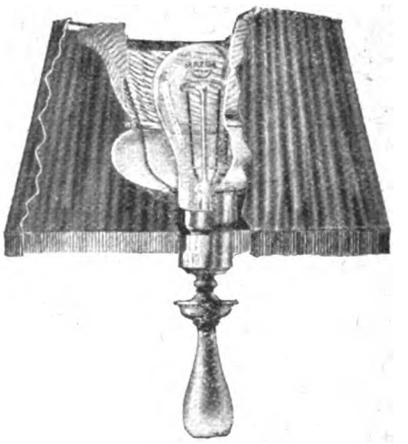

FIG. 2.—THE DEVICE FITTED WITH A SHADE.

supports an ordinary silk shade, as shown in the sectional illustration. (Fig. 2.)

Both the X-Ray reflector and diffusing glass can be easily removed for cleaning. The exterior surface of the X-ray reflector is white enamelled to enhance the illumination of the silk shade. The lower end of the "Eye-Restolite" is threaded for attachment to any ordinary floor or table standard. Three sizes are made for gasfilled lamps of 100 W, 150 W and 200 W, the first being fitted with a B.C. holder and the two larger sizes with E.S. holders. All sizes are retailed at the same price.

Brackets and Pendants Eliminated.

By means of the "Eye-Restolite" it is possible to illuminate any living room without the use of brackets or ceiling pendant. Moreover, this particular form of indirect lighting has a peculiar charm which is not possessed by the ordinary form of lighting. Most people prefer the appearance of table or floor standard lighting to overhead lighting; but with the ordinary standard, other fittings for general illumination are necessary. With the "Eye-Restolite" an adequate and absolutely glareless general illumination is possible, combined with a higher local intensity, for reading or writing.

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Mersey and West Lancs Electricity District.

Liverpool and Birkenhead Against the Scheme.

Liverpool Corporation, acting on the advice of the Tramways and Electric Power and Lighting Committee, decided last week to withdraw from the scheme covered by the Mersey and West Lancashire Electricity District Order, 1923, issued by the Electricity Commissioners (see THE ELECTRICIAN, April 27th, p. 464).

Supporting the Committee's recommendation to withdraw, Sir Max Muspratt said :—" The scheme is from ten to twenty years too early. It is up to the Electricity Commissioners and others interested in the matter to approach the whole question anew under the conditions of to-day and not the conditions as they appeared three years ago."

Letters were read from the Chairman of the Dock Board, the Council of the Liverpool Chamber of Commerce, the Mersey and West Lancashire Electricity Provisional Committee, the Mayor of Bootle, and the Town Clerk of Warrington, asking the Corporation to defer action on the matter, or not to withdraw from the scheme.

Sir Max Muspratt further said that when the scheme was first propounded there were great prospects of its success, but it had been so much cut about and altered that it was time for the Commissioners to prepare an entirely new scheme. There were already four power stations on Merseyside, and there was not the consumption for a large new super-station, unless these stations, including the Liverpool one, were closed down. That was not yet an economic proposition. A better scheme could be prepared, and ultimately the whole of the Merseyside would come together as a result of natural growth, and not as the result of a paper scheme which had broken down totally.

On hearing the decision of Liverpool Corporation to withdraw from the scheme, the Birkenhead Council, by a large majority, came to a similar decision, deciding to ask the Commissioners to allow Birkenhead to conduct its future electrical development independently of other authorities, or, failing that, to join with Wallasey in the setting up of a joint board for the Wirral district. The news that Liverpool had decided to withdraw created a good deal of surprise, as previously Birkenhead's principal objection was that it gave to Liverpool too commanding a share in the joint control, and that it was in other respects as well more advantageous to the Lancashire side of the Mersey than the Cheshire side.

Wallasey Council has adopted a formal resolution approving of the draft order of the Electricity Commissioners in regard to the formation of the Wirral Joint Electricity Board, the Council to reserve their right of action if any fundamental change in the scheme was proposed. It will be remembered that the Commissioners proposed to hold a local inquiry into the scheme at Liverpool on May 15th. In consequence of representations by Counsel and certain parties concerned, the date has now been changed to May 17th.

Parliamentary Intelligence.

Glasgow Tramways Department and Contract Work.

Mr. WHEATLEY, on May 1st, asked the Parliamentary Secretary to the Ministry of Transport if he was aware that it had been reported to the Glasgow Corporation Tramway Committee that his Ministry had made it a condition of grants for road schemes that the work should be done by contract, whereas the tramways department had hitherto supervised its own extension schemes ; and would he state under what authority the Ministry had enforced this condition ?

COL. ASHLEY : My Department have not attached any such conditions to grants made from the Road Fund. Local Authorities were, however, advised that the view of the Government was that the contract system should be adopted to the utmost possible extent in connection with works expedited for the relief of unemployment.

Mr. WHEATLEY asked if any difficulty would be put in the way of an important and efficient Corporation like Glasgow doing its own work if it could be better done by direct labour.

Col. ASHLEY : My view is that contract labour is more economical.

Mr. WHEATLEY said the experience of Glasgow was quite contrary.

Indian Cables.

Earl WINTERTON informed Mr. GILBERT, on May 7th, that no subsidy or annual allowance is paid by the Indian Government to any of the cable companies owning cables to India.

Telephones in the Midlands.

Mr. LLOYD, on May 7th, asked the Postmaster-General whether his attention had been called to the great lack of connecting telephone lines between Birmingham, Dudley, Stourbridge, and Wolverhampton, and to the great inconvenience and delay thereby caused to the trade and business of the district ; and whether he would have further provision of such lines made without delay ?

Sir W. JOYNSON-HICKS : An underground cable has recently been brought into use between Birmingham and Wolverhampton, and there should be no delay on calls between these towns. I will, however, have inquiry made. Underground cables between Birmingham, Dudley and Stourbridge are nearing completion, and additional circuits will be available for service very shortly.

Questions asked in Parliament with regard to wireless matters will be found under " Wireless News," on p. 521. Reports of the proceedings of the Select Committees considering Private Bills appear on p. 526.

The Duddell Memorial Fund.

Bronze Commemoration Medal Design.

It will be within the recollection of readers of THE ELECTRICIAN that in October, 1920, the Council of the Physical Society of London decided that the late Mr. William Duddell's memory should be perpetuated. The Councils of the Institution of Electrical Engineers and the Röntgen Society were invited to co-operate and a small Committee, of which Mr. R. S. Whipple was chairman, was appointed to collect funds. We are now informed that £699 15s. 8d. has been subscribed for this purpose and that the memorial is to take the form of a bronze medal which will be awarded periodically by the Council of the Physical Society to those who have advanced physical knowledge by the invention or design of scientific instruments, or of materials used in their construction. The interest on £400 (invested in 5 per cent. Inscribed Stock) will be given to the recipients of the medal.

We reproduce two photographs showing the obverse and the reverse of the medal, which has been designed by the well known medallist, Mrs. Mary G. Gillick. As will be seen, the obverse shows the head of Duddell in profile, with his name " William Du Bois Duddell " written above it. The dates of his birth and death—

THE DUDDELL MEMORIAL MEDAL.

1872 and 1917—are placed in Roman characters horizontally across the medal. The artist has succeeded in showing in a striking manner both the apparent youthfulness of Duddell as well as the erectness of his carriage.

The obverse of the medal represents the quest of Science for Knowledge, a symbolic figure with a lamp and a globe. Above the figure the words " The Physical Society of London " appear, whilst below the figure is the motto " Rerum naturam expandere," which may be freely translated as " To elucidate the causes of things."

A diploma to accompany the medal has been prepared by Mr. Emery Walker.

The dies from which the medal will be impressed and also the scrip of the investment will be handed by Sir William Bragg to the president of the Physical Society, on behalf of the subscribers to the Memorial Fund, at a meeting to be held to-day, at 5 p.m., at the Imperial College of Science, London.

Insulating Oils.

Tentative British Standard Specification.

A tentative British Standard specification for insulating oils for use in transformers, oil switches and circuit breakers (publication No. 148-1923) has just been issued by the BRITISH ENGINEERING STANDARDS ASSOCIATION.

This specification is the outcome of an extensive research undertaken in the first instance by the Research Committee of the Institution of Electrical Engineers, and continued by the Electrical Research Association, when that body was formed.

The Association has issued this as a tentative specification in the first instance, as the methods of conducting the tests are at present undergoing further investigation, every effort being made to simplify them as much as possible. The Institution of Petroleum Technologists is also preparing methods of testing oils for the ordinary physical properties, such as viscosity, flash point, etc., which it is hoped will be available for use in connection with this specification.

This is the first B.E.S.A. specification based on the work of the British Electrical and Allied Industries Research Association, and illustrates the very great value of such a body to the industry. Copies of the specification may be obtained from the offices of the B.E.S.A., 28, Victoria Street, London, S.W.1, price 1s. 2d. post free.

E.D.A. Slogan Competition.

It is intimated by the BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION that applications for the printed conditions of the Slogan Competition should not be marked with the word " Slogan " on the envelope, as such communications will not be opened until the closing date of the competition. Envelopes containing actual attempts only should be so endorsed. Those who have already applied for the conditions in a sealed envelope bearing the word " Slogan " should make further application to the E.D.A., 15, Savoy Street, Strand, London, W.C.2.

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Merchandise to Sell and Profit By.

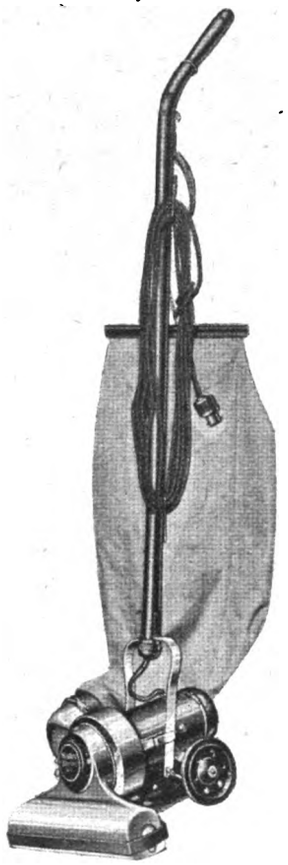
In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

The Western Electric Vacuum Cleaner.

In the selection of the right vacuum cleaner to handle for the spring boost, retailers have a difficult task. To all appearances vacuum cleaners are very similar in design and it is only by closely studying both the electrical and mechanical details that the difference between one make and another can be appreciated. This study involves some time and expense which owing to the daily stress can be ill afforded. How, therefore, can selection be made; what shall be the basis? Firstly, one fundamental must be established; cleaners cannot be bought on price alone. Secondly, it is very wise to narrow the selection down to those makers who have a reputation for marketing a piece of first class apparatus at an economic price—economic in the sense that the price is a figure which will attract the public and will yield a profit to the retailer. It is for these reasons that we illustrate and commend to the attention of retailers the machine manufactured by the WESTERN ELECTRIC CO. In this cleaner, retailers can have confidence that they have a quality device backed by a vigorous publicity campaign. They can also have the assurance that the profits will not be lost in heavy service charges through troubles occurring after the machines have been delivered and put into service.



AN EFFICIENT VACUUM CLEANER.

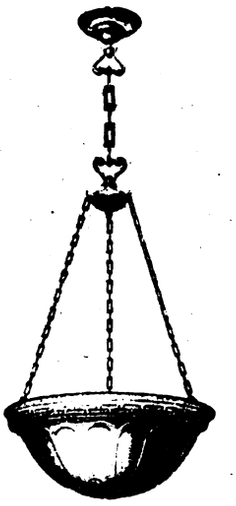
Western Ornamental Loud Speakers.

It does not often fall to our happy lot to have to review a catalogue similar to that just issued by the WESTERN ELECTRIC CO. It is truly a work of great artistic merit and it is outside the province of a mere commercial writer of "Merchandise to Sell and Profit By" to review it. Therefore we must regretfully leave the discussion of the artistic wonder of the catalogue and deal with the mundane commercial aspect of loud speakers.

Briefly described, the list illustrates eight new designs of ornamental loud speakers. It has long been the criticism that the more commonly known shape and style of loud speaker is a very ugly piece of apparatus. Hence with characteristic energy the WESTERN ELECTRIC CO. undertook the task of developing these new ornamental speakers. They have succeeded. The range has been planned to satisfy all tastes and decorative schemes. It is not possible to illustrate any of the speakers in these columns and do justice to the design and decoration; therefore all wireless retailers who have the market for "something different" must not fail to secure a copy of the new publication.

"Lighting Equipment" of Classical Design.

Those seeking lighting equipment that is different from the rest will do well to study closely the designs in the catalogue of UNDERWOOD'S (MANCHESTER), LTD. The range shown is obviously the result of a deliberate policy to market "lighting equipment" as distinct from mere "fittings." Practically all the types are fitted with "Moonstone" Glass. We illustrate the "Whalley" fitting which is a fine example and an excellent attempt to market a fitting of classic design at a low price.

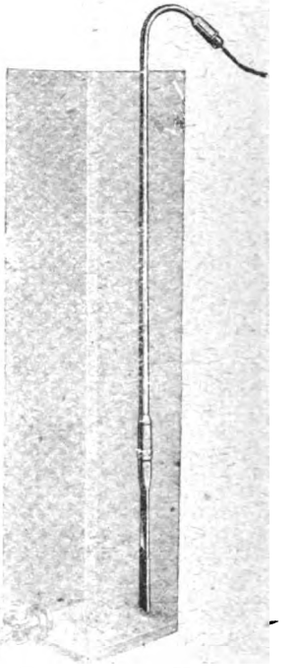


A CLASSICAL LIGHTING FITTING.

Photographers' Needs.

We have previously commented on the heating devices which ELECTRIC FIRES, LTD., offer to the retailer so that he can solicit and secure a large turnover from the photographic enthusiast. The passing of Easter is the signal for more recruits to join these enthusiasts, hence the market for the retailer is particularly in need of cultivation just now. The professional photographers' needs also are ever growing and the gospel of the "electrical idea" can be demonstrated to them with these useful devices. We illustrate the No. 47 immersion heater. It is shown in a developing tank with a depth of 5 ft. It can, however, be used in tanks much shallower than this so long as the water level is kept above the heating blade, which extends for a distance of 9 in. from the bottom end.

We advise all retailers to secure full information and samples of this range of devices. In the words of the "British Journal of Photography," "the professional worker will welcome them as still another step towards ready standardisation of working conditions, whilst amateurs will find them veritable luxuries in the dark room."



AN ELECTRICALLY HEATED DEVELOPING TANK.

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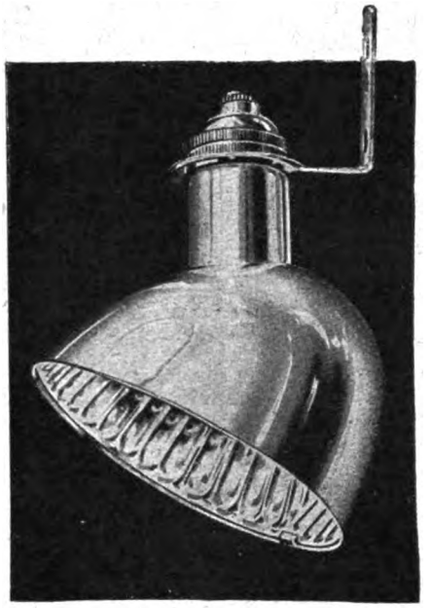
Shop Window Lighting.

It cannot be denied that the trade word " X-Ray " is an excellent one, but the trader who uses an " X-Ray " reflector in his window or showcase will quickly realise that these reflectors do not give a lighting result in the terms of X, but in the terms of a powerful seductive light. Stripped of all the (quite necessary) scientific illumination data, this is the simple platform on which a large turnover in " X-Ray " reflector lighting can be achieved. No deep



THE " SCOOPETTE " FITTING.

laid sales campaign is necessary. The essential part of any plan, however simple, is for the contractor to install them in the windows of his own premises. An offer to carry out installations on the " money back if not satisfied " principle will secure a lot of business. There is no risk in embarking on this plan. It is safe as " houses in the bank," because not one trader in a hundred will want the installation taken out.

We illustrate the " X-Ray " " Scoopette " reflector fitting, which is but one of the many types of " X-Ray " reflectors manufactured by the BRITISH THOMSON-HOUSTON Co. This particular reflector is for showcases or closely dressed windows. Other types are made for shop window lighting.

" Balsok " Insulating Beads.

It has been claimed that there is no *final* solution to any problem. This philosophy of a wise man is denied by LIONEL ROBINSON and Co. They claim that " Balsok " insulating beads are the *final* solution of the problem of bare wire insulation. We advise buyers of this class of material to analyse the merits and price of " Balsok " beads and discuss their insulating problems with Lionel Robinson. They can then prove who is right—the philosopher or Lionel Robinson and Co.

An " Ever-Ready " Contribution to Electrical Service.

A BATTERY WITH A REPUTATION.

Buying electrical merchandise is a most difficult occupation and is full of pitfalls and particularly so is the buying of dry bell batteries. One is so tempted to buy the commonplace 6½ in. by 2½ in. round cell on price and price alone. If this line of thought is closely followed a " South Sea Bubble " profit will perhaps be made but it will be at the expense of the contractor's or the retailer's reputation. Who will argue that they can afford to risk their reputation? A bell battery which can be recommended with every confidence is the " Flag " battery which is manufactured by The EVER READY (Great Britain) Co. This cell is 6½ in. by 2⅝ in. diameter, and for those who have need of a cell of high quality but slightly more competitive in price, the Ever Ready Co. can offer the " Britannic " Cell which is 6½ in. by 2⅝ in. The shelf standing capacity of " Ever Ready " cells is one of the special features claimed by the manufacturers. They claim that experience has proved that provided cells are carefully stocked in a dry store of even temperature, approximately 60 deg. F., they do not deteriorate to any extent over a period of six months.

A Standard Cooker for Ship Work.

One of the places where electric cooking may be expected to receive an ever-increasing application is on ship board, and it is not, therefore, surprising to learn that the famous No. 5 280 " Falco " cooker which is marketed by THE HOTPOINT ELECTRIC APPLIANCE Co., has been adapted for a life on the ocean wave. We illustrate the cooker

THE " FALCO " 5 280 MARINE COOKER.

in its new form. It will be noted that the adaptations consist in the use of guard rails to prevent saucepans, etc., going for voyages on their own account during heavy weather, and the provision of a drop down door for the oven. The cooker's feet are fitted with screws for bolting down, or, if necessary, the cooker can be fixed to the bulkhead by an angle bracket.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

The merits of Vislok nuts are well known. We have to announce something which is perhaps not so well known and that is the fact that VISLOK, LTD., have just issued a new price list and descriptive booklet.

Mains engineers and superintendents will be interested in the Mangnall-Irving Thrust-Borer, manufactured by the HYDRAULIC ENGINEERING Co. In a pamphlet just issued (T. B. 13) are quoted facts and figures relative to certain jobs carried out with the boring machine.

Electrical men who have need to paint, varnish or enamel, will have but an incomplete buying record if they do not secure a copy of JENSON AND NICHOLSON'S latest publication. We must confess having but little exact knowledge as to what the electrical manufacturer requires, but if this list does not cover it we shall be surprised.

A. H. HUNT continues to keep pace with the wireless demand. It has just been our pleasure to receive a copy of their new catalogue No. 50, which describes, with prices, a large range of wireless batteries and accessories. As is well known, A. H. Hunt are the sole agents in England for the Hellesen dry, wet and inert cells. Any retailer who is actively developing the wireless demand will be without a most complete catalogue if he does not apply for a copy.

The following publicity matter has just been issued by METROPOLITAN-VICKERS ELECTRICAL Co.: (*a*) Circular 1286/1 describing Horn cap lightning arresters; (*b*) circular 1426/1 entitled Turbo-alternators; (*c*) circular 1978/1 is a reprint from " The Metropolitan-Vickers Gazette," being an article on " Battery Locomotives for Service in Industrial Shunting Yards; " (*d*) publication No. 7620/1 on rotary convertors; (*e*) auto-transformers and Star-Delta starters (leaflet 59/5–1).

The ATELIERS CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, Belgium, has kindly sent us a copy of No. 97 of their quarterly bulletin, which contains interesting technical details on synchronous induction motors, high tension cables, electric cranes, centrifugal pumps, electrically driven rolling mills and transformer oils. The bulletin is copiously illustrated with curves, diagrams and illustrations, and its 64 pages contain much useful information which will be of value to both electrical and mechanical engineers.

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Tomlinson Lee *v.* Peel.

Damages Claimed for Alleged Slander.

Mr. Justice DARLING and a special jury in the King's Bench Division on May 3rd had before them an action brought by Mr. Harry Tomlinson Lee, ex-chief electrical engineer for the Borough of Wimbledon, against Mr. William Nicholson Peel, an alderman on the Wimbledon Town Council, claiming damages for alleged defamatory words spoken and published concerning the plaintiff as an electrical engineer. By his defence defendant denied he spoke or published the words complained of within the meaning alleged, and said that if he did so they were spoken on a privileged occasion, and alternatively that they were true in substance and in fact.

Mr. MADDOCKS, opening the case for the plaintiff, gave details of Mr. Lee's career, and referred to the incidents leading up to the homily read him by the chairman of the Electricity Committee in 1920. This was referred to in detail during the hearing of Mr. Lee's action against Mr. S. Mussell, a former Mayor of Wimbledon, in March (see THE ELECTRICIAN, March 9th, 1923, p. 260).

The Words Complained of.

Having referred to Mr. Lee's dismissal, and to the subsequent meeting of the Town Council at which Mr. Mussell used the words complained of in the former action, Mr. MADDOCKS dealt with the words complained of in the present action. The plaintiff, he said, alleged that on March 6th, 1922, at a meeting of the Council at which the members of the general public were present, the defendant said: "The men who professed to be Mr. Lee's friends have ruined his career. The public should know that it was not within the last two months, nor within the last two years, that there has been dissatisfaction with Mr. Lee, and Councillor Bellingham knows that as well as I do. Councillor Bellingham knows very well that the committee interviewed Mr. Lee from time to time and tried to make him change his ways. Mr. Lee has been warned from time to time, and has been advised as to his conduct."

Further, on April 26th, 1922, at Southdown Road, Wimbledon, the defendant said that Mr. Tomlinson Lee had been dismissed because he was going the pace too much and neglecting his work.

Mr. Ralph Dixon Pond, a solicitor's managing clerk, of 24, Rayleigh Road, Wimbledon, said that he was at the South Western Hotel, Wimbledon, on March 5th, 1922, with a former Mayor and other persons, when the defendant said to him, "What about Tomlinson Lee?" He (the witness) said: "I don't wish you to discuss Mr. Lee's matter with me. You are an alderman of the borough, and, as such, there is a proper place for you to say what you have to say in reference to that matter, and that is in the Council chamber." The defendant then said: "Oh, I shall speak about him; you don't know all the facts. Tomlinson Lee ought to have been dismissed ten years ago. He is incompetent for his job."

The Plaintiff's Evidence.

The plaintiff, giving evidence, said that the trouble between him and the Electricity Committee seemed to arise in November or December, 1920. The defendant never asked him to explain his conduct.

In cross-examination by Mr. GREGORY, the plaintiff said that he was a competent electrical engineer, and knew how to get the most out of electrical plant.

Questioned about his estimates since 1920, the witness said that in that year he was using seven boilers at the electricity works and his output was 2 500 kW. He tried to get the machinery for cleaning out the boilers, but his committee refused it. It would not surprise him to learn that since he left it had not been necessary to use more than four boilers if they were kept clean, and that the output had been increased to 3 700 kW.

Mr. GREGORY: Do you know that, in the first year since you left, the profit from the undertaking was £27 000?—They could not help it. (Laughter.) There has been a war.

After other matters had been dealt with,

Mr. GREGORY said: I have asked questions suggesting that you were not properly carrying out your duties in 1920. I say that that state of affairs had been going on bit by bit, and that the meaning of it was that you were giving way to drink.

The plaintiff denied that he had ever given way to drink and further denied that he used bad language to members of the Electricity Committee.

The Case for the Defence.

When the hearing was resumed on May 4th, Mr. GREGORY, for the defence, told the jury that he was going to state quite boldly that Mr. Lee was dismissed for incompetence. The position between the Electricity Committee and Mr. Lee became such that they could not safely act on his advice. The electricity station had got into such a state that the undertaking was making a serious loss. In his (counsel's) opinion the committee made a great mistake in not clearly stating to Mr. Lee that they were dismissing him because they had lost confidence in him. For long, the committee, although dissatisfied with the plaintiff's habits and conduct, were trying to take a kindly view of his weakness for intoxicants. The committee, in a friendly spirit, prepared what had been called a "homily." Unfortunately, that homily did not have the desired effect.

Chief Inspector Turner, of the Bradford Police, called for the plaintiff, said that he met Mr. Lee several times during the Electrical Engineers' Convention, at Bradford, in June, 1920. On each occasion the plaintiff was perfectly sober.

Mr. Arthur Edwin Mackenzie, who attended on subpœna, was called for the defendant. He said that he succeeded Mr. Lee as electrical engineer to the Council in April, 1922. He found that the consumption of coal at the generating station was far greater than it should have been. That was due to the state of the boilers, which were in a filthy condition. There was scale in the boilers which had taken several years to form. When the boilers were cleaned there was an immediate reduction in the coal consumption. After years of considerable loss and small profits, there was a profit of £5 894 on the electricity undertaking for the year which ended on March 31st, 1922, while for the year just ended he estimated that the profit would be between £25 000 and £26 000; and this in spite of the fact that, since the plaintiff left, the charge per kWh had been reduced from 8d. to 6d.

Mr. MADDOCKS (cross-examining): You don't attribute the wonderful development in the generating station to Mr. Mackenzie?

The witness: Yes.

Mr. Justice DARLING: Ask him what nation he belongs to. (Laughter.)

Mr. MADDOCKS: Wages have dropped, coal has come down in price, coal strike stopped, all on account of Mr. Mackenzie?—No.

It is not all due to you?—Not all.

The Defendant's Evidence.

The hearing was resumed on May 7th. Mr. A. Sheldon, formerly Town Clerk of Wimbledon, said that he had never seen the plaintiff drunk in the ordinary sense of the word, but he had seen him on occasions when it was evident that he had been drinking. He also said that on one occasion the plaintiff denounced the Electricity Committee in his hearing.

The defendant was called by Mr. CASSELS. He said that he was a tailor and had been on the Wimbledon Council for some years.

Counsel read a passage of which the plaintiff complained in the witness's statement at the meeting of the borough council on March 6th, 1922. The witness replied that what he said on that occasion was uttered under pressure from six out of the thirty-two members. They kept on asking for reasons why Mr. Lee was dismissed, and the other members were anxious not to give reasons which might injure the plaintiff. Referring to the interview with Mr. Pond at the South Western Hotel, Wimbledon, on Sunday March 5th, 1922, the witness denied that he uttered the words which were attributed to him. When he was spoken to by Mr. Pond on the subject, the witness told him that, so far as he knew, the Electricity Committee and the Council had lost confidence in Mr. Lee; that the Electricity Committee and the General Purposes Committee were unanimous; and that the Council had decided by a majority to dismiss him. The conversation was carried on in a whisper, and he (the witness) spoke to Mr. Pond on the subject only because he was an old member of the Council.

Mr. CASSELS: Mr. Pond says that you insisted upon talking to him about Mr. Lee?—That would have been madness on my part, because I knew of the action which he was taking on the plaintiff's behalf.

Counsel: He says that you told him that Mr. Lee ought to have been dismissed ten years before?—That is not so. He asked me whether he was competent for his job, and I told him that I was not in a position to judge as I had no technical knowledge of electrical engineering.

The witness added that Mr. Pond imagined things.

Counsel: Mr. Pond says that he put certain questions to you about embezzlement and immorality on the plaintiff's part?—Nothing of the kind; it is his imagination.

The Reasons for Mr. Lee's Dismissal.

In answer to further questions the defendant said that after 1909 he had seen the plaintiff during the daytime inside public-houses at Wimbledon while his car was waiting for hours at a time in the council yard. When questions concerning the work of the electricity department arose in committee, Mr. Lee got very excited and he showed his resentment. He gave the impression that he regarded himself as the sole arbiter. On those occasions there was no doubt that the plaintiff was under the influence of drink. He (the witness) had also heard him use bad language concerning the committee.

Cross-examined by Mr. MADDOCKS, the witness said that he never asserted that Mr. Lee was dismissed for intemperance.

What were your reasons for dismissing Mr. Lee?—His general conduct from 1908 onwards, his attitude before the committee, disturbances about the use that he made of his cars, and his coming into committee meetings when he was under the influence of drink.

The witness said that he had no ill-feeling towards the plaintiff. He came to the conclusion that Mr. Lee was really incompetent for his job, but he never said so to Mr. Pond.

Evidence was given on Tuesday by Mr. A. W. Hickmott, who said that he was Chairman of the Wimbledon Electricity Committee when the Committee recommended that the plaintiff's appointment should be terminated. That recommendation was unanimous.

The witness admitted that he was being sued by the plaintiff, but he said that he could not say what his defence was.

Mr. CASSELS said that the action was for libel in a letter written by the witness to the then Mayor of Wimbledon. The defence was a plea of privilege.

Asked what were his reasons for recommending the dismissal of the plaintiff, the witness said that he was perfectly well aware what his reasons were, but he had to be careful. When he was asked in

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the council meeting what his reasons were he declined to say, but the moment he made a direct statement he had a writ against him. When the Mayor spoke he put his foot in it.

Mr. MADDOCKS: Yes, to the tune of £250.

Asked whether one of his reasons for the dismissal of the plaintiff was that his car had been seen outside public-houses, the witness said, "What are you getting at?"

Later he said:—I know what you are at. You want to get evidence against me at my own trial, and you won't get it. (Laughter.)

Alderman D. Stuart, of Cambridge Road, Wimbledon, said he was a member of the Institution of Electrical Engineers, and was employed at the General Post Office. He was a member of the Wimbledon Corporation and of its Electricity Committtee from 1907 until 1923. He was chairman of the committee from 1910 to 1917. He had nothing to say up to that year of plaintiffs' work. He had never seen him the worse for drink, but certainly under the influence of drink. He gave a testimonial to plaintiff as to his technical ability.

Counsel: Would you be prepared to repeat that testimonial now?—No.

Witness said he voted for plaintiff's dismissal. He had no animosity against him, and he stated publicly that as plaintiff and he were of the same profession it was not his wish to do anything to injure him. He also had a writ.

Cross-examined: Witness said that while he was chairman of the Electricity Committee he had no complaint as to plaintiff's engineering ability or management of the business. Some of the electrical papers in London might have made strong observations in favour of the plaintiff. He interviewed representatives of some of these papers. It was to tell the papers that there was another side to the question. He believed one of the papers referred to "Tammany" methods at Wimbledon.

Re-examined: Witness thought that latterly plaintiff lost a grip of his work. He had nothing against plaintiff's technical ability, but witness thought he was neglectful.

The hearing was proceeding when we went to press.

Joint Engineering Council.

Details of Constitution and By-laws.

As we go to press we have received a copy of the constitution and by-laws of the ENGINEERING JOINT COUNCIL, a body which it will be remembered has been founded by the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Electrical Engineers, and the Institution of Naval Architects to consider and advise upon matters referred to it by one of the constituent Institutions. The Council will consist of two members from each of the constituent institutions, who shall be appointed annually, and who shall not be eligible to serve for more than four years. One of the first two appointed by each institution shall serve for not more than two years and shall be eligible for reappointment for a further period of not more than four years. The by-laws provide for two meetings in each year, one in November and one in March, and for the annual appointment of a secretary. No decision taken by the Joint Council shall be valid unless at least one half of the Council are present, and every decision must be confirmed at a subsequent meeting at which at least one half of the council must be present. This by-law does not apply to the admission or exclusion of societies from membership, which must be decided by the vote of all the representatives on the council.

Glasgow Electricity Department Sports Ground.

The bowling green and tennis courts of the Glasgow Corporation Electricity Department at Dalmarnock were opened on Saturday for their second season. Mrs. Mackellar Dewar, wife of the convener of the Electricity Committee, threw the first jack on the bowling green, and was presented by the electrical engineer, Mr. Mitchell, who is the president of the bowling club, with a silver jack as a souvenir of the occasion. The opening of the tennis courts was performed by Mrs. M'Innes Shaw, wife of the sub-convener of the Electricity Committee, who played the first game, and who was afterwards presented with the racquet with which the opening game was played. The presentation was made by the president of the tennis club, Mr. Maccall, secretary and treasurer of the department. Members of the Corporation and of the staff of the department afterwards took part in games on the bowling green and tennis courts.

The INDUSTRIAL COURT has decided that electrical fitters and other skilled workers in the industry covered by a District Council for the North Western Area, whose wages have been hitherto controlled by the standard district engineering rate, shall be given basic rates of 11·75d., 11d. and 10·25d. per hour for zones A, B and C respectively. The "all-in" rates per hour payable on and after May 1st, are to be 18·35d., 17·58d., and 16·79d. per hour for the three zones. On and after August 1st, these rates become 17·86d., 17·10d., and 16·34d. respectively.

N.A.S.E. Prize Competition.

Mr. E. E. Gammon Wins the "W. E. Highfield" Shield.

Twelve papers were presented on Tuesday evening by members of the NATIONAL ASSOCIATION OF SUPERVISING ELECTRICIANS for the "W. E. Highfield" Shield Competition. The papers were read anonymously, each being given an identifying number, and the judging was by popular vote.

The shield was won by Mr. E. E. Gammon, whose paper was entitled "The N.A.S.E.: A Criticism." Mr. Gammon will hold the shield for a year. He also won the first prize—a wireless set, presented by the Cable Accessories Co. The second prize, presented by Major T. Vincent Smith, went to Mr. R. W. J. Stark, for a paper on "Electro-Chemistry," and the third prize, presented by Mr. A. H. Dykes, was won by Mr. J. J. Southern, whose paper was entitled "Distribution of Electrical Energy in a Modern Fighting Ship."

The papers covered a wide variety of subjects, and the care with which they had been compiled proved the interest which had been taken in the competition. The scheme is part of the educational programme of the Association, and Mr. T. H. Windibank was responsible for its inception.

West Midlands Industrial Council.

The annual meeting of the Industrial Council for the electricity supply industry for the West Midlands district was held at the Birmingham Chamber of Commerce on May 4th. In the absence through illness of Mr. R. A. Chattock (manager of the Birmingham Electricity Supply Undertaking), the chairman, the vice-chairman (Alderman Gregory) presided. A discussion took place on the question of the advisability of all the workmen becoming members of their appropriate trade unions.

It was decided to recommend the constituent employing authorities to post notices in their works embodying the following resolution of the Council:—"That, in view of the general adoption of the principles of 'Whitleyism' by employers in industry and the betterment of the relations between employers and employees, which has followed the setting up of Whitley Councils, this Council, which regulates the wages and working conditions of employees in electricity undertakings and is composed on the one hand of representatives of such undertakings and of trade unions on the other, is of the opinion that in the interests of all concerned it is desirable that employees should be members of their respective unions, but that there should be no question of making such membership a condition of employment."

The annual report, which was adopted, stated that the views expressed in 1919 as to the benefits of "Whitleyism" to the industry had been fully borne out by the experience of the past 3½ years.

Horace Green & Co.

Annual Social and Concert.

In connection with the annual profit sharing scheme a social evening and concert was held on Saturday last for the Staff and Employees of Horace Green and Co., in the Cononley National School. Following tea, a concert was given by Mr. and Mrs. Max Bradford, of Bradford, and various talented employees of the firm. In a brief speech Mr. Horace Green outlined the aims of the Profit Sharing Scheme, which was inaugurated in 1914, and also the arrangement whereby employees might invest their savings in the business. The evening concluded with a Whist Drive and Dance. Approximately 200 were present.

Birmingham Electrical Golfing Society.

The Spring meeting of the BIRMINGHAM ELECTRICAL GOLFING SOCIETY will be held at the Robin Hood Golf Club on Monday afternoon, May 14th, when the Challenge Cup presented by the Electrical Trade will be up for competition. Golfers in the Electrical Trade in the Midlands are eligible and can enter up to the time of the competition, namely, 2 o'clock on Monday next. The Summer Meeting will be held in July, and the Autumn Meeting towards the end of September. The hon. secretary is Mr. W. A. Millinger, 9, Livery Street, Birmingham.

It is stated that TELEPHONE KIOSKS are to be erected on the Thames Embankment.

"PRINTER'S PIE," though it changes in character and bulk, in quality every year becomes better and better. The 1923 edition which has just come to hand is no exception and there are sufficient funny pictures and excellent stories to tickle the most jaded palate. We need hardly add that the whole of the proceeds go to the various printers' charities which is an additional reason why everyone should buy it.

A complaint was recently made to the Birmingham Chamber of Commerce that the railway companies decline to treat ELECTRIC APPARATUS FOR SCALING BOILERS accompanying passenger as commercial luggage and applied the customary scale of charges for special traffic. In view of the fact that the apparatus invariably accompanies the demonstrator, a representation has been made to the railway companies to treat the traffic as commercial luggage.

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Imperial Notes.

AUSTRALIA.

Adelaide Electric Supply Co.'s Good Dividend.

The Adelaide Electric Supply Co. has declared an interim dividend at the rate of 12 per cent. per annum, free of tax, on the ordinary shares, payable on June 1st.

Tramway Subway Proposal.

At a meeting of the Town Planning Association in Brisbane (Queensland) Mr. James Allan advocated the construction of a tramway subway under Ann Street to relieve the ever-increasing congestion of traffic in the main streets. Engineer members of the Association have been asked to report on the question.

Post Office Reorganisation.

Mr. H. P. Brown, a staff engineer of the British Post Office, and Mr. W. H. Swanton, a former chairman of the Melbourne Chamber of Commerce, have been engaged to advise the Australian Postmaster-General upon the best means of reorganising and improving his Department, upon which it has been decided to spend £9 000 000 in the next three years. Mr. Brown's services have been lent by the British Post Office.

CANADA.

The St. Maurice Power Project.

We have received from the William Cramp and Sons Ship and Engine Building Co. some particulars regarding the new St. Maurice power project of the Shawinigan Water and Power Co., of Montreal. A contract for the hydraulic machinery and equipment for the plant has just been placed with the Dominion Engineering Works, the Canadian licensees of the William Cramp Co. There are to be four 30 000 H.P. propeller-type turbines, to be built according to the latest designs developed by the I. P. Morris Department of the Cramp Co. They will, consequently, be the largest turbines of this type in the world, exceeding in unit capacity those recently completed by the Dominion Engineering Works for the Manitoba Power Co. at Winnipeg. The new plant is to be located at Gres Falls, about ten miles below the Shawinigan station and as far again below Laurentide. The site has been owned by the Shawinigan Co., for some time. A new subsidiary company, to be known as the St. Maurice Power Co., has been organised to construct and operate the new station, which will be known as the St. Maurice plant. The entire development is being financed by Aldred and Co., of New York. Construction work on the dam and foundations is already under way, and completion of the entire plant has been promised by June, 1924. If this schedule is carried out it will make a record for speedy construction for plants of this size. The turbines are to operate under a normal head of 60 ft., and to run at a speed of 130 revs. per min. Their performance will be watched with much interest by engineers, as they are to embody a number of improvements recently developed in the laboratories of the Cramp Co., including the Moody diagonal-flow propeller-type runner, and the Moody spreading draft tubes.

INDIA.

Bengal Radio Club Formed.

It has been decided to establish a Radio Club for Bengal to be affiliated in due course to the Radio Society of Great Britain. A committee has been appointed to frame rules and regulations and to draw up a summary of the proposals of the Club. In his presidential speech, Mr. Stapleton, of the Marconi International Marine Communications Co., pointed out the facilities that the club would possess for amateurs to apply their knowledge, and suggested that the club should seek to popularise the science as an interesting hobby, to investigate its possibilities as a means of communication, both commercially and privately, as well as to spread knowledge by inviting members to give lectures, demonstrations, etc. He also promised to lend the assistance of the Marconi Co., and also their apparatus for instructional and experimental purposes.

Revised Tariff on Electrical Goods.

The Indian Finance Act, which came into operation on March 1st, contains amendments and additions to the Indian Customs Tariff. H.t. electrolytic copper wire and cables, insulated or bare, and poles, troughs, conduits and insulators for transmission systems are now included under machinery, the import duty on which is 2½ per cent.; the duty upon tramcars is 15 per cent., instead of 30 per cent. as heretofore; and the following new item has been added to the tariff: Electrical control gear and transmission gear—viz., switches, fuses and current-breaking devices of all sorts and descriptions, designed for use in circuits of less than 10 A and at a pressure not exceeding 250 V and regulators for use with motors designed to consume less than 187 W; bare or insulated copper wires and cables, any one core of which has a sectional area of less than 0·0125 sq. in. and wires and cables of other metals of not more than equivalent conductivity; and line insulators, including also cleats, connectors, leading-in tubes and the like, of types and sizes such as are ordinarily used in connection with the transmission of power for other than industrial purposes, and the fittings thereof, 15 per cent. *ad valorem*.

SOUTH AFRICA.

Electricity Supply Commission Appointed.

H.M. Senior Trade Commissioner in South Africa has forwarded to the Department of Overseas Trade a report which recently appeared in the South African Press concerning the Electricity Act, 1922. According to the report the Electricity Supply Commission provided for under the Act has now been appointed and, so far, its functions have been exercised by a board of officials appointed as a separate body under the Act to supervise the issue of licences (to private undertakings as well as to the Commission contemplated) on the basis adopted by the Transvaal some years ago. The new Commission has the following constitution: Dr. H. J. van der Byl, permanent chairman, Mr. Robert Niven, of Johannesburg, Mr. J. R. Foulton, retired railway engineer. The first meeting of the Commission will be held at an early date, and among the first points to be considered are: (1) The taking over from the South African Railways of the great power station in course of construction at Colenso; (2) the erection of a power station at Durban; (3) the provision of electric power in the neighbourhood of the Sabie Goldfields, Transvaal, and (4) the erection of a power station at Witbank.

Foreign Notes.

EUROPE.

Polish Railway Electrification.

A message from Warsaw says that on April 17th a new joint stock local electric railway company was formed, which will construct in the first place a line between Warsaw, Grodzisk, and Zyrardow, and a line from Warsaw to Wolomine to connect the suburbs with the capital. The new concern inaugurates the co-operation of British and Polish capital. The necessary power will be supplied by the Pruszkow electric works.

A New Italian Company.

A new company, with the title Instrumento di Misura C.G.S., Ltd., has been formed, with head office in Milan, and a capital of L.4 500 000. The company has absorbed the Officine C.G.S. of Monza, and will continue and develop the manufacture of C.G.S. electrical measuring instruments. The management of the new company has announced that, "conscious of the recognised good quality of the instruments manufactured at the C.G.S. workshops, they will make every effort to render still more perfect their own productions, and rely on the support and sympathy of all those concerned towards this purely national industry."

French Electrical Development.

Our French contemporary, "L'Association Ouvriere," in a recent issue, recorded the rapidity with which the use of electricity is spreading in the rural districts of France. Although the supply companies now existing are rapidly extending their operations, there is a strong tendency on the part of municipalities to take the initiative in cases where such a course seems likely to accelerate matters. Our contemporary records that in February last, the General Council of the Department of the Cher held a special meeting and voted a sum of ten million francs for electricity purposes, covering all parts of the Department where the population was sufficient to ensure a return on the outlay. This, apparently, is typical of what is going on all over the country.

LATIN-AMERICA.

Vera Cruz Electric and La Plata Tramways Accounts.

The directors of the Vera Cruz Electric Light Power and Traction Co., recommend a dividend of 2½ per cent. on the ordinary shares, making 7½ per cent. for the year. The allocation of £5 000 to depreciation and general reserve brings that fund up to £100 000. The sum of £2 500 is set aside for corporation tax, leaving £12 443 to be carried forward.

The accounts of La Plata Electric Tramways Co. for 1922, after providing for debenture and other interest, show a profit of £9 722, to which is added £7 251 brought forward. After allocating £10 000 to reserve, there remains a credit balance of £6 973 to be carried forward, subject to corporation tax, if any.

U.S.A.

A Large Railway Electrification Scheme.

The Westinghouse Electric and Manufacturing Co. has just entered into a contract with the Virginian Railway Co. for the complete electrification of the line between Mullens and Roanoke (in the State of Virginia) comprising 134 route miles and 215 miles of track. This line will handle a very heavy coal traffic with 6 000 ton trains up about a 2 per cent. grade and 9 000 ton trains over the rest of the line. The contract includes the supply of 600 ton split phase 25 cycle 11 000 V locomotives of the most powerful type ever contemplated. The total contract, including a 50 000 kW power house, amounts to $15 000 000. and is claimed to be the largest railway electrification scheme in the world to date.

The Birmingham Tramways football team won the NATIONAL TRAMWAYS SHIELD for the eighth time on May 3rd, defeating Bournemouth by five goals to one.

LONGMANS, GREEN AND CO. announce the forthcoming publication of "The Inspection and Testing of Materials, Apparatus and Lines," by F. L. Henley, Staff Engineer, G.P.O. Methods employed by the Post Office will be dealt with in the book in detail.

A memorial gateway has been erected at Chasetown to the memory of the late Mr. ARTHUR SOPWITH, of Cannock Chase Colliery. He was the first to light a colliery by electricity, and many colliery engineers came to Cannock Chase to study what was then a remarkable achievement.

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Electricity Supply.

Extensions and Developments.

DOVER Town Council has decided to expend £250 on the purchase of electric cookers, to be let out on hire.

WIGAN Corporation has made arrangements to provide one of the largest colliery companies in the Wigan coalfields with an electricity supply of approximately 4 000 000 kWh per annum.

LIVERPOOL Corporation is to seek borrowing powers to the extent of £10 000, with which it is proposed to install a new 1 500 kW rotary converter, switchgear, etc., at the Marsh Lane power station, Bootle.

Our Irish correspondent informs us that the newly-formed Electric Light Co. at FIVEMILETOWN (Co. Tyrone) has been so successful that the churches and business places, and practically every house in the town, are now lighted by electricity.

CANTERBURY Town Council has applied for a loan of £1 870 for water supply piping at the Electricity Works, and has decided, subject to the necessary consent being obtained, to supply electricity to the paper mills at Chartham, subject to a ten years' agreement.

The proposed extensions of the generating plant of the WORTHING Borough Council are to include a heavy oil engine and dynamo set of a capacity of 750 kW, a 15-ton overhead travelling crane, centrifugal motor-driven circulating water pumps, with piping tanks, etc.

During the last twelve months the coal consumption at the SOUTHPORT Electricity Works has been 2·95 lb. per kWh, compared with 4·03 lb. per kWh during the preceding twelve months. New auxiliary pumps are now being fitted at the generating station by the Brush Co., and shortly new steam ejectors will be fitted.

HOVE Town Council proposes to acquire a site for the erection of an additional converter station, from which the current taken in bulk from the Brighton works can be distributed in the Aldrington area, which is expanding rapidly. Recent developments in that district have necessitated an entire rearrangement of the service.

TUNBRIDGE WELLS Town Council has considered a report of the engineer as to the proposed extensions to the electricity works, the cost of which is estimated at £56 943, and has decided to refer the matter to a consulting engineer for consideration and report, and to ask Mr. Ernest M. Lacey what would be his fee to undertake the matter.

It is expected that the existing electrical station on the sea front at TORQUAY will be closed in September, when the new generating station at Newton Abbot will be ready for occupation. The new station will start work with a capacity of 6 000 kW, the supply voltage being 11 000. The equipment includes Stirling boilers and British Thomson-Houston turbo-alternators.

Alterations in Charges, Proposed and Actual.

The lighting charge at PEMBROKE (Ireland) is to be reduced by 2d. per kWh from the June quarter onwards.

WALTON-ON-NAZE Urban Council has decided to reduce the lighting charge from 1s. per kWh to 9d. per kWh.

DARTFORD Urban Council has decided to extend the discount of 2½ per cent. for prompt payment of accounts for lighting to those consumers who are supplied with electricity under special agreements.

GILLINGHAM (Kent) Town Council has applied to the Commissioners for an extension for two years of the Statutory Undertakings (Temporary Increases of Charges) Act, 1918, which authorises the present charges for electricity, and which expires on August 31st next.

CHESTERFIELD Electricity Committee has decided not to require any minimum payment or consumption from small houses supplied with electricity, and after 1 000 kWh are used at 2½d. per kWh in excess of the ordinary price, the current is to be charged for at the ordinary lighting rate.

STRETFORD Urban District Council has made the following reductions in electricity charges: Lighting, from 6½d. to 6d. per kWh; heating and cooking from 1d. per kWh, plus 85 per cent. to 1d. per kWh, plus 65 per cent.; power, advance of 85 per cent. on pre-war rates reduced to 65 per cent.

Tapping New Areas.

The THAMES VALLEY ELECTRIC SUPPLY Co. is seeking permission to supply electricity in the Henley-on-Thames district.

DEVIZES Town Council has decided not to oppose the application of the Western Electric Distributing Corporation, Ltd., for an order to supply electricity to the district.

NUNEATON Electricity Committee proposes to apply for an order to supply the parish of Hartshill, and for sanction to a loan of £8 000 in connection with the scheme.

SEATON Urban Council, in consideration of concessions made by the Seaton and District Electric Lighting Co., has withdrawn its objections to the draft special order for the electric lighting of Seaton.

The YORKSHIRE ELECTRIC POWER Co. is being asked to prepare an amended scheme for the supply of electricity to the townships of Wetherby, Boston Spa, Thorner, Bardsey, East Keswick, Collingham, Linton, Scarcroft and Thorparch.

At a meeting of residents at MILNTHORPE last week, Mr. T. Wilkinson, electrical engineer of Arnside, submitted an electric lighting scheme for the parish, and he was requested to prepare definite estimates for future consideration.

STOCKPORT Town Council having received a request from the Macclesfield Electricity Co. for a supply of electricity in bulk, has replied that the supply could only be afforded with the consent of the Hazel Grove and Bramhall Urban Council, at the Hazel Grove sub-station, and on the same terms as the Hazel Grove supply.

LUTON Town Council having received from the Dunstable Town Council a communication as to whether the Corporation is able and willing to supply electricity to Dunstable, Leighton Buzzard and Linslade, has appointed a deputation, including the electrical engineer, to confer with representatives of the councils named.

CRANBROOK Rural Council has decided to consent to an application being made to the Commissioners for a special order to supply electricity in the district by Major B. J. Day, of Hawkhurst, and Lieut.-Col. C. B. Bartley, of Goudhurst. It is proposed to have a central generating station at Cranbrook, and to distribute electricity by means of overhead wires.

REIGATE Town Council has received from the Commissioners an intimation that they will be prepared to entertain an application by the Corporation to supply electricity to Horley and district provided statutory powers for a bulk supply of electricity to the Council are previously obtained by the parties with whom the Corporation are in negotiation.

WORKINGTON Town Council has decided that the proprietors of the St. Helen's Colliery be requested to give their terms and conditions for a supply of electricity to the borough, the maximum quantity at present not to exceed 1 000 B.H.P. The Town Clerk has been instructed to write to the Commissioners and ascertain whether it is their intention to set up an electricity area in West Cumberland under the Government scheme, and, if not, what attitude the Commissioners would take towards a joint application of the local authorities in the area.

Miscellaneous Supply Items.

STOURPORT Council has decided to urge that Stourport should be included in the Shropshire, Worcestershire and Staffordshire Electric Power Co.'s Bill, which provides for the erection of a large electric station at Stourport, and that a clause be inserted in the Bill giving the Council the option of purchase.

BLACKBURN Town Council, on May 3rd, referred back a recommendation of the Electricity Committee that the chairman and vice-chairman be authorised to contract on behalf of the Corporation for the supply of electrical energy to consumers, the terms of such contracts to be subsequently reported to the Committee. The opinion was expressed that this was vesting the heads of the department with wide authority and reducing the full Committee to a position of impotence. On the other hand, it was urged that the officials should be given executive power to negotiate with probable customers without having to wait for meetings of the Committee.

Personal Items.

We learn with pleasure that Mr. THOMAS ROLES, city electrical engineer at Bradford, has resumed his duties after some months absence owing to ill-health.

Mr. S. G. MARTLEW, of Harrow, chief electrical engineer with Kodak, Ltd., has been appointed chief electrical engineer to Gillingham (Kent) Corporation.

Mr. R. A. CHATTOCK, city electrical engineer at Birmingham, is recovering from a recent severe attack of influenza. It is hoped that he will be able to resume his duties in the course of two or three weeks.

Mr. N. BROOKSBANK has taken up an appointment with the Victoria Falls and Transvaal Power Co. at its London office, and has resigned the position of chief electrical assistant in the Ipswich electricity and tramways department.

Mr. E. SEYMOUR WOOD, late of the South Hetton Coal Co., has concluded arrangements to represent the Harland Engineering Co. and the British Electric Plant Co. on the East Coast with headquarters at Newcastle. Mr. Wood is well known on the North-East Coast, and has been for 12 years on the Council for the Institution of Mining Electrical Engineers, and the North of England Institution of Mining and Mechanical Engineers.

Wimbledon Electricity Committee has recommended the Staffing Committee to increase the salary of the electrical engineer, Mr. A. E. MCKENZIE, from £1 000 to £1 250, as from April 1st last, with a further increase to £1 500 on April 1st, 1924, provided that the net profits of the undertaking during the year ending March 1st, 1924, will enable the Council to reduce the charges for lighting purposes to 4½d. per kWh, and for cooking and heating to 1d. per kWh, and also to allocate out of the net profits such a sum as would bring the reserve fund up to £10 000. It is also recommended that when the alterations to the boilers are completed, Mr. McKenzie be paid £250, and on the completion of the installation of the 3 000 kW turbo-alternator, a further sum of £250, and that he be permitted to undertake work as a consulting engineer on agreeing to remain with the Corporation for three years from April 1st, 1923, subject to his right to determine the agreement on three months' notice, if he should obtain an appointment as chief electrical engineer of a station of a capacity of 20 000 kW or upwards.

OBITUARY.—The death is announced at Hampstead, London, N.W., after an operation, of Mr. JOHN TAYLOR OSLER, the eldest son of the late Mr. Alfred C. Osler, and of Mrs. Osler, Fallowfield, Edgbaston. Mr. Osler, who was 49 years of age, was a director of F. and C. Osler, Ltd., electric fittings makers, Birmingham, and had been manager of the firm's London branch for many years.

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Private Bills.

Oakham Gas and Electricity.

Following its third reading in the House of Lords, the OAKHAM GAS AND ELECTRICITY BILL was, on May 3rd, read the first time in the House of Commons, and referred to the Examiners of Petitions for Private Bills.

Bradford Trolley Vehicles Bill.

On May 4th, the Bradford Corporation (Trolley Vehicles) Provisional Order (No. 1) Bill was read a second time in the House of Commons and committed.

London Electric Railway Bill.

The Bill of the London Electric Railway Co., which seeks power to construct extensions of the underground railway system, came before a Committee of the House of Commons, presided over by Sir Park Goff, on May 2nd. This was the Committee which previously approved the extension scheme of the City and South London Railway Co. The Bill proposes an extension from Charing Cross to Kennington, thus connecting the Hampstead and Highgate Railway at Charing Cross with the City and South London Railway at Kennington through Waterloo. Other connections from this extension are to be made with the Bakerloo Railway.

Mr. E. SHORTT (counsel for the London Electric Railway Co.) said the Bill represented was a portion of the scheme, part of which the Committee had already approved, under the City and South London Bill, and which was intended to give to the south of the Thames that flexibility of distribution of traffic which existed in the north of London, as well as to relieve congestion at the Elephant and Castle and Waterloo. In addition to the extensions, it was proposed to construct a huge booking hall beneath Piccadilly Circus, and to enlarge Leicester Square station. The average number of passengers dealt with by the tube railway at Waterloo per annum was about 12 000 000, and at the Elephant and Castle 14 000 000, and if this scheme were authorised the facilities for dealing with the heavy traffic at those stations would be more than doubled. There would be three new stations, and it was anticipated that the expenditure would be £2 227 000.

Southern Railway Co.'s Opposition.

The only real opposition came from the Southern Railway Co., in connection with their works at Waterloo. That company has in hand a scheme to build an underground line from Waterloo to Nine Elms, because the existing facilities on the surface are quite inadequate to meet the demand made upon them. The scheme has been passed by the Traffic Board of the Southern Railway Co., and is definitely to be put in hand on land already in the ownership of the company. It was also objected that the construction of a railway under Charing Cross Hotel, the property of the company, would be calculated to damage that property.

LORD ASHFIELD, giving evidence in support of the Bill, said that it was assumed that in a very short time after the railways proposed in the Bill had been built, and allowing for the electrification of the suburban system of the Southern Railway, the London electric line would deal with 24 500 000 passengers a year.

On May 3rd engineering evidence was given both for the promoters and the Southern Railway Co. The position taken up by the latter, as revealed in the cross-examination of Mr. Dalrymple-Hay and Sir Robert Elliott-Cooper, who were the engineering witnesses for the promoters, was that the proposals of the Bill would involve the proposed tube extension cutting right through the tube line proposed by the Southern group from Nine Elms to Waterloo, which would be built in the form of a loop, to facilitate the trains returning. It was said that the Southern Railway welcomed any extension of the facilities at Waterloo, but they felt they had prior rights, especially as their works would be constructed upon land now in their possession, and they were not prepared to give up these rights.

Agreement Reached.

When the Committee met again on Tuesday, it was announced that the London Electric Railway Co., and the Southern Railway Co., had reached agreement. It was explained by Mr. MCMILLAN, K.C., (for the Southern Railway Co.), that the engineers had considered the various points at which the undertaking of the Southern Co. might be affected by the proposed works. The most important matter was that of Waterloo Station, and the promoters had agreed to withdraw from the Bill the powers regarding the construction of a tunnel connecting the Bakerloo Railway with the Charing Cross and Kennington extension.

Mr. E. SHORTT, K.C., (for the London Electric Railway Co.), pointed out to the Committee that the tunnel which it had been agreed to withdraw was an essential part of the Company's scheme, but the Company had consented to withdraw it because it would, undoubtedly, block the schemes of the Southern Co. The Company's engineers could provide another scheme, but, unfortunately, it would require another Bill; also, though it would not be so good, it would be sufficient to enable the Company to do all that was necessary in the public interests.

After deliberating in private, the Committee came to the conclusion that the preamble of the Bill was proved, subject to the approval of clauses giving effect to the agreement arrived at.

Tenders Invited and Accepted.

UNITED KINGDOM.

MANCHESTER CORPORATION, May 14th.—Drilling machine for Tramways Department. Specifications from the Manager, 55, Piccadilly, Manchester.

HALIFAX HOUSING COMMITTEE, May 16th.—Electricians' work in 54 houses on Sandbeds site. Particulars from the Borough Engineer.

DOVER CORPORATION, May 17th.—Turbo-alternator, with auxiliaries, cables, switchgear, converting plant, cooling pond, buildings and foundations. Specifications from the Borough Electrical Engineer.

DARLINGTON CORPORATION, May 18th.—Cooling tower, etc. Specification from the Borough Electrical Engineer.

DUNDEE CORPORATION, May 18th.—L.T. twin paper-insulated lead-covered and steel tape armoured 7/·064 cable for pressures up to 660 V. Particulars from the Engineer and Manager of the Electricity Department.

INDIA STORE DEPARTMENT, May 18th.—Dry core cable. Tender forms from the Director-General, India Store Department, Branch No. 11, Belvedere Road, Lambeth, London, S.E.1.

METROPOLITAN ASYLUMS BOARD, May 23rd.—Electric light wiring and fitting in the administrative block, the engineers' office block, wards 1 to 10, and the isolation ward block at the North Western Fever Hospital, Hampstead, N.W. Specification, etc., from the Board's Offices, Victoria Embankment, London, E.C.4

PLYMOUTH CORPORATION, May 28th.—Two water-tube boilers, with economiser, etc. Specifications (before May 15th) from the Borough Electrical Engineer.

COMMISSIONERS OF H.M. WORKS, ETC., May 29th.—Erection of telephone exchange at Albert Dock, London, E.1. Specification from the Contracts Branch, King Charles Street, S.W.1.

NEWCASTLE-ON-TYNE CORPORATION, May 30th.—One 5-ton and two 3-ton electric travelling gantry cranes. Specifications from the City Engineer.

AUSTRALIA.

NEW SOUTH WALES RAILWAYS AND TRAMWAYS, July 4th.*—Venturi meter, with recorder of combined and counter type, also necessary connection between U tube and recorder, pressure pipe and fittings, for Zarra Street power house, Newcastle, N.S.W.

IRELAND.

BELFAST CORPORATION, May 22nd.—C.C. switchgear (specification W. 12) and transformers (W. 13). Specifications from the City Electrical Engineer.

ROUMANIA.

A ROUMANIAN MUNICIPALITY, June 1st.*—One 600 H.P. Diesel engine with 220 V d.c. dynamo.

BURTON-ON-TRENT CORPORATION have accepted the tender of Johnson and Phillips for relaying low-pressure mains, £0 900.

The tender of the Medical Supply Association for X-ray apparatus, £591, has been accepted by CAMBERWELL (LONDON) GUARDIANS.

The British Thomson-Houston Co. have secured a contract for the supply of a 6 000 kW alternator to COVENTRY CORPORATION.

The tender of Callenders' Cable and Construction Company for h.t. and l.t. cables, at £2 531 19s. 2d., has been accepted by ERITH CORPORATION.

The tender of Scott and Western for water softening plant, for the electricity works, has been accepted by MALVERN URBAN DISTRICT COUNCIL.

The tender of Bolckow, Vaughan and Co., for supply of tram rails and fishplates, at £13 611 1s. 6d., has been accepted by NEWCASTLE-ON-TYNE CORPORATION.

HAMMERSMITH (LONDON) BOROUGH COUNCIL have accepted the offer of the Cambridge and Paul Instrument Co. to supply CO_2 recording instruments, for two new boilers, at £377 5s. 9d.

The tenders of Wrights Motors, Ltd., for an alternator and 13 motors at £1 143 7s. 6d., and J. Crossley and Sons, for an electric capstan at £100, have been accepted by HALIFAX CORPORATION.

The following tenders have been accepted by WICKLOW URBAN DISTRICT COUNCIL: Crossley Bros., engines and generators, £2 159; Drake and Gorham, motor booster, £124, and switchboard, £315.

TONBRIDGE CORPORATION have placed contracts with the English Electric Co. for rotary converters and switchgear for two substations, £6 953 10s., and British Insulated and Helsby Cables, Ltd., for mains, £7 338.

The following tenders for stores for BRIDLINGTON ELECTRICITY DEPARTMENT have been accepted: Specialities (Liverpool), Ltd., lamps; T. Beadle and Co., electrical stores; Humber Rubber and Engineers' Supplies. Ltd., engineers' stores.

Amongst the tenders recommended for acceptance by BERMONDSEY (LONDON) BOROUGH COUNCIL are those of Ferranti, Ltd., for 20 shilling slot meters, at £3 12s. 6d. each, Venner Time Switches Ltd., for 12 time switches at £5 7s. 8d. each, and two ditto at £7 2s. 6d. each.

ISLINGTON (LONDON) BOROUGH COUNCIL are recommended to accept the tender of the Guild of Engineers (London), Ltd. (the lowest tender) for electric light wiring and fitting of the depot, Liverpool Road, at £133. Thirteen tenders were received, the highest being £236 10s.

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* Particulars from the Department of Overseas Trade.

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Electric Traction.

Tramway Extensions and Developments.

LIVERPOOL City Council last week approved the proposal of the Tramways Committee to apply for powers to construct additional suburban tracks. The estimated capital expenditure is £168 000.

SUNDERLAND Tramways Committee is considering an extension to Silksworth to join the Sunderland District Tramways, and also an extension from Seaburn to the next village of Whitburn along the coast north of Sunderland.

MIDDLETON and Rochdale Town Councils and Chadderton Urban District Council have appointed a Joint Committee to consider the advisability of purchasing the tramway undertaking of the Middleton Electric Traction Co., whose lease expires this year.

LEEDS City Council has approved a scheme for the reorganisation of the staffs in the tramways and highways departments, providing for the appointment of an assistant tramways general manager, an assistant traffic superintendent, and an assistant electrical engineer.

WALLASEY Tramways Committee has appointed a sub-committee to inquire into the working of the undertaking and its financial position, with power to call evidence and engage the services of experts and to report to the committee and make recommendations.

CARLISLE City Council having resolved to make representation to the Board of Trade regarding the condition of the tramway track in Carlisle, Mr. W. C. Bryden, secretary to the City of Carlisle Electric Tramways Co., has informed the Town Clerk that this matter has been receiving the serious consideration of his directors for some time and that recently considerable expenditure on permanent way repairs was sanctioned. Orders have been placed for the necessary material, and as soon as delivery has been obtained an immediate start will be made.

Fares, Receipts and Passengers.

During the year ended March 31st the total number of passengers carried on the BOURNEMOUTH Corporation Tramways was 25 548 131, an increase of 1 276 439 over the previous year. The total receipts were £211 051, as against £207 410, and the net profits amounted to £21 955, against a deficit the previous year of £248.

READING Corporation Tramways showed a net profit of £8 500 for the year ended April, 1923, as against a profit of £2 988 for the previous year, and a deficit of £14 023 in 1920-21. The revenue from all sources amounted to £97 804, compared with £98 822 for the previous year. 11 097 576 passengers were carried, a decrease of 252 281. Penny fares will be reintroduced on July 1st.

The total revenue of BELFAST Corporation tramways for the year ending March 31st was £641 718, and the working expenses £413 901. There was 14 per cent. decrease in expenditure. Over 84 000 000 passengers were carried and the car miles ran to 6¼ millions. The receipts per car mile have risen from 9·51d. in 1914 to 26·67d. in 1923. It was decided to revert to the penny minimum fare and half fares for children on May 14th.

Tramway Receipts for 1921-22.

A return has been issued by the Ministry of Transport giving particulars of the accounts and statistical returns of the TRAMWAYS and LIGHT RAILWAYS UNDERTAKINGS IN GREAT BRITAIN for the year ended December 31st, 1921, for companies, and March 31st, 1922, for local authorities. The tables show that the total route mileage open for traffic at the end of the year was 2 579 miles, of which 1 756 miles were worked by local authorities and 823 miles by companies.

The total gross receipts for 1921-22 were £32 523 339, as compared with £32 692 209 in 1920-21, the net receipts amounting to £5 688 047, or £1 335 544 more than the corresponding figure for the preceding year. The number of passengers carried during the year was 4 256 268 692, a decrease of 413 647 712, or 8·86 per cent., as compared with 1920-21. Car miles run amounted to 332 079 865, a decrease of 13 073 720, or 3·79 per cent. Of the total car miles run 98·24 per cent. were electric car miles.

Staffs and Wages.

In accordance with the agreement made on March 22nd, 1922, between the Municipal Employees' Association and the LIVERPOOL Tramways Committee, the wages of drivers, conductors and shed workers last week became subject to a reduction of 1s. per week.

BURNLEY Tramways Committee has considered a request for inspectors to be placed on the administrative staff and has decided to accede to the request of the men to be entitled to two weeks' holiday with pay per year and six weeks' full wages during sickness, but to be required to work on special occasions in excess of 48 hours per week without extra pay.

Local and National Expenditure.

The inquiry which is proceeding into local government reveals the increasing and almost intolerable load of taxation which our industries have to bear. The gross expenditure of local authorities in 1913–4 was £106 000 000; in 1919–20 it was £196 000 000, or nearly double. The Imperial Budget in 1914 was about £200 000 000; to-day it is four times the amount. The industrious and efficient efforts of the Inland Revenue in re-assessing the income tax on property is a further discouragement, and has raised a Parliamentary storm.

Wireless News.

Radio Manufacturers and the Public.

Since its inaugural meeting early last week, the Committee appointed to consider the agreement between the Post Office and the British Broadcasting Co., and the future of broadcasting, has taken evidence from Sir Wm. Noble and Mr. McKinstry, representing the B.B.C. The various aspects of the controversy have occupied a certain amount of space, both advertisement and editorial, in the daily Press. On Monday and Tuesday lengthy manifestoes issued by the National Association of Radio Manufacturers appeared in several papers. On Monday the title was "The Truth About the Broadcasting Controversy." The manifesto explained clearly the necessity which led to the formation of the British Broadcasting Co., and emphasised the fact that the company does not in any way imply a monopoly. This direct and clearly-worded statement should have the effect of removing some of the prejudice against the B.B.C. which recent sweeping assertions in certain daily papers may have created.

The manifesto which appeared on Tuesday was entitled: "A Word to Those who make their own Wireless Receiving Sets." It was pointed out that the "home constructor" does not at present pay for his broadcasting programme, and that he should be willing to pay a licence fee of 10s. a year. It was also asked that those making sets in future should use only British-made parts. Such parts, it was stated, should be stamped B.B.C. to ensure that they were British. The manifesto concluded: "We, as British manufacturers, do not object to the 3rd licence, but it must be issued to everyone who has a set now. That is our strong desire. You must not be penalised for doing something in ignorance. Neither must we be hurt by foreign competition on an unfair basis. To this, we believe, every fair-minded Britisher will agree."

Managers, Artists and the B.B.C.

Something in the nature of a deadlock continues between the theatrical managers and the B.B.C. Last week a meeting was held to discuss the situation that has arisen as a result of the decision by the managers to oppose the broadcasting of all kinds of entertainments by every means in their power. The meeting was private, and after a long series of discussions it was adjourned to a date that has yet to be fixed. It may be noted, however, that the B.B.C. has come to a working arrangement with the British National Opera Co.

On Sunday a meeting was arranged by the Concert Artists' Association to discuss the broadcasting question. Widely differing views were expressed, Mr. Arthur Burrows and Mr. J. C. W. Reith speaking on behalf of the B.B.C. Mr. Reith stated that he would be delighted to meet a representative committee of the Concert Association, and he would endeavour to negotiate with them a minimum standard fee.

Mr. John Humphreys, vice-chairman of the Association, pointed out that the meeting was not empowered by the rules of the Association to pass any resolution; but if the Broadcasting Co. were prepared to bring the contracts to the committee of the Association and they were found to be reasonable and workable, there was nothing to prevent the committee from advising the members as to their acceptance or otherwise.

Wireless on Licensed Premises.

The Whitehaven magistrates are to be congratulated on their decision to overrule the objection of the Chief Constable to an application for a music and singing licence by the proprietors of the Grand Hotel, Whitehaven. It was explained that the proprietors proposed to install the wireless telephone for the amusement of commercial travellers staying at the hotel. The Chief Constable objected to the application on the grounds that the wireless would interfere with police supervision.

Meanwhile, the National Free Church Council has adopted a resolution viewing with grave concern the applications being made by publicans for permission to erect wireless apparatus on their premises as likely to attract to public-houses large numbers of young people who do not now patronise them.

The New Station at Birmingham.

Birmingham's new broadcasting station is to be installed at the Summer Lane power station of the Birmingham Electrical Supply Department. The transmitting gear, aerials, etc., are now being erected. The studio in which the artistes will perform will be somewhere in the centre of the city. The music, etc., will be carried thence to Summer Lane by cable.

The aerial will be fixed between two of the chimney stacks, and the transmitting will be done from a small building to be erected adjoining the station.

Research Work at Vancouver and Fiji.

On May 3rd, in the House of Commons, Sir B. CHADWICK asked the Postmaster-General if a party of wireless experts was recently sent out by the British Government to carry out experiments between Vancouver and Fiji; if so, what was the object of the mission and the estimated cost?

Sir W. JOYNSON-HICKS: I understand that a small expedition recently left England under the direction of the Pacific Cable Board to undertake wireless research work on Vancouver Island and at Fiji. I am informed that the object of the mission is to undertake such research work.

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J. Marsten. Radio Head Sets (*Radio News*, 4, p. 1 279, January, 1923). R. 366.

A Remarkable Loud Speaker (*Radio News*, 4, p. 1 948, May, 1923). R.366.

N. W. McLachlan. The Magnetic Drum Relay Applied to Wireless Relays, Siphon Recorders and Transmitting Keys (*Wireless World and Radio Review*, 12, pp. 104-108, April 28th, 1923). R.367.

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M. Thouvais. How I Received the American Amateurs' Signals in France (*Radio News*, 4, p. 1 961, May, 1923). R.545.

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W. Harper. Overcoming Difficulties in Radio Reception in the Country (*Radio News*, 4, p. 1 775, April, 1923). R.550.

N. W. McLachlan. Radio Broadcasting (*Electrician*, 90, p. 394, April 13th, 1923). R.550.

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The Newark Broadcasting Station WJZ. (*Wireless Weekly*, 1, pp. 4-7, April 11th, 1923). R.550/612.

Radio Society of Great Britain. Memorandum on Broadcasting and the Licence Problem (*Wireless World and Radio Review*, 12, pp. 89-90, April 21st, 1923; *Wireless Weekly*, 1, pp. 112-113, April 18th, 1923). R.550.

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M. S. Waldman. Radiotelephony in France (*Wireless Age*, 10, p. 43, April, 1923). R.550.

J. Farrell. How Market Reports Are Made (*Radio News*, 4, p. 1 264, January, 1923). R.556.

H. H. Foster. Radio in the National Guard (*Radio News*, 4, p. 1 259, January, 1923). R.560.

L. Fournier. A Radio Controlled Clock (*Radio News*, 4, p. 1 260, January, 1923). R.570.

M. E. Pelgrims. The Marconi Radio Bell (*Radio News*, 4, p. 1 263, January, 1923). R.570.

R. Phillips. Radio Control (*Radio News*, 4, pp. 1 458-1 460, February; pp. 1 628-1 629, March; pp. 1 786-1 787, April; pp. 1 944-1 945, May, 1923). R.570.

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Companies' Reports, Dividends, etc.

HURST NELSON AND CO.—Interim dividend recommended of 1s. per share on the ordinary shares.

CHLORIDE ELECTRICAL STORAGE CO.—Final dividend declared of 5 per cent. actual, free of tax, on the ordinary shares, making 10 per cent., free of tax for the year, plus a bonus of 5 per cent. actual, also free of tax.

The following companies will be STRUCK OFF THE REGISTER OF JOINT STOCK Companies, unless cause to the contrary is shown before July 20th; Rotherham Electrical Engineering Co., Steel's Electric and Engineering Co. The following will be struck off the register, unless cause to the contrary is shown before July 27th: Accumulator Trust, British Electrical Winders.

Forthcoming Issue.

A meeting of the holders of METROPOLITAN DISTRICT AND LONDON ELECTRIC RAILWAYS JOINT POWER HOUSE RENT CHARGE STOCK will be held on May 16th for the purpose of sanctioning the issue of sufficient Metropolitan District and London Electric Railways Joint Power House Rent Charge stock (not exceeding £675 000) to meet the cost of enlargements and extensions to the Lots Road generating station.

Supply and Lighting.

LANCASHIRE ELECTRIC LIGHT AND POWER CO.—Dividend recommended of 8 per cent. per annum for the half-year ended March 31st, on the participating preference shares, making 7½ per cent. for the year, and 7½ per cent. on the ordinary shares for the year to March 31st. For the preceding year the fixed dividend of 7 per cent. was paid on the preference shares, but nothing was paid on the ordinary shares.

SHROPSHIRE, WORCESTERSHIRE AND STAFFORDSHIRE ELECTRIC POWER CO.—The report for 1922 states the net receipts for the year from sales of current, interest and dividends on investments, etc., amounted to £140 057, compared with £95 153 in the previous year. After deducting administration and general expenses, debenture and loan interest and adding £27 272, the amount brought forward from last account, there remains a sum of £91 586 (compared with £41 083 in the previous year). Reserve sinking fund takes £1 379, reserve £40 000, payment of the dividend on the 7 per cent. preference shares for the year £3 500, payment of the dividend on the 6 per cent. preference shares for the year £9 000, and the sum of £37 707 is carried forward.

URBAN ELECTRIC SUPPLY CO.—The net profit for 1922 was £122 006, compared with £95 562 for 1921. Interest, debenture redemption, income tax, and half-yearly dividend of 2½ per cent. on the cumulative preference shares absorb £65 672. The directors recommend placing £5 000 to general reserve, £30 000 to depreciation reserve, and £6 250 to six months' dividend on the cumulative preference shares to December 31st. They also recommend that, subject to special resolutions relating to arrears and alteration of the rate of dividend on the preference shares being passed, one-fourth part of the arrears of preference dividend be paid, leaving £8 203 to be carried forward. The resolutions provide for dealing with the four years' arrears of preference dividend, amounting to £50 000, by paying one year's arrears in cash and by raising the rate of dividend from 5 per cent. to 6 per cent. as from January 1st, 1923, in consideration of the cancellation of the remaining three years' arrears. The scheme also provides for the issue of £350 000 second debenture stock ranking immediately after the existing first mortgage debenture stock, and of £100 000 six per cent. cumulative preference shares of £1 each ranking pari passu with the existing preference shares. It is proposed to make a public issue at an early date of £250 000 of the £350 000 debenture stock.

Traction Companies' Results.

GATESHEAD AND DISTRICT TRAMWAYS CO.—Dividend of 10 per cent. recommended on the ordinary shares for 1922, carrying forward £16 974. The net surplus for 1922 was £23 230, plus £22 407 brought forward, making £45 637. Allocations include £50 000 to special reserve and £3 317 to sinking fund for redemption of mortgages.

Cable and Telegraph Companies.

SIEMENS BROS. AND CO.—The directors are unable to recommend a dividend on the preference shares for the six months to December 31st, or on the ordinary shares. Profit for 1922 was £14 041.

ANGLO-AMERICAN TELEGRAPH CO.—The report for the year ending March 31st states that three quarterly interim dividends of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, were paid on May 1st, August 1st and November 1st, 1922, and the directors on February 1st last paid the final dividend for the year ended December 31st, 1922, amounting to £1 10s. per cent. on the ordinary stock, £1 10s. per cent. on the preferred stock, and £1 10s. per cent. on the deferred stock. These payments, together with £68 906 for income tax, absorbed altogether £262 500, being the rent paid by the Western Union Telegraph Co. for the year, equal to 3¾ per cent. on the ordinary stock, 6 per cent. on the preferred stock, and 1½ per cent. on the deferred stock. The balance at credit of revenue account (£66 663) includes £1 038 interest received, and the balance of £65 625 is available for the payment of dividends for the quarter to March 31st, 1923.

New Companies.

BUSSANEL ENGINEERS, LTD.—Private. Reg. April 26th. Cap., £1 000 in £1 shares. Electrical and general engineers, manufacturers of wireless apparatus and other electrical accessories, etc. Reg. office: 2, Northport Street, London, N.

LONDON WIRELESS CO., LTD.—Private. Reg. April 21st. Cap., £500 in £1 shares (100 preference and 400 ordinary). Manufacturers of wireless apparatus, etc. Sarah West, 34, Putney Hill, London, S.W.15, is secretary and a permanent director.

CHELTENHAM WIRELESS SUPPLIES, LTD.—Private. Reg. April 11th. Cap., £1 000 in £1 shares (200 preference and 800 ordinary). Electrical, mechanical and general engineers, manufacturers of and dealers in wireless apparatus, etc. Reg. office: 4, Crescent Terrace, Cheltenham.

DISPATCH ENGINEERING CO., LTD.—Private. Reg. April 11th. Cap., £1 000 in £1 shares. To adopt an agreement with A. Cocks and E. Carter, and to carry on the business of mechanical, electrical and experimental engineers, makers of models, etc. Reg. office: 1A, Pentlow Street, Putney, London, S.W.15.

WIRELESS APPARATUS, LTD.—Private. Reg. April 11th. Cap., £2 000 in 1 000 "A" shares of £1, and 8 000 "B" shares of 2s. 6d. each. Wholesale or retail sellers, installers and suppliers of apparatus for wireless telephony and telegraphy, etc. P. Richardson, The Gables, Shiplake, Oxon, engineer, is a subscriber.

STAFFORD RADIO CO., LTD.—Private. Reg. April 26th. Cap., £2 000 in £1 shares. To adopt an agreement with B. A. Colman, and to carry on the business of manufacturers of and dealers in apparatus of all kinds capable of being employed in wireless telegraphy and telephony. Reg. office: 150, Southampton Row, London, W.C.1.

A.E.G. MACHINERY AND APPARATUS CO.—Private. Reg. April 24th. Cap., £10 000 in £1 shares. To carry on the business of manufacturing, constructional or consulting electrical, gas, hydraulic, mining, civil, marine and mechanical engineers, founders, manufacturers of and dealers in machinery, etc. Reg. office: 76, Victoria Street, London, S.W.

ALBION ROTARY ENGINES, LTD.—Private. Reg. April 11th. Cap., £900 in 600 "A" shares of £1 each, and 6 000 "B" shares of 1s. each. To adopt an agreement with W. J. L. Sandy, and to carry on the business of engineers, electricians, manufacturers of and dealers in metals, tools, machines, engines or attachments, etc. Reg. office: Albion House, 59-61. New Oxford Street, London, W.C.

NATIONAL RADIO CORPORATION, LTD.—Reg. April 6th. Cap., £20 000 in 18 000 10 per cent. cumulative participating preference shares of £1 each and 40 000 ordinary shares of 1s. each. To acquire from J. Macdougall and turn to account certain provisional protection, rights and inventions relating to or in connection with telegraphy or otherwise. Reg. office: Thanet House, 231-2, Strand, London, W.C.

WIRELESS CLUB, LTD.—Private. Reg. April 13th. Cap., £500 in 25 preference shares of £10 each and 250 ordinary shares of £1 each. To promote an association and provide club accommodation for wireless users, apparatus makers, dealers and licence holders; to acquire from the Postmaster-General such licences as may be obtainable for broadcasting, etc. Secretary, J. H. Worrall, 5, Harpur Street, London, W.C.1.

MANSFIELD ENGINEERING CO. (1923), LTD.—Public. Reg. April 13th. Cap., £100 000 in £1 shares. To take over as from June 30th, 1922, the business of mechanical and electrical engineers, manufacturers of machinery, and general merchants, carried on by the Mansfield Engineering Co., Ltd., at Recreation Street, Mansfield, and Hucknall, Notts and elsewhere; and to adopt an agreement with Commercial Reconstructions, Ltd. Reg. office: Recreation Street, Mansfield, Notts.

BOROUGH ENGINEERING WORKS, LTD.—Private. Reg. April 20th. Cap., £10 000 in £1 shares (7 000 preference and 3 000 ordinary). To adopt an agreement with F. Joslin and W. D. Joslin of the one part and G. W. Baker of the other part, and to carry on the business of engineers, ironfounders, pavement light contractors, electrical engineers and makers of electrical appliances of all kinds, as formerly carried on by the said F. Joslin and W. D. Joslin as the Borough Engineering Works, at Luton, Beds.

BRUCE CAMPBELL, LTD.—Private. Reg. April 12th. Cap., £1 500 in £1 shares (250 founders). To acquire the business of electrical engineer and contractor carried on by F. B. Campbell, at Preston, as "Bruce Campbell," and to carry on the business of electrical and mechanical engineers, contractors, manufacturers of and dealers in electric, magnetic, telegraphic, telephonic and other appliances, manufacturers of and dealers in wireless telegraphs and telephones, etc. Reg. office: 8, Tulketh Brow, Ashton-on-Ribble, Preston.

ELECTRICITY FINANCE AND DISTRIBUTION CORPORATION, LTD.—Private. Reg. April 10th. Cap., £2 000 in 1 800 non-cumulative 10 per cent. preference shares of £1, and 4 000 ordinary shares of 1s. each. To acquire, develop, amalgamate or carry on any trade of electric lighting, or any business relating to the electrical distribution of light, heat and power, electrical and general engineering, building, contracting for the supply and construction of works incidental to electrical engineering, etc. Also to act as stock and share brokers and underwriters; to promote any Provisional Order or Act of Parliament for establishing electrical undertakings or light railways, etc. Reg. office: 43, Cannon Street, London, E.C.4.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

BOWMAN, L. and H., 84, New King's Road, W., electricians. £12 15s. March 21st.

PRYCO, LTD., 14, Shouldham Street, Edgware Road, W., electrical factors. £15 3s. 5d. March 21.

Deeds of Arrangement.

BEEVOR, Richard Elliot, trading as R. E. BEEVOR AND CO. and BEEVOR ELECTRICAL SUPPLY CO., 109, Regent Street, and 26, Sackville Street, W., importer and exporter. Filed May 7th. Trustee, J. James, 4, Walbrook, E.C., I.A. Liabilities unsecured, £4 880; assets, less secured claims, £519.

GREGSON, Anthony Bland, trading as LANCASHIRE ELECTRICAL CO., 56, Stanley Street, Liverpool, electrical engineer. Filed May 7th. Trustee, P. S. Booth, 2, Bixteth Street, Liverpool, accountant. Secured creditors, £60; liabilities unsecured, £3 275; assets, less secured claims, £406.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

BREWSTER (Henry J.) and CAPLE (John J.), trading as Henry J. Brewster and Co., 11, Queen Victoria Street, London, E.C. wireless instrument manufacturers and contractors. Creditors were called together recently, at the offices of Messrs. O. Sunderland and Co., accountants and auditors, 15, Eastcheap, E.C., when a statement of affairs was presented by Mr. C. Latham, which disclosed liabilities of £750, all of which was due to the trade. In addition there was a claim for £600 by the Dickinson Electric Co., which had not yet been admitted. After allowing £80 for preferential claims the assets were estimated to realise £827, or a surplus of £77. The assets consisted of cash at bank, £46; office furniture, £70; tools, etc., £5; book debts, £130, valued at £50; and stock, £735. There was a further contingent asset in the shape of an equity in property at Goodmayes. A contract had been entered into for the supply of fittings with the Dickinson Electric Co. The latter alleged the goods were not satisfactory, and had refused to accept delivery, and had made a claim for breach of contract. After discussing the position it was decided to confirm the deed of assignment executed to Mr. Latham, while a committee was appointed consisting of the representatives of Messrs. Heath and Co., Ltd., R. Cadisch and Sons, the India Rubber and Gutta Percha Co. The opinion was expressed that the trustee should endeavour to effect a compromise of the claim referred to. It was also the feeling of the creditors that the trustee should carry on the business in consultation with the committee, as it was considered that if the Postmaster-General was able to effect a fair settlement of the broadcasting situation there was every prospect that the concern would prove profitable, and that the creditors would be paid in full.

GREGSON, Anthony Bland, trading as the Lancashire Electric Co., 56-58, Stanley Street, Liverpool. Creditors were called together on May 4th, at the offices of Messrs. Foster and Killip, accountants, Liverpool, when a statement of affairs was presented which showed liabilities of £3 116. The indebtedness to the trade was £718. Assets were estimated to realise £406, from which had to be deducted £131 for preferential claims, leaving net assets of £275, or a deficiency of £2 841. After discussing the position a resolution was passed to the effect that the estate should be wound up under a deed of assignment with Mr. Parkin S. Booth, accountant, of 35-36, Exchange Chambers, Bixteth Street, Liverpool, as trustee, together with a committee consisting of the representatives of Messrs. Downs and Davies, the General Electric Co., Ltd., and Higgs Bros. The following are creditors:—Blackwell, F. C., and Co., Crosby, £12; Baxendale Bros., Ltd., Liverpool, £22; General Electric Co., Ltd., Liverpool, £66; White, J. C., Manchester, £21; Simplex Conduits, Ltd., Birmingham, £14; Higgs Bros., Birmingham, £62; Stewart Thomson and Patrick, Ltd., Liverpool, £30; Macintosh Cable Co., Derby, £15; Davies and Blondiaux, London, £13; Benham and Sons, Ltd., London, £44.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Winding-up Petition.

PRYCO, LTD.—A petition for the winding-up was presented on May 3rd by Bell Battery and Accessory Co., 39, Wilson Street, London, and is to be heard at the Royal Courts of Justice on May 29th.

Company Winding-Up Voluntarily.

J. H. Mc. BEAN, LTD. Harold Appleyard, Prudential Buildings, Market Place, Dewsbury, chartered accountant, appointed liquidator.

Bankruptcy Information.

HARRIS, John, lately carrying on business at King's Head Buildings, Church Street, Nuneaton, electrical engineer. Receiving order, April 30th. Debtor's petition. First meeting, May 15th, 2.45 p.m., Official Receiver's Office, 9–11, High Street, Coventry. Public examination, June 11th, 2.45 p.m., County Hall, Coventry.

VERITY, Albert William, electrician, lately carrying on business at 143A, Leeds Road, Bradford, in co-partnership with Hubert Lee, under the style of Verity and Lee, electrical contractors. Receiving order, May 3rd. Debtor's petition.

Notice of Intended Dividend.

GILL, Frederick John, 26, Hardwick Street, Buxton, electrical engineer. Last day for receiving proofs, May 16th. Trustee, J. G. Gibson, Official Receiver, Byrom Street, Manchester.

Partnerships Dissolved.

COPLAND, GREEN AND CO. (James COPLAND and Albert Lambton GREEN), electrical factors and agents, Llanrwst Street, Liverpool, by mutual consent as from April 28th, 1923; the business will be carried on by J. Copland.

R. T. VAUX AND SON (Ralph Thomas VAUX and George Noble VAUX), electrical engineers, 12, Fawcett Street, and 8, Bedford Street, Sunderland, as from April 23rd, 1923. Debts received and paid by G. N. Vaux, who will continue the business.

Bankruptcy Proceedings.

ANODE WIRELESS AND SCIENTIFIC INSTRUMENTS, LTD., electricians and manufacturers of generators and other electrical instruments, 265, Strand, W.C. The statutory meetings of the creditors and of the shareholders under a winding-up order made against this company on March 13th were held on Wednesday, May 2nd, at the Board of Trade offices, 33, Carey Street, W.C. The Official Receiver reported that the company was registered on October 6th last, with a nominal capital of £30 000 in shares of £1 each, and was formed to take over as a going concern the goodwill of the business formerly conducted by Anode, Ltd., and to carry on business as above. The company was promoted by Pherezshaw Ruttonjee Minvalla, Walter Ernest Peek and Albert Henry Lunniss. The total issued capital was £7 323, of which £1 823 was allotted for cash and the balance as fully paid. The register certificate authorising the company to begin business was issued on October 17th, and three days later the company entered into an agreement with Anode, Ltd., for the purchase of the business which had been started by Peek and Lunniss in 1919, together with all plant, office furniture and patents and benefits of all pending contracts for £6 300, to be satisfied as to £800 in cash and as to the balance in fully paid shares of the company. The shares were duly issued, but only £200 of the cash had been paid. The business was carried on at 47, King's Road, Camden Town, with registered offices at 265, Strand, W.C., but in consequence of the shortness of capital, promises to provide further sums being unfulfilled, the company on January 19th passed an extraordinary resolution for voluntary liquidation with Mr. E. S. Howard, C.A., 56, Budge Row, E.C., as liquidator. According to the statement of the company's affairs that had been lodged, the liabilities amounted to £2 444, of which £1 576 were returned as expected to rank, while the assets were estimated to realise £441 after payment of the preferential claims amounting to £266. A total deficiency of £8 458 was disclosed with reference to the shareholders. These figures, however, did not now show the position accurately, because of the voluntary action of Mr. Peek and Mr. Lunniss to which he had referred, which increased the amount of the assets available for distribution among the unsecured creditors whose claims would be increased too by the action. It was decided at both meetings to leave the liquidation in the hands of the Official Receiver.

The annual autumn gathering of the INSTITUTE OF METALS will be held in Manchester from September 10th to 13th. A ballot of members and students desirous of participating in this and other meetings will take place on July 12th. Particulars may be had from the Secretary, Mr. Shaw Scott, 36–8, Victoria Street, London, S.W.1.

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Institution Notes.

In the report in this column last week of the final meeting of the NORTH WESTERN CENTRE OF THE INSTITUTION OF ELECTRICAL ENGINEERS, the name of Mr. W. R. Anderson, a member of the new Committee, was incorrectly given as "Addison."

Sir J. G. Broodbank has been elected president of the INSTITUTE OF TRANSPORT for the year commencing October 1st next. Mr. A. Winter Gray has been appointed secretary of the Institute from October 1st, when Mr. H. E. Blain will relinquish the office of hon. secretary and become a vice-president.

The INSTITUTE OF PATENTEES has been presented with a book entitled "What's Wanted," by Sir William Bull, who has opened the book by entering what, in his opinion, are the inventions needed at the present time. The secretary of the Institute will be glad to receive suggestions for record in the book.

Mr. Charles Erith will lecture, on May 18th, before the Southern Division of the ELECTRICAL POWER ENGINEERS' ASSOCIATION on "Combustion of Fuel" at the Institution of Electrical Engineers, London, W.C.2. During the lecture a film will be shown illustrating the actual process of combustion in a boiler furnace fitted with the "Riley" stoker.

The first annual joint meeting of the RÖNTGEN SOCIETY and the ELECTRO-THERAPEUTIC SECTION OF THE ROYAL SOCIETY OF MEDICINE will take place at 5.30 p.m. on May 17th, at the Barnes Hall, Royal Society of Medicine, 1, Wimpole Street, London, W.1. The Mackenzie Davidson Memorial Lecture will be delivered by Dr. A. W. George, of Boston, Mass., U.S.A., on "The Pathological Gall Bladder." The meeting will be followed by a dinner at the Langham Hotel, London, W.1, at 8 p.m.

The general monthly meeting of the members of the ROYAL INSTITUTION was held on Monday, the Duke of Northumberland (president) being in the chair. Sir J. J. Thomson was elected Honorary Professor of Natural Philosophy and Sir Ernest Rutherford Professor of Natural Philosophy. It was announced that the Duke of Northumberland had nominated the following as vice-presidents for the ensuing year: Dr. Mitchell Bruce, Lord Iveagh, Sir Edward Pollock, Lord Rothschild, Sir Alfred Yarrow, Lord Justice Younger, Sir James Crichton-Browne, treasurer, and Sir Arthur Keith, secretary.

The Council of the INSTITUTION OF CIVIL ENGINEERS has made the following awards in respect of papers read and discussed at the ordinary meetings during the session 1922–1923: Telford Medals to Mr. H. W. H. Richards (London) and Mr. E. O. Forster Brown (London); a George Stephenson Medal to Mr. Asa Binns (London); a Watt Medal to Mr. A. B. Buckley, jun. (Winchester); Telford Premiums to Mr. W. A. Fraser (Edinburgh); Mr. S. L. Rothery (Calexico, U.S.A.); Mr. Mark Randall (Johannesburg); and Mr. D. E. Lloyd-Davies (Capetown); an Indian Premium to Mr. D. H. Remfrey (Calcutta); a Manby Premium to Mr. F. M. G. Du-Plat-Taylor (London); and a Crampton Prize to Mr. F. W. Jameson (Kimberley).

The following members have been nominated to serve on the WIRELESS SECTION COMMITTEE of the INSTITUTION OF ELECTRICAL ENGINEERS for 1923–24: Chairman, Mr. E. H. Shaughnessy; new nominations for membership of the committee—Mr. C. F. Elwell, Professor G. W. O. Howe, Admiral Sir H. B. Jackson, and Mr. C. F. Trippe. The following will continue to serve as members of the committee: Messrs. B. Binyon, S. Brydon, Dr. W. H. Eccles, Messrs. G. H. Nash, C. C. Paterson, J. St. Vincent Pletts, Capt. H. R. Sankey, and Mr. R. L. Smith-Rose. Not later than fourteen days after the publication of the Committee's list of nominations, any five members of the Wireless Section may nominate any other duly qualified person to fill any vacancy by delivering such nomination in writing to the secretary of the Institution, together with the written consent of such member to accept office if elected, but each such nominator shall be debarred from nominating any other person for the same election.

Business Items.

The telephone numbers of the CHLORIDE ELECTRICAL STORAGE Co. (Showrooms Department), Shaftesbury Avenue, London, W., are now Regent 8070–8073 (four lines).

The London office of T. W. BROADBENT, LTD., is now at 17, Queen Victoria Street, E.C.4, to which address all correspondence relating to the firm's London and export trade should now be sent.

The BIRMINGHAM AGENTS OF F. AND A. PARKINSON, LTD., are now Green and Jackson, Grenville Buildings, 12, Cherry Street. Telephone, Central 1688; telegraphic address, "Jehanjay," Birmingham.

The Department of Overseas Trade (reference 577) reports that an agent in Rome desires to secure the REPRESENTATION FOR THE WHOLE OF ITALY of British manufacturers of electrical goods, including accumulators, transformers, motors, telephone and telegraph material, etc.

The British Vice-Consul at Savona, Italy, has reported that a local firm is desirous of receiving quotations from British manufacturers of ALL KINDS OF ELECTRIC CABLES. Particulars may be obtained from the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1, quoting reference 19365/F.W./C.C.

Forty Years Ago.

"The Electrician," May 12th, 1883.

LICENSES FOR TELEPHONE LINES.—The chairman of the National Telephone Company writes to a daily paper as follows: "I have had negotiations with the department in reference to inter-town telephonic communication, and the Postmaster-General has refused to my and to all other private telephone companies the license to erect trunk wires between town and town. He, however, undertakes to do the work himself, and to let the wires to the telephone companies."

* * * *

ELECTRIC EXHIBITION AT VIENNA.—We are informed that the French are the first among the exhibitors at Vienna who have completed the plan of their exhibits. The French telegraph department will have a richly decorated pavilion in the centre of the section devoted to their country, in which some valuable historical apparatus will be shown, as well as modern instruments. With this pavilion as the centre, the French section will occupy an area of 1 500 square metres; this, of course, does not include machines in action, which will be shown in the machine room. Close to France will be found the representatives of Russia, who will occupy from 300 to 400 square metres.

Patents in the Irish Free State.

The secretary of the INSTITUTE OF PATENTEES states, in connection with patents in the Irish Free State, that, pending legislation which is being considered, dealing with patents, trade marks and designs in An Saorstat, no action is necessary in regard to patents, etc., granted or approved before December 6th, 1922.

Where applications have been lodged, but a decision was not given by the Patent Office before December 6th, 1922, particulars should be furnished to the Ministry of Industry and Commerce (Department of Trade and Shipping), Dublin. Applications arising after December 6th, 1922, should be addressed to the above-named Ministry. In this connection, applications are received in the first instance, and their receipt is duly noted without payment of fees. The scale of fees requisite in such cases will be notified to applicants before the applications are finally dealt with.

British Empire Patent.

A deputation from the BRITISH SCIENCE GUILD, headed by Lord Askwith, last week waited on Lieut.-Col. A. Buckley (Parliamentary Secretary to the Department of Overseas Trade) on the subject of a British Empire patent. Mr. W. Temple Franks (Comptroller-General of Patents) was present.

The deputation strongly urged that the necessary steps should be taken as early as possible by the Government to secure effect being given to the provisional scheme for an Empire patent drawn up at the British Empire Patent Conference held in London in June of last year. The scheme in question provides that a patent issued anywhere within the British Empire shall extend to the United Kingdom, or to any of the self-governing Dominions, or to India, upon registration in the particular territory in which protection is desired.

The proposals of the deputation were sympathetically received by Lieut.-Col. Buckley.

Prices of Metals, Chemicals, etc.

TUESDAY, May 8.

			Price.	Inc.	Dec.
Copper—					
Best Selected	per ton	£73 15 0	—	5s.
Electro Wirebars	,,	£80 0 0	—	—
H.C. Wire, basis	per lb.	11⅛d.	—	—
Sheet	,,	11⅜d.	—	—
Phosphor Bronze Wire (Telephone)—					
Phosphor Bronze Wire, basis	per lb.	1s. 3⅛d.	—	—
Brass 60/40—					
Rod, basis	,,	7½d.	—	—
Sheet, basis	,,	10½d.	—	—
Wire, basis	,,	10¾d.	—	—
Pig Iron—					
Cleveland Warrants	per ton	£6 10 0	—	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 10 0	—	—
Lead Pig—					
English	,,	£26 5 0	—	15s.
Foreign or Colonial	,,	£25 0 0	—	15s.
Tin—					
Ingot	,,	£210 10 0	—	10s.
Wire, basis	per lb.	2s. 9d.	—	—
Aluminium Ingots	per ton	£110 0 0	—	—
Spelter	,,	£32 2 6	—	2s. 6d.
Mercury	per bottle	£10 0 0	—	—

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2⅜d.
,, (Roll-Brimstone)—,, £8 5s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. ,, £26 10s. per ton, £7 10s.
Boric Acid (Crystals). ,, £55 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 2½d.; plantation 1st latex, 1s. 1½d.–1s. 1⅝d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

192 185 THREE STAR ACCUMULATORS, LTD., and C. KENDALL. Batteries for miners' lamps. (2/11/21.)
171 378 PHILIPS' GLOEILAMPENFABRIEKEN. Electric discharge tubes. (10/11/20.)
192 202 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Switches. (8/11/21.)
192 217 BUCKLEY, SAUNDERS AND CO., J. W. POOLE, and W. J. READETT. Electric rivet-heating machines of resistance type. (16/2/22.)
192 247 A. E. McColl, C. C. Garrard, and A. H. Railing. Switches. (13/12/21.)
174 333 J. S. MOLLERHOJ. Testing insulated wires. (15/1/21.)
192 262 A. SERNICOLI and A. ANSELMI. Arc-light stage-lighting apparatus. (30/12/21.)
192 272 J. F. SUTTON. Inductance coils for wireless telegraphy. (21/1/22.)
192 280 CABLE ACCESSORIES CO., F. H. REEVES, and P. W. DAVIS. Switches. (1/2/22.)
192 284 CALLENDER'S CABLE AND CONSTRUCTION CO. and C. W. KAY. Telephone and signalling systems on transmission lines. (3/2/22.)
192 285 BRITISH L. M. ERICSSON Mfg. Co., and W. M. CROWE. Electro-magnetic relays. (3/2/22.)
192 290 FERRANTI, LTD., and A. H. HIGGS. Protection of switchgear. (6/2/22.) (Addition to 191 971.)
192 320 J. MCGRATH. Fuse wire holders. (31/3/22.)
182 094 SOC. D'ETUDES POUR LIAISONS TELEPHONIQUES ET TELEGRAPHIQUES A LONGUE DISTANCE. Junction between telephonic and like circuits. (20/6/21.)
178 858 LANDIS AND GYR AKT.-GES. Prepayment meter for gas, water, electricity, etc. (21/4/21.)
192 327 HEINZE ELECTRIC CO., B. AMES, and P. J. GILINSON. Electric horns. (25/4/22.)
192 328 A. R. DOW. Cooking and toasting attachments for electric radiators. (26/4/22.)
192 332 TELEGRAPHIE GES. SYSTEM STILLE, and Dr. C. STILLE. Magnetic sound recording and reproducing apparatus. (6/5/22.)
190 435 AKT.-GES. BROWN, BOVERI, ET CIE. Multiple control apparatus for electric railways. (20/12/21.)
180 090 ALIGEMEINE ELEKTRICITATS-GES. Apparatus for winding up a spring motor by hand and by an electric motor. (27/5/21.)
183 116 SIEMENS AND HALSKE A.-G. Telephone systems. (15/7/21.)
192 338 ETABLISSEMENTS DAVEY, BICKFORD, SMITH ET CIE SOC. ANON. FRANCAISE. Electric blasting primers. (30/1/22.)
192 342 PHILIPS' GLOEILAMPENFABRIEKEN. Electric discharge tubes. (3/11/21.) (Divided Application on 171 378. Addition to 171 378.)
187 974 P. G. VAN WIJK. Circuit-breakers. (26/10/21.)
192 346 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Wireless receiving systems. (30/9/21.) (Divided Application on 191 125.)
192 429 RADIO COMMUNICATION CO., LTD., and J. SCOTT-TAGGART. Wireless receiving systems. (8/8/21.)
192 439 H. BARON (SIGNAL GES.). Phase regulating devices. (27/9/21.)
192 449 CABLE ACCESSORIES CO., F. H. REEVES, and P. W. DAVIS. Portable electric hand lamps. (22/10/21.)
192 460 H. SEFTON-JONES (C. LORENZ AKT.-GES.). Production of high-frequency oscillations by means of low-frequency. (29/10/21.)
192 461 H. SEFTON-JONES (C. LORENZ AKT.-GES.). Increasing frequency by means of static transformers. (29/10/21.)
170 863 G. SOMAINI. Dynamo-electric machines. (30/10/20.)
192 464 W. R. BULLIMORE. Thermionic valve for use in wireless telegraphy. (31/10/21.)
192 465 HORSTMANN GEAR CO. (E. H. and A. HORSTMANN). Time switches. (31/10/21.)

APPLICATIONS FOR PATENTS.

April 23rd.

10 903 F. H. BLAXLEY. Variable grid leaks.
10 912 A. HILL. Method of lighting vehicles.
10 918 A. E. KNOWLES. Controlling liquid level in electrolytic cells, etc.
10 924 W. FISHER. Storage batteries.
10 934 A. MEULEMANS. Electric fan.
10 939 H. HUBBLE. Switches.
10 947 C. J. COLEMAN. Telephone receivers.
10 948 and 10949 C. J. COLEMAN. Loud speakers for wireless telephony.
10 963 G. S. CATTELL and G. H. IDE. Electric radiators.
10 969 WESTERN ELECTRIC CO. Signalling systems.
10 981 M. LATOUR. Telephone repeating systems. (22/4/22, France.)
10 987 GENERAL ELECTRIC CO., LTD., and F. READ. Combined switch and plug connectors.
10 994 N. J. AUSTIN. Cables.

April 24th.

11 043 ROBINS, CHAPMAN AND CO. Valve protection for circuits employing thermionic valves, etc.
11 050 A. PARSONS. Insulator for wireless aerials.
11 056 J. A. SHORTT. Variable resistance for wireless telephony.
11 065 J. MCBLAIN. Electrical apparatus for generating ozone.
11 066 E. J. AND E. L. ANGEL and W. A. JARVIS. Time-setting device for controlling maintenance of electric circuit for a variable period.
11 076 B. KOSALSKI. Fire and burglar alarm.
11 083 L. R. GLEASON. Adjusting devices for wireless instruments.
11 091 WESTERN ELECTRIC CO. Telephone systems. (22/12/22, U.S.)
11 093 D. PEPPER. Electric batteries.
11 097 C. F. ELWELL, LTD., and K. WILSON. Wireless receiving devices.
11 112 E. C. R. MARKS (SCHWEITZER AND CONRAD, INC.). Circuit-controlling devices.
11 117 G. A. MORLEY. Primary batteries.
11 118 G. A. MORLEY. Apparatus for testing batteries.
11 123 L. H. G. TWINE. Wireless telephone receivers.
11 125 BRITISH THOMSON-HOUSTON CO. Vibrating converters.
11 127 C. E. FELLOWES. Portable electric lamp fittings.
11 130 E. MOMMSEN (LEGAL REPRESENTATIVE OF T. L. CARBONE). Flame arc lamp. (24/4/22, Germany.)
11 135 J. E. G. POWELL. Telephone receivers.
11 137 P. H. WALLER. Trip switch devices.
11 140 F. A. ROJAS. Rheostat.

April 25th.

11 199 A. GREEN. Crystal detector.
11 200 A. GREEN. Condenser for wireless receiving sets.
11 204 A. ROGERS. Coil holders for wireless instruments.
11 207 EDISON SWAN ELECTRIC CO. and P. FREEDMAN. Electric lamps.
11 208 EDISON SWAN ELECTRIC CO., P. FREEDMAN and E. GREETHAM. Thermionic devices.
11 210 P. RICHARDSON. Wireless aerials.
11 216 CAMBRIDGE AND PAUL INSTRUMENT CO. and H. A. DAYNES. Thermo-electric pyrometers.
11 218 W. DUBILIER. Electric condensers. (25/10/22, U.S.)
11 238 SPERRY DEVELOPMENT CO. Electro-dynamic transmission systems. (5/5/22, U.S.)
11 244 PHILIPS GLOEILAMPENFABRIEKEN. Electric discharge tubes. (21/10/22, Holland.)
11 252 A. NIELSEN. Electric heating plates.

April 26th.

11 285 K. E. EDGEWORTH. Supply of power to wireless transmitters.
11 292 GRAMOSTYLES, LTD., and H. JENKINSON. Detectors for wireless instruments.
11 293 LONDON ELECTRIC RAILWAY CO. Coin-operated turnstile mechanism.
11 294 M. L. MAGNETO SYNDICATE and E. A. WATSON. Transformation of electrical energy.
11 299 W. H. SCOTT. Electric winches.
11 300 A. L. PATTENDEN and W. J. DAY. Crystal holders for wireless receivers.
11 309 R. W. M. THOMSON. Electric contacts.
11 331 AKT. GES. BROWN, BOVERI ET CIE. Apparatus for taking d.c. free from higher harmonics from a rectifier. (26/4/22, Germany.)
11 337 PHILIPS GLOEILAMPENFABRIEKEN. Device for holding or hermetically sealing cylindrical body. (9/9/23, Holland.)

April 27th.

11 354 D. MCLENNAN. Telephone receivers.
11 370 B. R. SIMMONS. Crystal holder for wireless systems.
11 394 A. F. LAGO. Automatic alarms.
11 395 W. R. CLEAVER. Clock time switch.
11 401 T. A. GILLAM. Electro-galvanic soles for footwear.
11 403 H. K. HARRIS. Publicity telegraphs.
11 404 N. DAWSON. Telephone register.
11 408 E. Y. ROBINSON. Electric vacuum tube devices.
11 410 J. C. N. EASTICK. Knife switch.
11 411 IGRANIC ELECTRIC CO. Switches and adjustment devices.
11 422 R. ZIEGENBERG. Portable electric safety lamps.
11 425 RELAY AUTOMATIC TELEPHONE CO. and B. B. JOHNSON. Automatic telephone systems.
11 426 AKTIEBOLAGET BIRKA REGULATOR. Regulating devices for electrical apparatus. (1/9/22, Sweden.)
11 428 T. B. SHARP. Wireless telegraphy, etc.
11 439 SCINTILLA. High voltage connection device (16/6/22, Germany.)
11 440 W. J. RICKETS and E. A. GRAHAM. Cabinets with aerial systems for wireless reception.
11 442 R. ZIEGENBERG. Galvanic cells.
11 443 BRITISH THOMSON-HOUSTON CO. Incandescent lamps. (14/6/22, U.S.)
11 448 H. A. GAYDON. Plugs for batteries, etc.
11 456 SIEMENS AND HALSKE AKT. GES. Telephone systems. (15/5/22, Germany.)

April 28th.

11 461 A. C. BROWN. Telephone receivers.
11 462 D.A.S.H. WIRELESS SERVICE, H. A. BURTON and A. H. ONIONS. Hertzian wave detector.
11 490 W. AND T. AVERY and G. H. JACKSON. Electric illuminating.
11 494 A. H. RAILING and M. L. KAHN. Windings on commutating poles of dynamos.
11 495 A. H. RAILING, A. E. ANGOLD and J. STANLEY. Miners' electric hand lamps.
11 497 E. CREWDSON. High tension switches.
11 513 BRITISH THOMSON-HOUSTON CO. and A. P. YOUNG. Sound-emitting instruments.
11 514 BRITISH THOMSON-HOUSTON CO., F. A. FOSSEY and A. P. YOUNG. Magneto-electric machines.
11 515 J. A. COOMES AND CO. Holders for lamps and thermionic valves.
11 516 PHILIPS GLOEILAMPENFABRIEKEN. Machines for applying glass tubes to glass bulbs. (17/3/23, Holland.)
11 518 FERGUSON, PAILIN LTD. Switches.
11 521 R. H. N. DAWSON and F. K. WOODROFFE. Controlling circuits of thermionic valves.
11 522 R. H. N. DAWSON and F. K. WOODROFFE. Tuning devices for radio-telephony.

Arrangements for the Week.

FRIDAY, MAY 11th. (To-day.)

IRON AND STEEL INSTITUTE.

10 *a.m.* Annual Meeting at Great George Street, Westminster, London, W. A selection of Papers to be read and discussed.

2.30 *p.m.* Afternoon Session. A selection of Papers to be read and discussed.

PHYSICAL SOCIETY OF LONDON.

5 *p.m.* At the Imperial College of Science, South Kensington, London, W. Guthrie Lecture by Mr. J. H. Jeans on "The Present Position of the Radiation Problem."

INSTITUTION OF ELECTRICAL ENGINEERS.

7 *p.m.* At the Institution Building, Savoy Place, Victoria Embankment, London, W.C.2. "Electrical Measuring Instruments," by Mr. C. A. Wilck.

INSTITUTION OF ENGINEERING INSPECTION.

7.30 *p.m.* At the rooms of the Royal Society of Arts, John Street, Adelphi, London, W.C. Paper on "Some Notes on 'Ciment fondu'—a cement of high initial resistance—with Results of Chemical Analysis," by Mr. Harley F. Knight.

JUNIOR INSTITUTION OF ENGINEERS.

7.30 *p.m.* At 39, Victoria Street, London, S.W. Durham Bursar's Lecture, "The Theory of Resistance to the Flow of Gases and Fluids in Pipes," by Mr. W. F. C. Cooper.

THE ROYAL INSTITUTION OF GREAT BRITAIN.

9 *p.m.* At the Institution, 21, Albemarle Street, Piccadilly, London, W.1. Lecture on "Gaseous Combustion at High Pressures," by Prof. Wm. A Bone.

MONDAY, MAY 14th.

ROYAL SOCIETY OF ARTS.

8 *p.m.* At John Street, Adelphi, London, W.C.2. Third Howard Lecture by Mr. Stanley S. Cook on "The Development of the Steam Turbine."

TUESDAY, MAY 15th.

INSTITUTION OF TRANSPORT.

5.30 *p.m.* At the Institution of Electrical Engineers, Victoria Embankment, London, W.C.2. "The Design and Maintenance of Commercial Motor Vehicles," by Mr. G. J. Shave.

WEDNESDAY, MAY 16th.

INSTITUTION OF RAILWAY SIGNAL ENGINEERS.

6.30 *p.m.* At the Institution of Electrical Engineers, Victoria Embankment, London, W.C.2. "Signal Apparatus for Use in Foggy Weather and Snow," by Mr. W. Challis.

ROYAL SOCIETY OF ARTS.

8 *p.m.* At John Street, Adelphi, London, W.C.2. Lecture on "Industrial Lighting and the Prevention of Accidents," by Mr. Leon G ster.

THURSDAY, MAY 17th.

ROYAL INSTITUTION OF GREAT BRITAIN.

3 *p.m.* At 21, Albemarle Street, Piccadilly, London, W.1. Lecture by Prof. E. G. Coker on "Engineering Problems Solved by Photoelastic Methods."

FRIDAY, MAY 18th.

ROYAL INSTITUTION OF GREAT BRITAIN.

9 *p.m.* At the Institution, 21, Albemarle Street, Piccadilly, London, W. Lecture by Mr. William Morris Mordey on "Recent Studies on Alternating Magnetism."

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ESTABLISHED 1861.

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Electrical Engineering, Industry, Science and Finance.

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CONTENTS.

Notes of the Week	527	Personal Items	543
Economic Principles Governing the Use of Electrical Power in Iron and Steel Works. By C. A. Ablett	530	Business Items	543
Railway Electrification in South America	532	Imperial and Foreign Notes	544
The Electrician "All-Electric" House	534	Electricity Supply	545
Institution of Electrical Engineers	537	Tenders Invited and Accepted	546
Correspondence	538	Electric Traction	547
Ferguson, Pailin Ironclad Switchgear	539	Wireless News	547
Merchandise to Sell and Profit By. Illustrated	541	Companies' Meetings and Reports	548
Legal Intelligence	542	Commercial Intelligence	549
Telegraph and Telephone Notes	543	Prices of Metals, etc.	549
Obituary	543	Patent Record	550
		Arrangements of the Week	550

Notes of the Week.

The Faraday Medal.

The presentation of the Faraday Medal to Sir Charles Parsons at the meeting of the Institution of Electrical Engineers last week, was made the occasion of a display of eloquence and enthusiasm which was as delightful as it is unusual in engineering circles. The meeting was crowded, the applause was terrific, but not louder than the occasion demanded, and the speeches reached a high level. In inaugurating the Faraday medal the Institution made a *beau geste*. To receive this distinction is an honour, to bestow it is an equal honour. Two more illustrious names than those of its present holders could not be found and it must be the privilege and duty of succeeding councils to see that that high standard is not departed from. Of Sir Charles Parsons's work, the reason for the award of the medal, it is hardly necessary to say anything. The steam turbine, as Mr. Highfield truly said, is the outcome of that child-like curiosity which is the hall mark of genius. Its evolution was not unattended by difficulties, one of the principal being that the turbine is essentially a high powered unit, so that the first experimental sets (which were necessarily small) did not exhibit its characteristics at its best. We could not do without the turbine; we could as little do without its inventor who in his clear-sightedness, persistence and energy, may worthily be compared with that great man from whom the medal takes its name.

Combination Not Disintegration.

In the decisions they have come to regarding the North East Midlands Electricity District the Commissioners have manfully resisted the machinations of the "piece-meal" party. Some were anxious to exclude parts of Lindsey from the district on the grounds that the proposed scheme for development would give it no immediate advantages, others wished to exclude those portions of the areas served by the Yorkshire and Derbyshire and Nottinghamshire Power Companies that fell within the district. The Commissioners have agreed to none of these courses. If it is no particular advantage at present to include Lindsey it may be some day, and it might be a particular disadvantage to exclude it, which is sound sense enough. The Ferrybridge station of the Yorkshire Power Co. will be useful to the area and though the Derbyshire and Nottinghamshire Co. have not developed their portion of the area in the district they can easily do so from their Spondon station. The arguments for exclusion in these cases are therefore not accepted, again we think rightly. We have for so long been accustomed to think of electricity supply by parishes that to think of it by districts is for some a difficult mental exercise. But we are not at all sure whether in some parts of the country a district is a large enough unit. It may be necessary to interconnect even districts, and if this comes about such undertakings as the Yorkshire Power Co. and the Derbyshire and Nottinghamshire Power Co. will be in a useful position.

Megalomania Checked.

The proceedings at the enquiry showed a certain tendency to megalomania on the part of Sheffield together with an attempt on the part of the muncipalities in the area to combine to the exclusion of the Power Companies and other interests. These retrograde movements the Commissioners have quite rightly resisted. No definite decision as to further capital stations is to be taken until the way in which the district will develop becomes more clear, and interconnecting transmission lines instead of being purely municipal affairs are to be constructed partly by the Yorkshire Power Co. and partly by bringing in existing colliery systems. The distribution to the south of Sheffield is to be carried out by the Corporation and the

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Derbyshire and Nottinghamshire Co. in combination and not by the former alone, and the Joint Authority is to be a joint Authority proper and not merely a body made to look like one. The Commissioners are to be congratulated on their strong attitude and we feel sure that the scheme they suggest will redound to the benefit of the district.

Smoke Abatement—Useful Propaganda.

THE report of the Public Control Committee of the London County Council on what is conveniently called smoke abatement, which was presented at the meeting on Tuesday, contains some useful propaganda of which the electrical industry would do well to take notice. Both electricity and gas can be produced without undue smoke and "we are of opinion," says the report, "that the time has arrived when the use of the old fashioned kitchener might well cease," for as compared with the modern electric appliances, it is inefficient, out of date, and wasteful of fuel. Some figures which Prof. H. A. BARKER gave recently prove this beyond a doubt. But the report goes further than pious aspirations. It proposes legislation on the lines suggested by the Smoke and Noxious Vapours Abatement Committee and the substitution of chaotic and ineffective enactments by something which shall help to bring about a better and brighter London. With all this, of course, we have no fault to find. But we would go a little further than the committee. To substitute gas fumes for coal smoke is no real advance. To use a form of fuel which is inconvenient and dirty is not true progress. We suggest that in large cities the employment of electricity instead of both the coal and the gas fires should be strenuously canvassed, and that bodies such as the County Council Committee should be educated in order that this desirable consummation may be brought about. Unfortunately this seems unlikely to occur at present. For the Council, after considering the report, have refused to approach the Minister of Health on the question of fresh legislation, their reason being that smoke abatement is more a matter for the Borough Councils than the County Council. This sounds rather like what in the United States is called "passing the buck." Vested interests are strong, the education of the public will be a long and difficult matter. The County Council is a little David to deal with two such huge Goliaths. We hope, however, that electrical engineering will study the report. It contains plenty of evidence of the extent to which smoke at present pollutes the air and indicates ways in which they may give the public a sweeter atmosphere.

The Engineering Joint Council.

As announced last week the Engineering Joint Council has got itself formed to the extent of issuing a constitution and by-laws. It now remains to be seen what it will do and what will be its effect for good or evil on the progress of the engineering profession. We are rather afraid it will not be a very energetic body. In the first place it is not going to initiate anything. It is only to act in an advisory capacity. And apparently it can only advise after following a procedure which will not make for speedy working. All the same, we should like to think that those who have brought this body into being know their business. For there is plenty of need for some sort of institution which will adequately represent the views of the engineering profession as a whole, and there are plenty of problems, the question of status is one of them, with which it might immediately deal. If it does deal with these matters with energy and understanding it will be well worth while. If, on the other hand, it has simply been erected to give the air of having done something and yet to do nothing we shall do just as well or even better without it.

The Mersey Fiasco.

WE should think the Commissioners must be becoming inured to disappointment. They have seen so many of their best-laid schemes go agley and they must almost be used to it. All the same it must be a little trying when after enquiry and consideration a scheme has been evolved which it is hoped will be acceptable to all parties to find that the principal party has decided not to fall in with the proposals. This is what has occurred in the Mersey and West Lancashire District. As will be remembered the district was practically divided into two in order to give autonomy for the Wirral Peninsula and the rest of the district was to be dominated by Liverpool. But rather to our surprise Liverpool does not like its exalted position, because the scheme is "from ten to twenty years too early." We cannot see why and, even if it were, it seems extraordinary that a Corporation which has just started the first automatic sub-station in this country should cavil at a very ordinary scheme of linking up. But, as Mr. KIPLING remarked, "They are like that." Another reason given for the withdrawal is that Liverpool takes objection to the cutting away of the Wirral Peninsula. That is a reason we can understand, though it seems to contradict the other one. But electricity supply will never develop in this country as it ought to develop until it is organised by large districts. We hope that even now it is not too late for those concerned in the Mersey and West Lancashire District to see that and act accordingly.

Our Competition.

ON another page of this issue we publish the scheme for an "All-Electric" House which gained the third prize in our recent competition. This is due to Mr. EDWIN WHYTOCK of Glasgow. In commenting on it the judges remark that the fault of this competitor is that, though he allows for a balanced three-wire system for power and lighting, he could have avoided the use of separate power and lighting plugs, and so reduced their number considerably. He has budgeted for twenty-three in all. The installation proposed embodies material of the best quality and of the highest price. While, therefore, it would be quite suitable for one of the "new rich" it would hardly be the sort of thing the owner of the class of house we proposed would be likely to be able to pay for. As the judges point out, the question of cost in this connection is of prime importance if electricity is to make the strides we hope it will. It is useless, therefore, to attempt to put in an installation regardless of cost, particularly when the factors of efficiency and safety are no higher than when a less costly material is used. This competitor's specification and bill of quantities are not as complete as they should be, though his wiring plans are good and indicate an excellent knowledge of the proper methods of execution. This completes our dealings with the "All-Electric" House. We hope in a week or two to be receiving the first entries for our second competition. We again remind our readers that it bristles with difficulties, and that the closing date is June 29th. There is therefore no time to lose.

Another Echo from Wimbledon.

THE case of Lee *v.* Peel, of which we conclude our account on another page of this issue, almost attained the status of a *cause célèbre*. It was tried before Mr. JUSTICE DARLING, the court was crowded all the time, it lasted six days, and an inordinate amount of dirty linen was washed in public. We congratulate Mr. LEE on having obtained adequate if not substantial damages, and more on having once more cleared his name of the gravest imputations. The proceedings in the case throw a lurid light on the way local government is conducted in certain places. A committee fall out with a chief official, whether rightly or wrongly need not be discussed—probably there were faults on both sides. But instead of the unfortunate difference of opinion being treated as confidential it is broadcasted all over the borough, and in public houses and at street corners can be seen the unedifying sight of town councillors telling their friends all about it, and giving their opinions both freely and unwisely. If this case does nothing else we hope that it will at least show these egregious gentlemen that what is required from them is a little more dignity and a little less sense of their own importance.

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B.T.-H. Progress.

THE results of the year's trading by the British Thomson-Houston Co. are as satisfactory as those to which we recently referred in connection with the English Electric Co. The volume of orders received was greater than in the preceding year with the result that a profit of £494 592 was obtained. The payment of a dividend of 6 per cent. is recommended, leaving £236 671 to be carried to the next balance sheet. Commenting on the future, Mr. H. C. LEVIS said, "So far as the electrical industry is concerned there seems to be an almost unlimited field for progress." This is undoubtedly the case and, if our trading concerns maintain their spirit of enterprise, things look rosy for them and for the industry generally.

Electricity and the Iron and Steel Industry.

A meeting of the Iron and Steel Institute without a Paper by Mr. C. A. ABLETT on some phase of the problem of electricity in iron and steel works would be almost unthinkable. The meeting of the Institute held last week in London was no exception to this rule, and the electrical industry might therefore seriously consider the idea of recognising in some suitable form the worth of the useful propaganda which Mr. ABLETT provides on these occasions. For the more a subject of this kind is discussed, the more will the undoubted advantages of the employment of electricity for various purposes in iron and stee works become evident, and the more reason there will be for encouraging Mr. ABLETT in his good work. The effect is in fact cumulative.

Private v. Public Supply.

But when we come to consider details, we do not, as is also usual, find ourselves altogether in agreement with Mr. ABLETT's conclusions. In a paper which he read before the Institute three years ago he supported the claims of the direct current as against the three-phase drive, and as a not unnatural corollary took the view that an iron and steel works would, for economic reasons, do better to be electrically self-supporting than to link up with a public supply company and obtain its surplus power in that way. His reason for that policy, a reason which we traversed, was that "if a power supply authority undertakes to provide a stand-by of, say, 1 000 kW, it must invest capital in an additional 1 000 kW of plant and keep this plant as a stand-by to supply on demand whether it is demanded or not."

Possible Sources of Power.

Mr. ABLETT deals with this question in a rather different way in the paper which we publish in abstract on another page of this issue. He considers power supply for iron and steel works under four separate headings: power produced from natural sources in the works themselves; power produced in the works from exhaust steam, and from fuel used definitely for that purpose; and power purchased from outside. In considering this matter it must be noted that the advantages to be gained from the use of electricity in iron and steel works are by now generally accepted, and that the large amount of energy available in the works themselves in the form of by-product heat introduces a complication which is met with in few other factories except textile mills, and even there the heat is not strictly a by-product but has to be generated for carrying out the processes. In other words, it is usually more economical to generate at least a certain proportion of the electrical energy required on the site than to purchase it all from outside, a course we generally favour for factories.

Heat Resources and Load Factors.

Why this is so is quite clear from Mr. ABLETT's arguments. Blast furnace or coke-oven gas, hot burnt gases from the steel furnaces and other heat resources, such as hot slag, can be used either directly in gas engines or to fire the boilers. At a load factor of 65 per cent., the total cost in pence per kilowatt hour is 0·2d. with steam-turbine plant and gas-fired boilers, and 0·29d. with slow-speed gas-engine plant, while with coal-fired boilers and steam-turbine plant at the same load factor the cost is 0·42d. per kilowatt hour. On cost alone, therefore, the gas-fired boiler is the best to use, but as in practice there is often insufficient gas to produce the whole of the power in this way, a combination of gas-fired and coal-fired boilers may be necessary, and a certain increase in cost will therefore follow. A further argument for this arrangement is that the gas engine is not economical except at high load factors.

The Case for Gas Engines.

Nevertheless, Mr. ABLETT still clings to the idea of using gas engines on the grounds that while modern steam plant uses only about 15 per cent. of the heat supplied to it to produce power, the gas engine uses about 30 per cent. The former figure is, however, a little on the low side. The statistics recently issued by the Commissioners show that a thermal efficiency of 17·2 per cent. has been obtained, while the correspondence which has been appearing in our columns on the subject of boiler house efficiency indicates that still further improvements may be expected. There is no doubt in fact that the differences in the efficiencies of steam and gas plant are being gradually reduced, and to some extent, therefore, Mr. ABLETT'S arguments are less weighty than they otherwise would be. In any event, the employment of gas engines even in such a favourably situated position as an iron and steel works introduces complications and means increased incidental costs which would be better avoided.

The Case Against Purchasing Energy.

On the broader question of the relative advisability of an iron and steel works erecting its own generating plant or purchasing energy from a supply authority, Mr. ABLETT is most interesting. He takes the average cost per kilowatt for five municipal undertakings as £48 (a figure which does not err on the side of generosity), and points out that a steelworks could do much better for itself owing to its "natural resource" in having a load factor as high as 65 per cent., as against the average load factor of 21·48 per cent. obtained by five of the largest industrial cities in Great Britain during the past twelve months. He illustrates this by saying that an iron and steel works would therefore produce about three times as many units of power from their plant as a public supply authority would.

This is a little vague as he has omitted to say that the basis of comparison should be units generated per kilowatt installed. But, apart from that, it is hardly a fair argument. A supply authority's load factor depends on the load factors of hundreds of consumers, good, bad and indifferent. The load factor of an iron and steel works is its own, and it happens to be a particularly good one. The existence of such a good load factor would be taken into account by the supply authority in fixing its charges to the consumer, and thus some of Mr. ABLETT's arguments would be vitiated. The proper course for an iron and steel works is to use its waste energy to the greatest possible extent to generate electricity.

To obtain any surplus electrical energy that is required, two methods are possible; to instal a small private generating station or to purchase from the supply authority. Which is the better must depend on circumstances, but in many cases we think it highly probable that the latter would be chosen. In the former case, a small and therefore relatively inefficient generating station would be imposed on the waste heat system. The load factor of that station will certainly not by itself be as high as Mr. ABLETT maintains and his figures for cost would therefore not be applicable. On the other hand, the supply authority should be able to offer terms which would have much to recommend them and by accepting them the steel works management would be relieved from a certain responsibility.

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Economic Principles Governing the Use of Electrical Power in Iron and Steel Works.*

By C. A. ABLETT.

This Paper is mainly concerned with the selection of power plant in steel works. The source of power supply can be considered under four headings, namely, (1) power produced by the works from natural resources available within the works, (2) from exhaust steam, (3) from fuel used for that purpose; and finally (4) power purchased from an outside source.

Power from Natural Resources Available in the Works.

The main natural resources are (*a*) high load factor, (*b*) blast-furnace or coke-oven gas, (*c*) hot burnt gases from steel furnaces, puddling furnaces, etc., (*d*) other heat resources, such as hot slag.

High load factor is a natural resource of a steel or iron works, as it cheapens the cost of power produced. The load factor of an iron or steel works can be between 60 and 70 per cent., and even higher. Thus an iron or steel works produces about three times as many units of power from their plant as a public supply authority would, and the capital charge per unit of power produced should be about one-third.

Where the natural heat resources are used as a source of power, capital charges form a larger proportion of the cost of generation than where coal is burnt, so the advantages of high load factor are magnified.

Thus data presented for steam-turbine plant and gas-fired boilers show a total cost of 0·2d. per kWh with 65 per cent. load factor and 0·57d. with a 21·5 per cent. load factor. Corresponding figures for slow-speed gas-engine plant are 0·29d. and 0·82d. respectively.

Although the cost of power is greater in the latter case, it may happen that there is insufficient gas to produce all the power from steam-turbine plant and gas-fired boilers. In such a case the power plant might consist of a combination of gas-fired boilers and coal-fired boilers. It will be noted that at a 21·5 per cent. load factor the cost of power produced by slow speed gas engines is nearly as great as that produced by steam-turbine plant with coal-fired boilers. Hence the gas engine is not economical except at high load factors; but this only becomes apparent when the overall economy, including capital charges, etc., is compiled. If the power producing plant includes gas-driven blowing engines or steam turbo-blowers, there is a marked increase in economy in favour of the gas-driven combination.

In general, the more economical the power plant is in fuel consumption, the greater the capital cost of the plant becomes. Such special expenditure would therefore not generally be undertaken, except under high load factor conditions.

The Use of Blast-furnace or Coke-oven Gas.

It is more economical to use blast-furnace or coke-oven gases for heating furnaces than as a source of power; therefore it is the residue left over, after all heating requirements have been fulfilled, that is chiefly used for power production.

Next there is the choice of burning the gas under boilers for steam plant, or of utilising it in gas engines. In comparing these two methods the relative capital costs of steam and gas plant and the proportion the residue of gas bears to the power requirements, including load factor of the works, must be considered. The question of obsolescence must also be borne in mind. A decision regarding the installation of steam or gas plant may bind the works to a definite policy for some such period as twenty years, and the contingency that the plant may become obsolete before it is worn out must be provided for.

Modern steam plant utilises about 15 per cent. of the heat supplied to it to produce power, the remainder is wasted. Modern gas-engine plant uses about 30 per cent. of the heat supplied to it to produce power; of the remainder only a small portion is recoverable and the greater part wasted. The less efficient steam plant will probably become obsolete before the more efficient gas plant, and should therefore carry higher obsolescence charges.

Buildings for housing plant may also become obsolete and after the removal of the plant, stand vacant, earning no income and forming expensive obstructions.

Thermal Efficiencies of Prime Movers.

The extent to which any other form of engine can utilise the heat supplied to it is governed by the limits of working temperature. Gas-engine plant would utilise considerably more than 30 per cent. of the heat supplied to it. Boilers have been connected to gas-engine exhausts with the object of achieving this result, but a better solution of this problem may become available. Steam-turbine plants working at abnormally high pressures, and using more than 15 per cent. of the heat supplied, have been introduced. Apart from superheat, small increases in steam temperatures beyond the present normal limits involve very great increases in steam pressures. By adopting such abnormal pressures a saving of the order of 15 per cent. on the coal bill becomes possible. Such a saving at a 65 per cent. load factor would reduce the cost per kWh from 0·42 to 0·39, effecting a saving of 7·1 per cent. in the cost of power. But great care is necessary that the extra capital cost does not give rise to increased capital charges per unit produced, which will completely overshadow the saving in the coal bill. This is more likely to happen at a low load factor than at a high one.

If either gas-engine plants or steam-turbine plants could be arranged to exhaust at a temperature greatly below atmospheric temperature a great increase in efficiency would be attained, but the practical application of this idea presents difficulties.

Hot Burnt Gases from Steel and Puddling Furnaces.

As these gases should not contain combustible material they can only be used, as far as power production is concerned, to raise steam under boilers. Hot gases from nearly all puddling furnaces are being thus used to raise steam, and sufficient power can often be produced to drive the rolling mills and other plant in an ironworks, except where considerable quantities of steel are being rolled in the mills in addition to iron. But boilers designed for coal firing do not prove economical for this purpose. Where hot gases are used the conditions are different, and to obtain good results the boiler flues, etc., must be designed accordingly.

Power from Exhaust Steam.

An exhaust steam turbine is usually installed to work in conjunction with an old obsolescent steam engine, but the turbine so used automatically becomes obsolete to a similar degree to the steam engine, and the capital expended on it has thus undergone heavy depreciation. The resultant capital charges should be considered in any economic comparison. If, therefore, the capital cost of the exhaust steam plant is arranged to be written off in a short period and the total costs of the plant still appear favourable, a good case has been made out for exhaust steam. Here again the future must be considered. As an exhaust steam turbine tends to perpetuate obsolescent rolling-mill engines, it is not justifiable in considering exhaust steam as a natural heat resource of a works. Moreover, the performance figures of exhaust turbines are frequently given under much more favourable conditions than are obtainable in practice.

Power Produced from Fuel Used for that Purpose.

Where a steelworks has no natural heat resource available for power production (blast furnace, coke-oven gas or hot burnt gases from furnaces), or has insufficient natural heat resources to produce the total amount of power which they require, and must therefore purchase fuel for the production of power, they still have the advantage of a natural resource in having a high load factor. For example, assuming a load factor of 65 per cent., the cost of power produced by the works themselves, assuming a coal cost of 20s. per ton and that the plant consists of boilers and high-pressure steam-turbine plant, would be about 0·42d. per kWh. With a load factor of 21·5 per cent., which represents the average of five large public supply authorities, the cost would be 0·86d. per kWh.

In addition, a power supply authority must necessarily incur a heavy capital cost in providing cables and overhead lines to transmit power and must incur maintenance charges on this transmission system.

The average capital cost per kW installed by the five municipal undertakings already referred to works out at £48—much greater than that at which a steelworks can install its own plant. This gives a steelworks an additional advantage. In general, if the steelworks' demand for power is large, the

* Abstract of a Paper read before the Iron and Steel Institute.

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cost of power produced by the steelworks themselves will be less than that at which it can be purchased from a power supply authority. But if the demand for power is small, the conditions are reversed.

Power Purchased from an Outside Source.

A power supply authority is one of the commercial assets of a district. This must receive due consideration, but on sound business lines. An authority has an advantage in being able to install generating plant in larger sized units than are economically sound in a works plant. This, however, applies only to steam-turbine plant. An iron or steel works can, as a rule, install the largest sizes of gas engines which are available.

If a works is producing its own power and is considering the question of purchasing power from a power supply authority, they should first ascertain what their own production cost would be if capital were expended to bring the plant up to date, and obtain the opinion of an independent expert. They are then in a favourable position to negotiate with a power company. If it appears desirable to purchase a supply from a power supply authority, consideration should still be given to the consumer's right to develop his own waste power resources at any time and to terminate his agreement with the authority on payment of an ascertainable sum.

For many rolling-mill purposes direct current power possesses economical advantages over three-phase power. Engineers in making a comparison between the cost of purchasing power from a power supply authority, and the cost of producing power by the works themselves, would see that the power in both instances is of the same type, and that any losses in conversion are borne by the proper party.

Utilisation of Power for Driving Rolling Mills.

In considering electrical driving of rolling mills, the effect of the demand for power required by the different methods of driving must be considered. The mill drive is part of the works power equipment, and cannot be treated separately from the power station plant or power company's tariff, as the case may be. If they are dissociated the result will almost certainly be increased capital expenditure.

There exist marked differences in the working costs of mills. For instance, the author mentions three mills engaged in rolling beams weighing 18 lb. per foot run, whose costs were respectively 38·7, 58 and 53·5 kWh per ton. Similarly figures for three mills dealing with beams weighing 12 lb. per foot run were 47·2, 63·5 and 72·9 kWh per ton.

Cases of high power costs may be attributable to improper drafting of rolls, improper selection of drive, improper selection of motor, billets not properly heated, improper selection of system of power supply to suit local conditions, gradual introduction of mixed power plants, due to not adhering to the original programme, and lack of proper records.

The electrical drive gives ample facilities for detecting and remedying cases of high power costs, but little information is available on principles to be observed in drafting.

All losses, either electrical or mechanical should be kept to an absolute minimum. However, the arrangement of the plant to attain minimum losses entails increased capital costs, and it is a matter of judgment to select the type of plant to give the best all-round economy. The greatest differences in power consumptions are to be found in mills where the product rolled requires a greatly fluctuated power.

Where a mill is rolling less than the full output the power consumption is correspondingly high. Thus the author mentions a case where, with outputs varying from 7·2 to 35·5 tons per hour, the kWh per ton varied from 91·5 down to 48. Assuming that frictional losses were reduced by 50 per cent. the power consumption under the same conditions would be from 64·5 to 42·8 kWh per ton. If, on the other hand, frictional losses were increased by 50 per cent., the values would be from 115·5 down to 53 kWh per ton. In the original paper the author gives a diagram showing the effect of frictional losses on the costs of power for rolling at different outputs.

In conclusion the author advocates that the engineering side of an iron or steel works should be treated in the same manner as the commercial side, and subjected to regular balance sheets, scrutinised at stated intervals.

DISCUSSION.

Mr. WALTER DIXON said the paper stated the economics of this subject in a manner which could not be disputed, but it must be remembered that the primary object of a steelworks was to make steel and not electricity. He appreciated that, given the conditions mentioned in the paper, electricity might be generated more cheaply than it could be bought. At the same time, there were considerations which had to be taken into account which had not been mentioned in the paper, before a final conclusion could be come to. There was a great deal of self-evident wisdom in the paper, but it was the application of this self-evident wisdom which was the important thing.

Large Modern Gas Engines.

Mr. F. CLEMENTS said the comparison of steam turbines and gas engines depended upon the size of the plant. A fairly large-capacity steelworks would not demand much more than 6 000 kW, and that had an important influence on the size of unit dealt with in arriving at the figures. He had recently seen some of the latest type of 6 000 kW gas engines made in Belgium by the Cockerill Co., which, he believed, were the largest gas engines in the world, and as an example of the highest class of mechanical engineering these engines were unsurpassed. This development had taken place largely due to the fact that the builders had adopted the policy of increasing the average temperature throughout the cylinder. Instead of working at a normal mean effective pressure of (say) 60 to 65 lb., they had gone to from 80 to 85 lb., with a consequent increase in the power developed from the same size cylinder. This would result in the capital cost for a given power being materially reduced.

Efficiency Can Be Overdone.

Mr. L. ROTHERA remarked that while a matter of 1 per cent. efficiency was considered a large difference between two tenders for electrical plant, such a difference was negligible compared with the losses which might take place in the rolling mill. The paper showed that there might be 50 per cent, increase in the friction losses. One of the advantages of the electrical drive was that such an increase would be immediately detected on the instruments, and a rectification of the alignment of the mill plant would bring the friction losses back to their original amount. It was fairly obvious that that load factor from one mill would not be so good as that from (say) five mills, and he did not know whether the author had had that in mind when making his comparison between driving a mill from a central station supplying a large area as against a power plant for driving an isolated mill.

The Importance of Load Factor.

Mr. FRANK ANSLOW said he did not think people who were responsible for the management of steelworks were fully alive to the importance of load factor. Load factor had a great bearing upon the question of whether exhaust steam should or should not be used. The author had said that the load factor of a steelworks was in the neighbourhood of 65 per cent. Most of the iron and steelworks to-day were connected with collieries, and the colliery load factor was not nearly so good as that of the steelworks. The combined load factor was only about 35 to 40 per cent. Therefore, where the steelworks were being supplied from the power plant also supplying the colliery, the load factor would necessarily be below the figure mentioned by the author. Another point was that a saving of 15 per cent. in the coal bill did not necessarily mean a saving of 15 per cent. in the power bill.

The Imperial Wireless Chain.

Conferences between Postmaster-General and Marconi Co.

In connection with the conferences which are now taking place between the Postmaster-General and the Marconi Co. on the subject of the establishment of an Imperial Wireless Chain, Mr. Godfrey Isaacs, in a statement to "The Times," said that there were only three ways of settling the question (1) a joint control of the allocation of traffics over all stations whether Government or privately owned, with one transmitting centre; (2) the regional division of traffics, which meant an exclusive allocation of particular countries to particular stations; or (3) free competition between the different enterprises over the whole world. The first would have the advantage of using the capacity of each of the stations to its fullest extent. The regional division of traffics would mean that elasticity would be lost.

The third possibility would entail the handicap on private enterprise of free competition between all who conducted wireless services from this country to all parts of the world. It would entail, too, the handicap on private enterprise of competition with a State-subsidised service. Until these questions were decided the development of this country's wireless telegraph services was paralysed.

The view of the Post Office is that it should be possible to divide the Empire Wireless Chain between that Department and private enterprise.

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Railway Electrification in South America.

Inauguration of Electric Traction on the Buenos Aires Western Railway.

On April 30th, 1923, the President of the Argentine Republic, Dr. Marcelo T. de Alvear, inaugurated an electric service on the suburban lines of the Buenos Aires Western Railway. This railway, which has a mileage of 1 882, is one of the great British-owned systems in the Argentine and extends from Buenos Aires to the foot of the Andes. It is the oldest railway in the Argentine, having been inaugurated in 1857. It was operated by the Government until July 1st, 1890, when it was purchased by the Buenos Aires Western Railway Co.

Traffic Details.

Freight traffic on the Western system consists mainly of wheat, maize and general merchandise, whilst its passenger traffic during the twelve months ending June, 1922, amounted to 11 000 000; of these 9 000 000 were carried on the section serving the suburbs of Buenos Aires. This indicates the extent to which the population of the Argentine is concentrated in that city, which now contains about 1¾ million inhabitants—almost one-fourth of the population of the country. The congestion and the value of the land in the centre of the city have for some years exerted a great and growing influence on the extent and the population of the suburbs and this pressure has, if anything, been intensified by the conditions arising from the war, so that traffic on all the suburban lines is now increasing rapidly.

Dealing with the Suburban Problem.

From the attached map (Fig. 3) will be seen how the four railways serve different sections of the suburbs. Of these the Central Argentine Railway, which serves the northern districts as far as Tigre river, commenced an electric service on the Tigre lines in the year 1916. The termini of these railways are all some distance from the centre of the city, and are linked up by a comprehensive tramway system. Urban traffic is also catered for by the Subterraneo of the Anglo-Argentine Tramways. To facilitate the transhipment of passengers the railway arranged with the Anglo-Argentine Company to establish a joint underground station beneath Plaza Once, near their main terminal station at Once, and to run their suburban trains from this station.

On May 1st, 1923, the company began running this service in combination with the trains of the Anglo-Argentine Subterraneo, and through tickets are now issued from the suburbs on the Western line to any station on the Subterraneo between Once and Plaza de Mayo.

Preliminaries to Electrification.

This scheme of inter-communication was one of the considerations which turned the attention of the railway company's London Board to the question of electrification, and led them in 1912 to obtain from Messrs. Merz and McLellan a report upon the electrification of their suburban line. Work was commenced in 1913 under the supervision of the above-mentioned firm and of Livesey, Son and Henderson, the company's consulting engineers, but the outbreak of the war and the difficulties which the various contractors experienced in fulfilling their obligations resulted in the work being practically suspended for a number of years. On the conclusion of hostilities progress was resumed, and on October 16th, 1922, the first electric passenger train was run between Once (High Level) Station and Castelar, which is the end of the second zone of the Western suburban line. Since that date, as rolling stock became available, more and more of the suburban traffic has been handled electrically.

In addition to the electric passenger train service, a portion of the freight service is handled electrically, the railway company having constructed a tunnel between Once and the port of Buenos Aires. This tunnel is 5·1 km. long and was described in detail in the engineering papers of December, 1917.

The Electrification Scheme.

The complete electrification works for the suburban system include a power station of 25 000 kW capacity, 72·5 miles of high tension cables, four traction sub-stations with 15 000 kW of converting plant and the electrical equipment of 70 miles of single track. In addition the supply of power and lighting calls for transforming plant to the extent of 7 000 kW, this being distributed over the system in four static sub-stations and in two of the traction sub-stations.

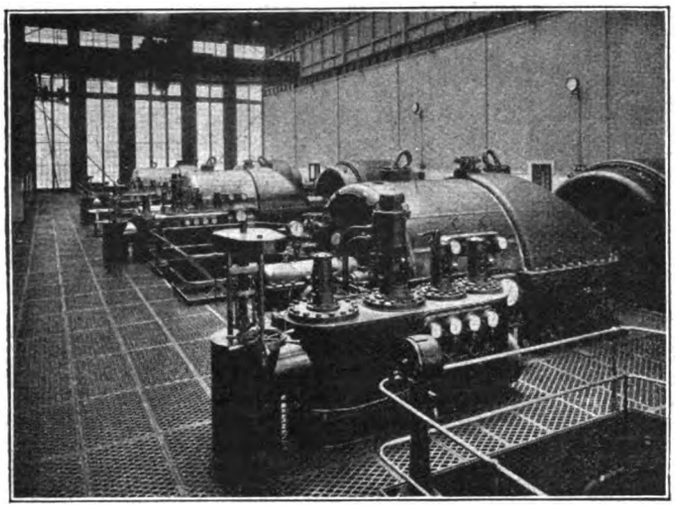

FIG. 1.—VIEW IN THE TURBINE ROOM.

FIG. 2.—THE CONTROL ROOM AT THE GENERATING STATION.

Power is produced in the generating station as three-phase current at 20 000 V, with a periodicity of 25 cycles, is transmitted to sub-stations, converted to direct current at 800 V and supplied to the electric trains through a third rail. At the Port and in goods sidings to be electrified in the future, overhead electrical equipment of the track has been installed.

The Power Station.

The power house has been placed near the Riachuelo on the Dock Sud on ground between the latter and the River Plate. It has been erected jointly by the Buenos Aires Western and the Buenos Aires Great Southern Railways and has been designed not only to supply power for the suburban lines of the Western Railway but also to give a supply to the Western workshops at Liniers, to the terminal station at Once, and to the Great Southern workshops at Banfield and the terminal station at Constitucion. When the Southern Railway decides to electrify their suburban lines the power station can be extended as required.

The boiler house is at right angles to the engine room, whilst the main transformer house and switch house are parallel to it. This design was made with the view to the extension of the power station to twelve turbo-generator sets and four boiler houses. Coaling facilities are also provided with the usual coal and ash handling plant. At the permanent end of the engine room, a loading bay, fitting shop, stores and workmen's accommodation have been provided.

The boiler house contains seven Babcock and Wilcox marine type water-tube boilers, each with a normal evaporation of

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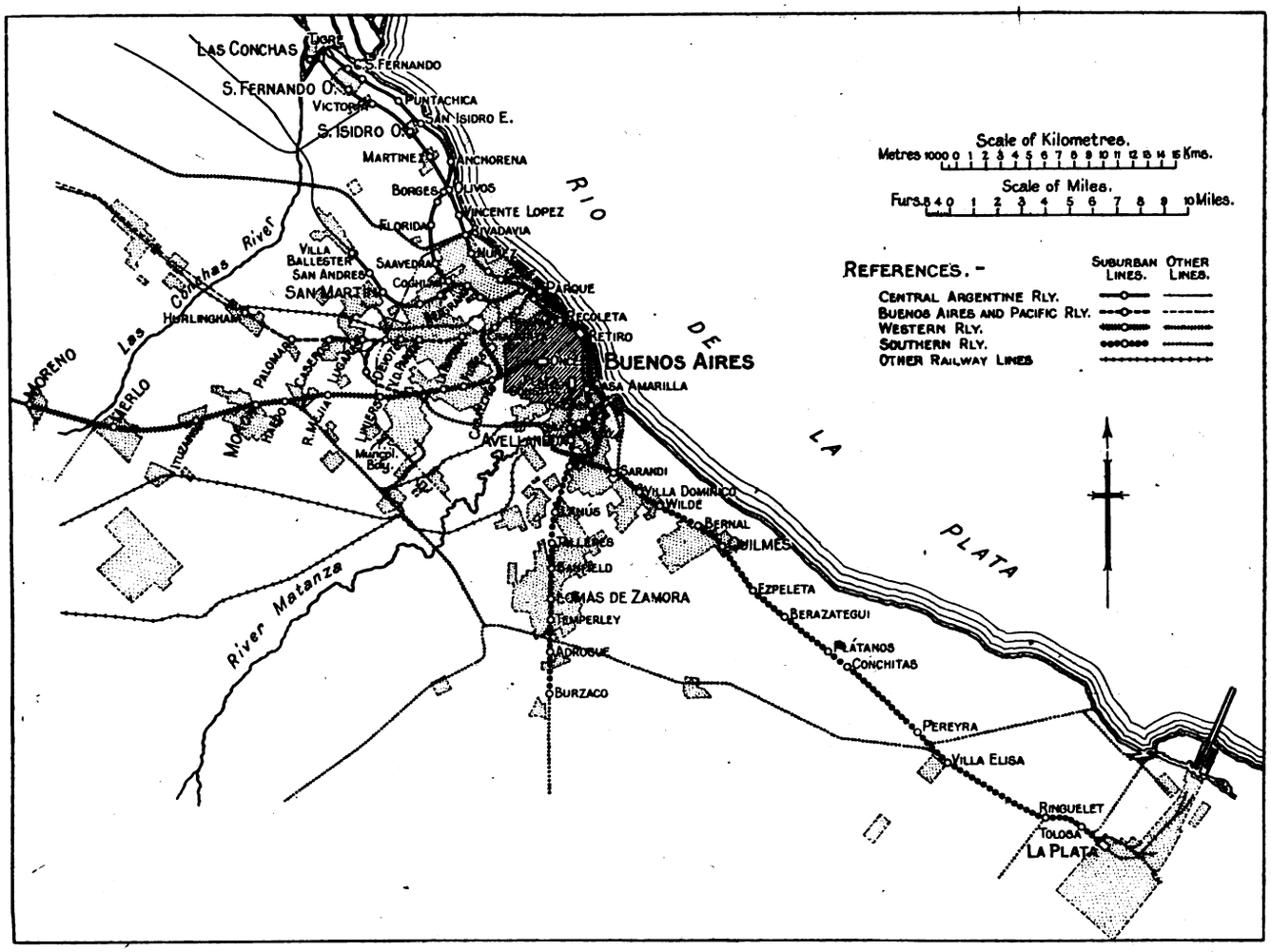

FIG. 3.—THE SUBURBAN RAILWAYS OF BUENOS AYRES.

20 000 lb. per hour. The working steam pressure and temperatures are 210 lb. per sq. in and 600 deg. F. The heating surface of each boiler is 4 170 sq. ft. and the grate area 98 sq. ft. Underfeed stokers are fitted, together with Babcock and Wilcox type of oil fuel equipment. The boilers are grouped in pairs, each boiler having its own superheater and Green's economiser. One steel chimney with an induced draught fan serves each pair of boilers and forced draught is supplied to the furnaces by six fans in the basement. The combined efficiency of the boilers and economisers works out at about 85 per cent. when either Welsh coal or Mexican oil is being burnt.

Oil Storage and Ash Handling Plant.

Two storage tanks erected adjacent to the power house are used for storing the oil. They are of 100 tons capacity each and draw their supply from the main oil deposit tanks of the Buenos Aires Western Railway Co. These latter have a capacity of 8 000 tons each, so that under ordinary circumstances an ample supply of oil is ensured. Ash handling plant which can be used in case it is necessary to employ coal in emergency, has been provided.

Engine Room.

The generating plant is arranged on the "unit" system. There are three turbines in the engine room (Fig. 1), although foundations are provided for the installation of a fourth set when necessary. These were supplied by the Metropolitan-Vickers Electrical Co., and are of the Rateau horizontal impulse type. They have an output of 7 500 kW at 0·85 power factor and 25 periods.

Each turbine set has its own auxiliaries and a self-excited exciter is coupled direct to the alternator shaft. From the alternator leads are run direct to the "unit" transformer which steps down the generated voltage from 2 500 V to 440 V for a supply to the unit distribution board.

From this board all units belonging to the generating set to which it belongs can be operated whilst, alternatively, a supply can be obtained from the station distribution boards. These distribution boards are situated in special chambers in the basement of the engine room and are fed from the main busbars of the station, being stepped down to 440 V in two special station transformers provided and housed in the main transformer house.

The main leads of the alternator run to three single phase transformers which step up the generated voltage to 20 000 V, at which pressure the power is supplied to the station busbars.

Immediately above the station distribution chambers are two chambers in which are located the two motor generators used for lighting the station and for charging the two batteries provided for the power required by the operating magnets of the main oil switches. They also provide the power for the tripping coils of switches and the indicating lamps on the switchboard.

Main Busbars.

The main busbars are in duplicate and the switchgear is arranged so that any generator, feeder, etc., can be put on either busbar as desired. Interconnection and subsection of the busbars is also provided. The arrangement of duplicate busbars has required the provision of an elaborate interlocking.

Power Station Switchgear.

All main switching is carried out at 20 000 V. The main switchgear, which was supplied by the English Electric Co., is located in a separate building. All high tension switchgear is placed in moulded concrete cubicles 10 ft. 6 in. wide, the walls being 4 in. thick.

Arrangements are provided for putting any machine feeder or transformer on to either set of busbars and for the prevention of faulty switching. The whole of the high tension switchgear is remote controlled from the control room (Fig. 2), and is arranged for direct current at 110 V supplied by two secondary batteries situated beneath the control room. Each panel is provided with chopover switches which energise coils for operating contactors. These contactors, when closed, complete the circuit through a direct current motor, one quarter of a turn of which is sufficient to close the main oil switches against a powerful spring. This operation is transmitted through a shaft upon which are mounted various sector contacts which upon operation light up the corresponding lamps on the panel in the control room, indicating whether the main switches are opened or closed.

(To be continued.)

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"The Electrician" "All-Electric" House.

The Third Prize Winner's Solution.

We give below the plans, bill of quantities, and other details of the scheme for THE ELECTRICIAN *"All-Electric" House to which the judges have awarded the third prize of £5. These were submitted by Mr. Edwin Whytock, 10, York Terrace, Shettleston, Glasgow, under the pseudonym of "Northern Lights." The titles and subheadings have been inserted by us.*

Description of the Installation.

Wiring Details.

In connection with the proposed "All-Electric" House as detailed in the leaflet and plans issued by THE ELECTRICIAN, I have pleasure in submitting the following scheme.

The normal load for this installation would be approximately 50 A, and I propose that half the load be connected to each side of the three wire supply. The bulk of the load would be for heating and cooking purposes. After dividing the heating load the lighting load would be placed on the same side of the supply as the portion which is distributed from passage on first floor (see plan).

In compliance with the rules of the Metropolitan Borough of Hackney Electricity Dept., D.P. main switches would be fixed near the supply mains and these would control the consumer's main fuses.

I propose running a pair of 7/0·064 in. cables from a pair of 50 A fuses in the scullery to a two-way distribution board in the scullery. From this distribution board I would run two circuits, one to the cooker and the other to the water tank heater as shown on the plan.

From a second pair of 50 A fuses in scullery I would run a pair of 7/0·064 cables to a six-way distribution board in passage on first floor, and from this board I would distribute to the various heating plugs as shown on plan.

From a pair of 10 A fuses in scullery I would run a pair of 7/0·029 cables to a six-way distribution board in passage on first floor distributing to the various lighting and switch points throughout the house. I have arranged the circuits so that not more than seven lighting points are supplied from one pair of fuses.

All wiring would be carried out in screwed, welded, enamelled steel tubing with a sufficient number of "draw-in" and "inspection" boxes, and there would be boxes at all switch and lighting points. All metal tubing would be securely fixed by means of metal saddles and screws and the use of "made bands" and "knees" would be avoided as much as possible.

The tubing would be concealed throughout the house with the exception of the scullery and the portion adjoining it and the tradesman's entrance, where it would be run neatly and symmetrically on walls and ceilings. The tubing would be metallically continuous throughout and efficiently "earthed" to a water pipe at three points. The earth wire would be not less than 7/0·064 in.

All heating plugs would be controlled by means of 10 A diamond "H" switches; each switch to control the live wire.

All lighting switches would be of Crabtree or Tucker make mounted on polished wood blocks. The wood "biscuit" blocks would be secured to the iron boxes by means of metal threaded screws and the switches to the blocks in the usual manner. This arrangement removes the risk of blocks slackening through "dooks" or plugs working loose.

All special fittings proposed are detailed in my letter to the client and are subject to his approval, and I have arranged that at least one light would be controlled on entering the living room, dining room or scullery by any door.

All plain pendants would consist of the necessary length of C.M.A. 23/36 flexible, the best make of ceiling rose and C.G., S.C. lampholder, complete with frosted bell shaped shades, except those in scullery and the portion adjoining, where 9 in. opal shades would be supplied.

I propose fitting in living room two 2 000 W Belling "Convexo" Fires which can be controlled to half or full heat as required; in the dining room one 2 000 "Convexo" similar to above; in No. 2 bedroom one 2 000 W Belling "Convexo" as above; in each of bedrooms Nos. 1, 3, 4, and 5, one 600 W Belling "Sunflower" bowl fire. This allows over 1·3 W per cub. ft. in living room and dining room and under 1·5 W per cub. ft. in the larger bedrooms.

For the hot water heater I propose fitting a set of 3-6 A Belling immersion heaters into a cylindrical copper tank 18 in. by 1 ft. 4½ in. high, of capacity about 10 gallons. This tank would not be supplied by me. The control would allow one, two or three heaters to be switched on, as required.

The cooker would be of Carron manufacture and would consist of oven, two grills and two hot plates. The kettle would be of Belling manufacture and 4 pints capacity.

Specification.

All lighting switches to be of Crabtree or Tucker manufacture. All cut outs, distribution boards, etc., to be of the highest grade manufacture. All cable to be of 2 500 grade C.M.A. taped and braided.

1. Supply and erection of one 50 A D.P.I.C. main switch controlling D.B. for cooker and tank heater.
2. Supply and erection of one 50 A D.P.I.C. main switch controlling heating distribution board.
3. Supply and erection of one 10 A D.P.I.C. main switch controlling lighting distribution board.
4. Supply and erection of two pairs of 50 A and one pair of 10 A I.C. fuses mounted on polished wood blocks in scullery.
5. Supply and erection of one pair of 7/0·064 in. cables in E.S. tubing from one pair of above 50 A fuses to a D.B. in scullery.
6. Supply and erection of one pair 7/0·064 in. cables in E.S. tubing from the other pair of above fuses to a heating D.B. in passage on first floor (see plan).
7. Supply and erection of one pair of 7/0·029 cables in E.S. tubing from 10 A pair of above fuses to lighting D.B. in passage on first floor.
8. Supply and erection of one 2-way, 25 A per way H.O. type I.C.D.B. in scullery (see plan).
9. Supply and erection of one 6-way, 10 A per way H.O. type I.C.D.B. in passage on first floor.
10. Supply and erection of one 6-way, 5 A per way H.O. type I.C.D.B. in passage on first floor.
11. Supply and erection of the necessary wiring in E.S. tubing to cooker and tank heater.
12. Supply and erection of the necessary wiring in E.S. tubing to twelve 10 A heating plugs and switches.
13. Supply and erection of the necessary wiring in E.S. tubing to 22 lighting points.
14. Supply and erection of the necessary wiring in E.S. tubing to 19 switch points.
15. Supply and erection of the necessary wiring in E.S. tubing to eight 2-way switch points.
16. Supply and erection of the necessary wiring to eleven lighting plugs and switches.
17. Supply and erection of twelve 10 A plugs complete with 10 A diamond "H" switches mounted on.
18. Supply and erection of twenty-one 5 A tumbler switches mounted on polished teak wood blocks.
19. Supply and erection of eight 2-way switches mounted on polished teak wood blocks.
20. Supply and erection of eleven 5 A plug sockets complete with 5 A tumbler switches mounted on teak wood blocks.
21. Supply and erection of one plugboard for kettle, consisting of polished wood board with two 5 A I.C. cutouts and one 5 A Diamond "H" switch and one 5 A plug and socket. The wiring for above to be looped from cooker and the board to be mounted on C.I.B. in scullery above cooker.
22. Supply and erection of thirteen plain pendants, consisting of the necessary length of flexible, ceiling rose complete with lampholder and frosted bell-shaped shade on 9 in. opal shade, mounted on teak wood block.
23. Supply and erection of two bowl fittings with "Superlux" bowls in living room.
24. Supply and erection of one special pendant fitted with silk shade to match decorations in living room.
25. Supply and erection of one antique copper lantern in hall.
26. Supply and erection of one W.T. fitting (well glass type) in loggia.
27. Supply and erection of one special two-light counterbalanced fitting in No. 2 bedroom.
28. Supply and erection of one 6 in. bracket in bathroom.
29. Supply and erection of one special ceiling and pendant fitting in dining room.
30. Supply and erection of one special pendant with polished back plate with ornamental spirals on flexible and special shade, for over-stair light.
31. Supply and erection of one Carron cooker complete with all accessories, including one 4-pint kettle.
32. Supply and erection of three Belling immersion heating elements in copper tank complete with 20 A Diamond "H" switch and Belling three-heat control.

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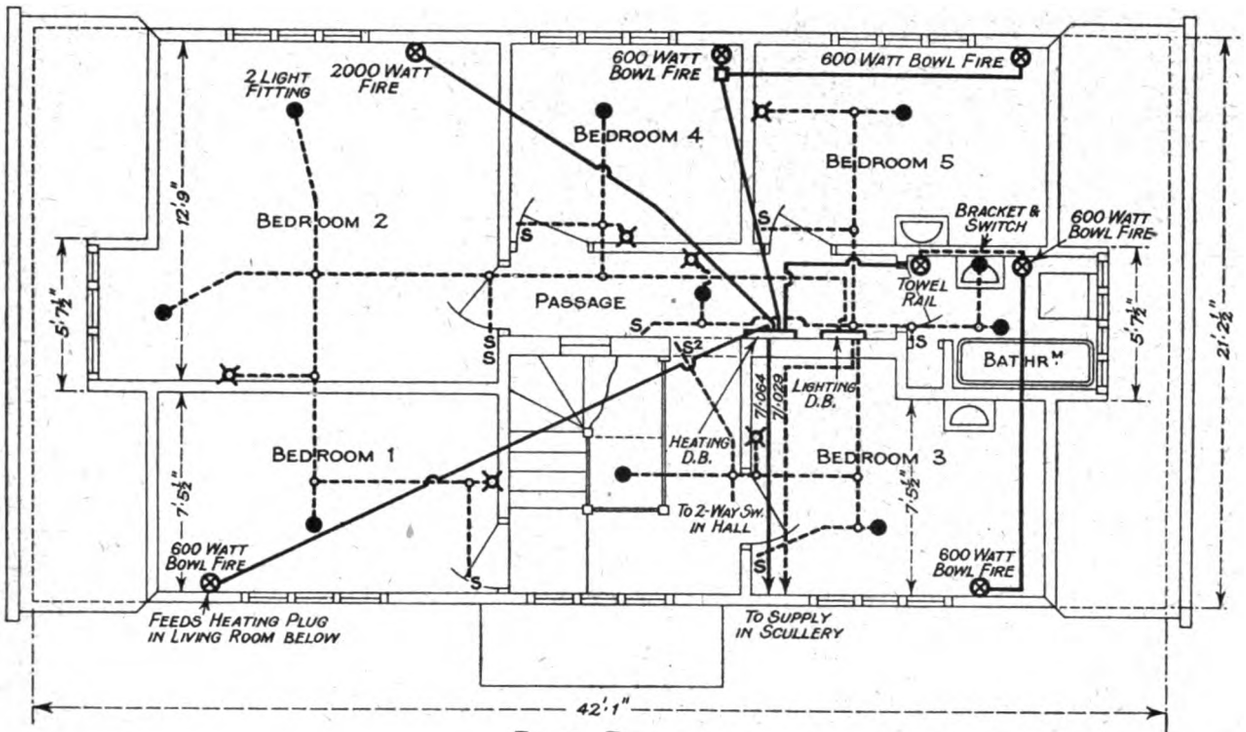
Wiring Plans of "The Electrician" "All-Electric House."

Third Prize Winner's Circuits and Arrangement of Apparatus.



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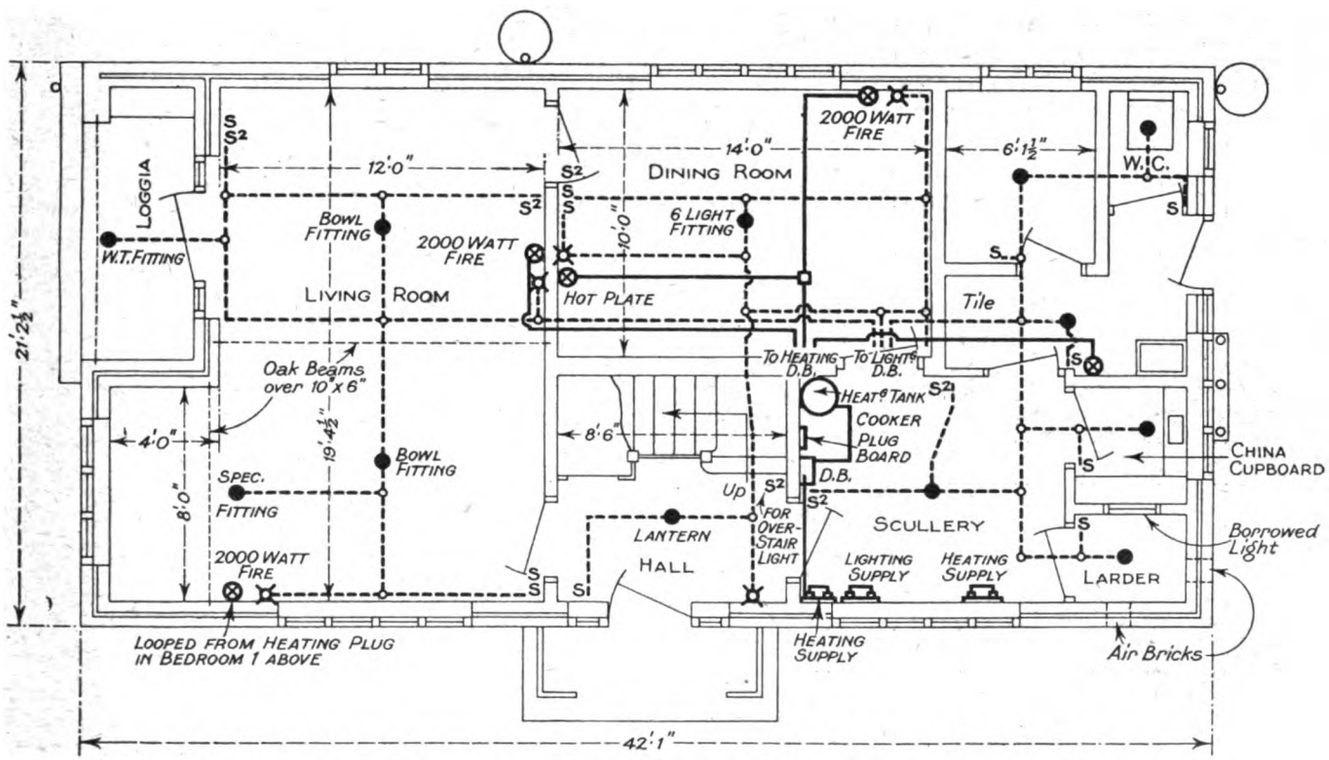

GROUND FLOOR.

SYMBOLS USED.—

——— DENOTES HEATING CIRCUIT (7/·029 CABLE IN ¾" TUBING UNLESS OTHERWISE STATED.)

– – – – " LIGHTING CIRCUIT (3/·036 CABLE IN ¾" TUBING UNLESS OTHERWISE STATED.)

● DENOTES LIGHTING POINT.
S " SWITCH POINT.
S² " TWO-WAY SWITCH POINT.
⊗ " 10 AMP. HEATING PLUG AND SWITCH.
⊠ " 5 AMP. LIGHTING PLUG AND SWITCH.
D.B. " DISTRIBUTION BOARD.

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33. Supply of three 2 000 W Belling "Convexo" fires (vitreous enamel finish.
34. Supply of one 2 000 W Belling "Convexo" fire (finished black).
35. Supply of five 600 W Belling bowl fires.
36. Supply and erection of one towel rail in bathroom.
37. Supply of one "Rotopex" washing machine and double roll ironer.
38. Supply of one Watson dish-washing machine.
39. Supply of one vacuum cleaner complete with all accessories.
40. Supply of one 333 W Belling "Dinky" iron.
41. Supply and erection of two 100 W gas-filled lamps..
42. Supply and erection of eighteen 60 W metal-filament wire drawn lamps.
43. Supply and erection of three 40 W metal-filament wire drawn lamps.
44. Supply and erection of five 20 W metal-filament wire drawn lamps.

The Bill of Quantities.

	£	s.	d.
1. Supply and erection of two 50 A D.P. switches, two pairs 50 A S.P. fuses, one 10 A D.P. switch and one pair 10 A S.P. fuses, all mounted. A sum	6	5	0
2. Supply and erection of two pairs 7/0·064 in. cables to heating distribution boards, 14 yds. at 3s. 11d. per yd.	2	14	10
3. Supply and erection of one pair 7/0·029 in. cables to lighting distribution boards, 10 yds. at 2s. 3d. per yd.	1	4	9
4. Supply and erection of one 2-way distribution board of 25 A per way	1	11	0
5. Supply and erection of one 6-way distribution board of 10 A per way	2	5	0
6. Supply and erection of one 6-way distribution board of 5 A per way	1	13	0
7. Supply and erection of wiring to cooker and heating tank. 4 yds. at 2s. 8d. per yd.	0	10	8
8. Supply and erection of wiring to twelve heating plug points at 15s. 9d. each	9	9	0
9. Supply and erection of wiring to 22 lighting points at 6s. each	6	12	0
10. Supply and erection of wiring to 19 switch points at 6s. 8d. each	6	6	8
11. Supply and erection of wiring to eight 2-way switch points at 7s. each	2	16	0
12. Supply and erection of wiring to 11 plug points at 6s. each	3	6	0
13. Supply and erection of twelve 10 A (hand shield) plugs and Diamond "H" type switches at 10s. 2d. each	6	2	0
14. Supply and erection of nineteen 5 A switches at 2s. 5d. each	2	5	11
15. Supply and erection of eight 2-way switches at 3s. 4d. each	1	6	8
16. Supply and erection of eleven 5 A plugs and switches at 5s. 3d. each	2	17	9
17. Supply and erection of 5 A D.P. switch, two 5 A S.P., I.C. fuses, one 5 A plug, all mounted on wooden block	0	16	9
18. Supply and erection of 13 plain pendants at 3s. 1d. each	2	0	1
19. Supply and erection of two bowl fittings in living room	5	0	0
20. Supply and erection of one special fitting in living room	0	8	0
21. Supply and erection of one special ceiling and pendant fitting in dining room	14	0	0
22. Supply and erection of one special lantern in hall	2	5	0
23. Supply and erection of one special two-light fitting in Bedroom No. 2	2	5	0
24. Supply and erection of one special pendant over stairs	0	8	0
25. Supply and erection of one W.T. fitting in loggia	0	11	0
26. Supply of three 2 000 W Belling "Convexo" fires, enamelled, at £4 10s. each	13	10	0
27. Supply of one 2 000 W Belling "Convexo" fire, black finish, at £3 10s...	3	10	0
28. Supply of five 600 W Belling bowl fires at £2 7s. 6d. each	11	17	6
29. Supply and erection of one towel rail	9	0	0
30. Supply and erection of one set of three Belling immersion heaters with three-heat control switch, mounted complete..	9	0	0
31. Supply of one 25 A Carron cooker	25	0	0
32. Washing machine "Rotapex"	42	0	0
33. Dish washing machine (Watson)	16	10	0
34. Vacuum cleaner (Watson)	15	0	0
35. One 333 W Belling "Dinky" iron..	1	1	0
36. Supply and erection of two 100 W gas-filled lamps at 5s. 6d. each	0	11	0
37. Supply and erection of eighteen 60 W metal filament wire drawn lamps at 2s. 6d. each	2	5	0
38. Supply and erection of three 40 W metal-filament lamps at 2s. 6d. each	0	7	6
39. Supply and erection of five 20 W metal-filament lamps at 2s. 6d. each	0	12	6
	£235	4	7

Letter to Client.

DEAR SIR,—We have pleasure in quoting for an Electrical Installation at your house, all as detailed in our specification, for the sum of two hundred and thirty-five pounds (£235).

In our estimate we have allowed for a complete installation for lighting and heating; all materials used would be of first grade only and the workmanship first class.

The wiring would be carried out in enamelled steel tubing, which we think is the safest method for a dwelling house, and further, this system lends itself to renewal of the wiring at any time with little or no disturbance.

All cables would be of highest grade manufacture and the main and sub-circuit switches would be of the best and most effective make.

The plain pendants would consist of the best quality of ceiling rose, flexible, cord grip and shade carrier lampholder, complete with frosted bell-shaped shade or 9 in. opal shade.

In the living room we have allowed for two bowl fittings with "Superlux" bowls, and also one special pendant fitted with silk shade to match decoration of room. We think the above fittings would be very effective both from point of view of illumination and artistic effect.

In the dining room we have allowed for a special counter-balanced fitting, with three fixed ceiling lights and three other lights suspended in a silk shade for table lighting; the latter lights can be raised or lowered as required.

In the hall we propose to supply a suitable antique copper lantern; for light over stair a special pendant consisting of polished brass back plate, with ornamental spirals on flexible and a special shade, and for No. 2 bedroom a special two-light counterbalanced type fitting with fancy glass or silk shades.

We would point out that fittings are purely a matter of taste, but from our experience we find that those outlined above are usually acceptable. These fittings can be seen in our showroom and are subject to your approval.

You will note that in the following rooms: Living room, dining room, scullery, No. 2 bedroom and over stair, we have allowed for at least one lamp in each room being controlled from two points, as according to the arrangement of the house, we feel that this is necessary for your convenience.

The water heater allowed for is efficient and compact and may be switched on for full heat, two-thirds heat, or one-third heat, as is required.

The cooker to be installed is of the best manufacture and contains all the latest improvements.

The radiators as detailed in the specification are ample to heat the rooms to which they are allotted, but should the necessity arise you may connect any radiator to any power plug.

We have arranged to fix a power plug in the outer scullery for connecting the dish washer or the washing machine, as each is required.

We intend fitting a lighting plug on the vacuum cleaner to suit the lighting plug sockets, as this will allow it to be used on stair and passage as well as in any room. The current taken by it is very small and would make little difference to your lighting account.

All the work will be carried out in strict accordance with the rules of the Metropolitan Borough of Hackney Electricity Department and any Fire Insurance company concerned.

Trusting our estimate will have your favourable consideration,

We remain, dear sir,

Your obedient servants,

NORTHERN LIGHTS.

The competitor also included a complete schedule of the electric light and power points illustrative of the plans.

The British Electrical and Allied Manufacturers' Association call attention to the fact that, in furtherance of TECHNICAL EDUCATION, they grant annually, to properly qualified candidates of British birth and engaged in engineering works, ten SCHOLARSHIPS each of £100, in addition to the payment of college fees. Applications by June 1st. Particulars may be obtained by writing to the Secretary, B.E.A.M.A., 36, Kingsway, London, W.C.2.

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The Institution of Electrical Engineers.

Presentation of Faraday Medal and Kelvin Lecture.

The lecture hall of the Institution of Electrical Engineers was overcrowded on Thursday, May 10th, on the occasion of the presentation of the Faraday Medal to Sir Charles Parsons, and the delivery of the Kelvin lecture by Dr. J. A. Fleming.

The PRESIDENT (Mr. F. Gill), before calling upon Mr. J. S. Highfield to speak in connection with the Faraday Medal, first made the announcement, already made in the Press, as to the disposal of the surplus funds from the war memorial. These were to go towards the foundation of two scholarships of £50, each tenable for three years, to provide for the education of children of members who were killed or permanently disabled during the war. Referring to the presentation of the Faraday Medal to Sir Charles Parsons, he commented on the fact that there were present, among the guests that evening, representatives of the four founder institutions of the Engineering Joint Council as well as representatives of the engineering institutions in Scotland, the North-East Coast, and Scotland. In calling upon Mr. Highfield to speak, he said he thought it was appropriate that he should do so as Mr. Highfield was President of the Institution at the time the Faraday Medal was instituted.

An Honour for the Institution.

Mr. J. S. HIGHFIELD said it was an honour to the Institution to be able to award the Faraday medal to Sir Charles Parsons, whose work for engineering during the past forty years was so well known. In announcing the award of the medal last year to Mr. Oliver Heaviside, he had said that as time proceeded the value of the medal would be enhanced by the illustrious names of the holders of it, and that prediction had very speedily come true. Speaking of Sir Charles Parsons's work, he said that one of the first marks of genius was the retention of a childlike curiosity; the power to see things as they were and not as we were told they were. Whilst ordinary engineers were thinking of steam as something which exerted pressure, Sir Charles Parsons thought of it as a steady, rushing, expanding wind. It was one of those instances in which the mighty mind of the master opened magic windows and let in fresh new air which all might use and enjoy if they could. But Sir Charles went a great deal farther than merely opening the windows. By a rare persistence he converted the idea of Hero of Alexandria into the great engine of production of power that we know to-day. Many of them knew of the unfortunate five years when, owing to mistakes, Sir Charles was deprived of the use of his parallel-flow invention. During that five years Sir Charles was devising turbines of every sort except the one he knew was the right one. The next stage was the use of the turbine at sea. The importance of the turbine was made clear in the design of that wonderful vessel the *Turbinia*. She was about 100 ft. long, and moved at speeds of over 30 knots. Quite apart from the turbine, she embodied all sorts of new devices which were familiar to-day, and during the voyage of that vessel from the Tyne to Cowes and back the inventor of the turbine was not only the chief engineer but the chief stoker, and it was not at all certain that he had also to deal with at least one mutiny. The Institution was honouring itself and adding, through Sir Charles Parsons's name, lustre to its membership, and he would express the hope that Sir Charles would long continue to enjoy the fame of his achievement and enjoy what undoubtedly he valued much more, the regard and affection of his many friends.

Work of Parsons not Properly Realised.

Dr. S. Z. DE FERRANTI said it was doubtful whether even those present, experts in their own particular lines in engineering work, fully realised the great work that Sir Charles Parsons had done. We went on with our everyday occupations and hardly stopped to think of the work that had been done by men like Sir Charles in making the world what it was to-day. Sir Charles had revolutionised the production of power from coal throughout the world. Before that time, the prevailing idea was that we required reciprocation to get work from coal. Sir Charles, however, had the boldness to believe that that was not necessary, and that by adopting a process more direct immensely better results would be obtained. So far as knowledge went to-day reciprocation appeared to be most suitable for small powers and the turbine most suitable for large powers; and yet Sir Charles had of necessity, at the start, to work on a small scale in order to demonstrate his ideas, and it was only after a number of years that he was able to develop the larger machines and show the full utility of the turbine principle which he had developed.

The Presentation of the Medal.

The PRESIDENT then presented the medal, but it was a little time before he could proceed, owing to the applause. In paying his own tribute of admiration of the work done by Sir Charles Parsons, Mr. Gill said that he had shown himself a master in vision, in scientific skill, and in persistence under enormous difficulties. The Faraday Medal was named in honour of Michael Faraday, a name to be conjured with among all electrical engineers as the founder and father of electrical engineering, no matter what country they came from. The terms of the award of the medal were: "It is awarded for notable scientific or industrial achievement in electrical engineering, or for conspicuous service rendered to the advancement of electrical science, without restriction as regards nationality, country of existence of membership of the Institution." The medal was only awarded by the Council after a most careful examination of those proposed for the honour. Before presenting the medal he had asked for the approval of the meeting of the Council's action in awarding it to Sir Charles Parsons.

After the long and loud applause had subsided,

The PRESIDENT, handing the medal to Sir Charles Parsons, said: "I present to you this medal, the second Faraday Medal awarded by the Council of the Institution of Electrical Engineers, in recognition of your most notable achievements for engineering and mankind. We present this to you, fully confident that you will worthily uphold the dignity and honour of the medal and of its holders, and we hope that you will have many years in which to enjoy the very special position of regard and affection of all members of the Institution which you will hold by right of your personality and by right of the award of the medal."

There was another hearty welcome for Sir Charles Parsons when he turned from the President to the audience to thank the Institution for the award.

Sir Charles Parsons on Faraday.

Sir CHARLES PARSONS said that words were inadequate to express his very deep appreciation of the honour which the Institution had conferred upon him. When it was announced at a previous meeting of the Institution that the award had been made he had no idea that the Council had anything of the kind in their minds. He could not say more to express his deep appreciation. Words were also inadequate to reply to the most kind expressions—far too kind—which had been made by Mr. Highfield and Dr. Ferranti. He had been told by the President that very little need be said on this occasion by himself, but he must say that he had felt at first that it might seem inappropriate that the Faraday Medal should be conferred upon an engineer. He had been reading Faraday's life, however, and he found that Faraday's work was very widespread. He worked for a year or two on the metallurgy of alloy steel, and then he was employed for a short time on the manufacture of optical glass—when he was a young man of 20 or 30 years of age—before he turned his attention to the development of the theory of electricity. Then he discovered the converse, that if electricity created magnetism, then magnetism should create electricity.

Sir Charles Parsons was again greeted with loud applause, and he bowed to the meeting several times before sitting down.

Fourteenth Kelvin Lecture.

Dr. J. A. FLEMING, F.R.S., then delivered the fourteenth Kelvin lecture, entitled "Problems in Telephony, Solved and Unsolved." We shall deal with this in a subsequent issue.

At the conclusion of the lecture a vote of thanks was accorded Dr. Fleming on the motion of Sir Oliver Lodge, seconded by Dr. W. H. Eccles.

A suggestion emanates from the Research Laboratories of the General Electric Co. (U.S.A.) that BUILDINGS WITHOUT WINDOWS should be erected in future. According to Reuter, it has been demonstrated that daylight costs factories, office buildings and museums more than electric light, and that ventilation and cleanliness would be facilitated if there were no windows.

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Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

"MODERN BOILER HOUSE PRACTICE."

To the Editor of THE ELECTRICIAN.

SIR,—I should like, if I may be allowed to trespass on your space once more, to make a comment on the letters of your correspondents, Mr. J. Edwin O'Breen in your issue of May 4th, and of Mr. H. P. Gaze in your issue of May 11th. If Mr. O'Breen will publish his own Boiler Test Code, based on suggested improvements in the "Continental" Code, I am sure he will be rendering a considerable service to British engineering, and I, for one, will be very glad to discuss the subject.

With regard to the escape of steam from the boiler stop-valves during a test, Mr. O'Breen touches on the delicate topic of the possibility of "wangling" boiler tests, about which much might be written. It is an old dodge to allow the steam to escape from the safety valve so that the calculations, based on the evaporation in the boiler, assume the figure equivalent to this escape of steam is in the form of superheated steam, so giving a fictitious higher result. To the same category belongs the ingenious idea—especially for cylindrical boilers—of working the boilers during the test, so that a short time before the end of the test the water is well down in the gauge glasses, and then at the last minute rushing in a whole lot of cold water to bring the level back to the starting point. Of course there ought to be a definite understanding in any proper boiler test code on these and many other similar points.

In reply to Mr. Gaze I must confess I do not like the idea, however indirect, of allowing the notion to be perpetuated that there are two kinds of boiler tests, the special "official" test for the purposes mainly of swank and the common or garden "every week all the year round" figure. This is one of the fundamental errors of the Institution of Civil Engineers' Code, and it is the stock excuse for the gross inefficiency of hundreds of boiler plants that test figures cannot possibly be approached in practice.

If boiler plants are controlled on proper lines of continuous record taking day and night, there is, however, surprisingly little difference between regular and "test" conditions. Mr. Gaze's own very interesting figures are a striking indication of this. Thus, he states that a given boiler plant has various boilers installed between 1907 and 1921 with "test" figures of 80 to 82 per cent. efficiency, and that the results of three months' running at 85 per cent. rating show an over-all boiler-plant efficiency of 79·16 per cent. In most power-station boiler plants, after the first "official" test, no further records of any importance are taken again, and the performance of the whole plant is allowed to slide anyhow, so that the average efficiency is something like 70 per cent., and not (say) 78 to 80 per cent., as it ought to be.

It is interesting to note in this connection that the figures being guaranteed with pulverised fuel, such as 84 per cent. boiler-plant efficiency at Vitry, refer to long-distance trials, and the 85 to 86 per cent. at the Lakeside station, Milwaukee, is the continuous week-to-week result all the year round.—I am, etc.,

D. BROWNLIE.

London,
May 14th.

Re "POWER CIRCUIT INTERFERENCE WITH TELEPHONE LINES."

To the Editor of THE ELECTRICIAN.

SIR,—There has been called to our attention the report in the March 2nd ELECTRICIAN of the informal discussion before the North Western Centre of the Institution of Electrical Engineers, under the title, "Power Circuit Interference with Telephone and Telegraph Lines."

As reported, the principal discussion started with what is believed to be a wrong premise resulting in wrong emphasis on different factors presented, the omission of some important factors, and resulting in wrong conclusions or at least implications. The premise referred to is that "Sensitive apparatus is necessary to transmit and faithfully reproduce telegraphic signals or spoken words." The whole question as to the degree of sensitivity, or rather of susceptiveness to the kind of influence which is later discussed, is ignored in such a premise.

Furthermore, the degree and character of susceptiveness determine how easily the signal services mentioned can be deranged by extraneous influences of a given character and amount. In other words, the degree and character of susceptiveness are quite as open to proper inquiry as are the degree and character of influence, the factors of which are discussed at some length.

The title itself is somewhat misleading to the student searching for the whole truth of the matter, and the search is more likely to be directed into all factors concerned if the subject is to be attacked constructively as the co-ordination between signal and power circuits, rather than as a discussion of interference with one of these services through inductive phenomena to which the power circuits contribute certain of the factors. There are, of course, signal circuit interferences with power circuits which are just as real (though the "just as" should, of course, be superfluous) as the interference with signal service. This interference to power circuits would be the difficulty in ready location and installation of power lines in which adequate attention has been given to the factors discussed by Mr. Barthlomew by signal lines whose locations and character has inadequately cared for the susceptiveness factors of the signal lines. The type of interference is by no means infrequent, and has often operated to oppose the proper initiation or extension of proper services—no less necessary than the signal services concerned.

The truth is, of course, that the problem of preventing both interferences—better described as the problem of inductive co-ordination—is a mutual problem and to be solved by reciprocal contributions by the signal and power companies in suitable modifications in their respective practices. For each of the power circuit factors discussed a signal circuit factor could and should be discussed to give a true picture or indicate the reasonable treatment of the problem. In some cases there is a signal system factor so directly corresponding to a power system factor as to be readily seen if one approaches this mutual problem with a balanced attention. This point appears to have been brought out to some extent by Mr. Medlin, Mr. Field and others.

It occurs to us that so much progress has been made in arriving at mutual understandings and proper bases for co-ordinating power and signal lines since the California report referred to by Mr. Bartholomew, that you might care to transmit to Mr. Bartholomew and some of the other engineers who joined in this discussion, copies of the Joint Report of the Bell Telephone System and National Electric Light Association, setting forth fundamental principles and qualitative practices for inductive co-ordination, and we are sending herewith some ten copies. We would be glad to send additional copies if they are desired.—I am, etc.,

W. J. CANADA,
Director of Engineering, National Electric Light Association.

New York,
April 24th.

British Trade Prospects.

Sir Eric Geddes's Pessimistic Views.

Speaking at the annual meeting of the Trade Protection Societies of the United Kingdom, Sir ERIC GEDDES took a pessimistic view of the British prospects for European trade.

The improvement in our export trade during the last two months had, he said, been checked, and he did not believe there was going to be a boom. He could think of no other reason for this retardation than the advance into the Ruhr Valley and the unsettled state of Europe. The situation in the Ruhr would in the end have a damaging effect on the purchasing power of Germany, France and Belgium, and this would effect for a considerable time the purchasing power of other countries, and result in a crippling of all the markets of the world.

To correct this we should give up our *role* of the benevolent onlooker and take a hand in the present situation. The British manufacturer was at present being forced to manufacture in the countries protected by either low currencies or high tariffs, and this meant that British capital, British goodwill and British skill were being exported to other countries.

If we were going to keep our place as a manufacturing nation we must increase our output per man-hour.

The Allies Electric Lamp Co., Ltd., have applied for RESTORATION OF A PATENT (No. 24 841 of 1914) granted to them for "Improvements in machines for cutting the globes of electric incandescence lamps and the like," which expired on December 31st, 1922, owing to non-payment of renewal fee.

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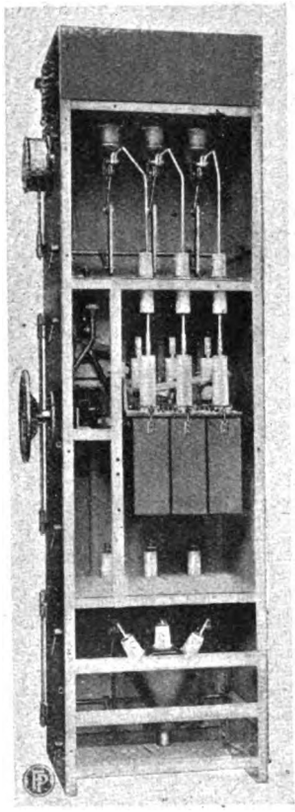
Ferguson, Pailin Ironclad Switchgear.

The usual types of interlocked switchgear employ separate handles for controlling the oil switch, the isolating switches, and the earthing gear. In the improved interlocked gear manufactured by FERGUSON, PAILIN, on the other hand, one hand-wheel controls all the apparatus in correct sequence without undue effort and without introducing intricate devices. The simplicity of this new arrangement should therefore cause it to be installed with advantage wherever interlocked switchgear is required.

This switchgear, we are informed, is suitable for use in h.t. and e.h.t. sub-stations, as well as for controlling plant in generating stations where the normal capacity does not exceed 10 000 kVA. The three-phase rupturing capacity is 75 000 kVA, but a larger size of oil-immersed circuit breaker can be supplied having a rupturing capacity of 200 000 kVA.

Constructional Details.

The switchgear is constructed on the sectional unit principle, all unit cubicles being similar in appearance and built accurately to the same dimensions. A unit section may



SIDE VIEW OF SWITCHGEAR WITH CASING REMOVED.

therefore be installed singly in any circuit it is desired to control, or a number of sections may be grouped together at a distribution centre and connected to common busbars.

Each cubicle is rigidly constructed in cellular form and is built up with heavy-gauge steel plates and angle iron. The plates are neatly trimmed and fitted without gaps to prevent, as far as possible, the entrance of dust. The doors are free from large holes, and are thus to a great extent dustproof.

Arrangement of Gear.

Beginning at the top of the standard cubicle the gear is arranged in the following compartments:—(1) Busbar and terminal compartment; (2) busbar isolating switch compartment; (3) oil-immersed circuit breaker and current transformer compartment; and (4) circuit isolating switches (when required) and potential transformer compartment.

The hand-wheel is provided with a pointer moving over a dial plate on the door, the top position of the pointer being the "engage" position; from this position a clockwise movement of the hand-wheel closes the circuit breaker, the "on" and "off" positions being clearly shown through a small window by a mechanically operated indicator positively coupled to the circuit breaker. Hand release is obtained by a thumb-push which is situated at the centre of the hand-wheel, and by means of which the breaker is tripped mechanically. When the circuit breaker is open it is possible to give the hand-wheel a counter clockwise rotation into the "engage" position, while a further counter clockwise rotation opens the isolating switches, which are provided with auxiliary contacts for earthing the disconnected apparatus, thus relieving it of any static charges. The door of the oil-immersed circuit breaker compartment can now be opened for inspection, the automatic releases on the circuit breaker can be checked, but an interlock prevents the door being closed unless the breaker is in the "off" position. The doors of the isolating switch compartments cannot be opened until the breaker is in the "off" position and the padlocks removed, while overlap catches ensure that the doors of the isolating switch compartment must be closed in advance of the breaker compartment doors. When the doors have been closed a clockwise rotation of the hand-wheel closes the isolating switches and brings the pointer to the "engage" position, and a further clockwise rotation closes the circuit breaker. The use of one wheel for the whole of the sequence of switching is an important feature of the switchgear. It makes the operation more simple, and may be safely left to unskilled and non-technical labour. The interlocks are positive—that is, unless the correct sequence is observed the gear cannot be operated and no damage can result, either to the operator or system.

Interlocking Arrangements.

The various interlocks ensure that it is not possible to open or close the isolating switches until the circuit breaker is in the "off" position; that the circuit breaker compartment door cannot be opened until the isolating switches are open and the isolated apparatus earthed; that the isolating switches cannot be closed until the earth circuit is broken, and the doors of the compartment closed; that when the circuit breaker compartment is open the operation of the breaker may be checked, but the door of the compartment cannot be closed unless the breaker is in the "off" position; and that it is impossible to operate the isolating switches except by means of the hand-wheel with door closed.

The hand-wheel is so arranged that it can be padlocked in the "off" position, and thus a feeder, machine or transformer may safely be kept "dead."

Isolating Switches.

The isolating switches are of the knife type, all contacts being carefully ground in during assembly. Each switch is a separate unit, coupled by means of driving rods of specially treated hard wood with metal-bushed ends, to the main operating spindle which is actuated by the hand-wheel. The wood driving rods are required to pass an alternating pressure test of 10 000 V per in. before assembly. The actuating mechanism is so arranged that safety catches are not required, as the action of the toggle mechanism is sufficient to prevent the switch opening either by gravity or on account of the electro-magnetic forces due to large rushes of current under fault conditions. The circuit breaker may be of the automatic or non-automatic type, as required. The former is usually supplied, but for such purposes as busbar sectionalising the latter can be substituted.

The lever gear is of the loose handle type, the automatic features being operative at any part of the travel of the operating lever. The lever gear is of the power reduction type, requiring a minimum of effort to close and open the breaker, yet quite unaffected by vibration or mechanical shock. It is not possible to open the breaker slowly by hand, the tripping plunger must be used for this purpose, thus ensuring a quick and definite break. When the circuit breaker has operated under fault or overload conditions it is not possible to close it completely until the conditions which caused its automatic operation have been removed. For use in conjunction with motor starting devices, in order to prevent the circuit breaker being closed except when the starting device is in the correct position, an electrical interlock can be supplied.

The instruments are mounted on the front of the panel, the connections to the current and potential transformers being made by phase-coloured insulated fireproof wiring run on porcelain cleats. The connections between the swing doors and the fixed element are made by means of terminal boards and flexible leads, no links or similar devices being employed on the fronts of the panels, thus facilitating manipulation.

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Merchandise to Sell and Profit By.

In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

Grimsby's Choice.

The Grimsby Corporation Electricity Committee recently organised an electrical exhibition, whose particular object was to demonstrate to the public the electric cookers which the Corporation are prepared to let out on hire. Grimsby made a wise choice in selecting the "Tricity" cookers manufactured by the BRITISH ELECTRIC TRANSFORMER CO., for this purpose.

The two cookers demonstrated and let out on hire by the Grimsby Corporation are the Tricity No. 639A and No. 666. We illustrate the former cooker which is designed to serve the needs of four to six persons. As will be seen from our illustration, the cooker has been designed for kitchens where space is limited, and that this objective has been achieved is demonstrated by the fact that the

A TRICITY COOKER FOR FOUR TO SIX PERSONS.

overall dimensions are 36 in. high, 27 in. wide and a depth of 16¾ in. Nothing essential has been neglected in the design by working to these limited dimensions, and for the list price of £20, the manufacturers offer a sound piece of apparatus that will do much to further the cause of electric cooking. It is the simplest job in the world to build a piece of electric cooking apparatus down to a price, but it is not so easy to parallel the success of the "Tricity" cookers.

The No. 666 cooker which met with success at Grimsby is not illustrated. It is built to a design very similar to the No. 639A, but is a much larger cooker both in dimensions and loading. It is listed at £24, and is a combination cooker for seven to ten persons.

A Useful Device to Sell.

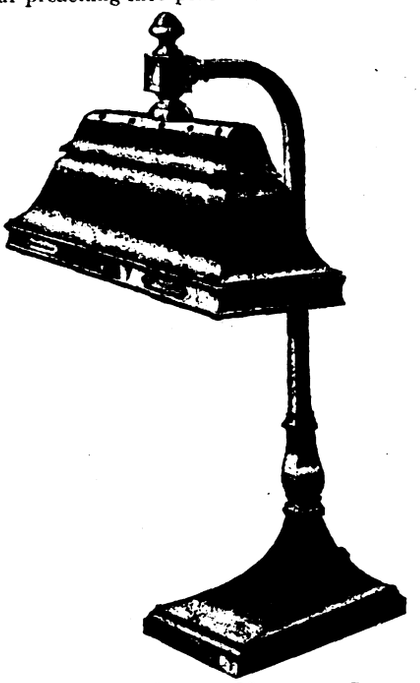
A. H. HUNT, LTD., continue to offer popular devices to the electrical retailer. The device illustrated consists of a slightly larger wander plug, in the body of which is fitted a brass screw-holder to take the ordinary flashlight or pocket lamp bulb. An insulated flexible wire 2 ft. long, is permanently connected to the plug ready for connection with the receiving set. In the event of accidental contact between any of the h.t. wires or connections, the l.t. or valve circuit, the filament of the small bulb in the wander plug is instantly fused, thus opening the circuit and saving the more expensive valve. The small bulb can then be replaced at the cost of a few pence.

A NEW WANDER PLUG.

The plug is also suitable for testing h.t. battery by connecting across the plug sockets. The plug lists at 2s. 6d., which price includes the lamp bulb.

Another Colour Matching Standard.

We have previously indicated the way to the market for colour matching fittings and counter standards. We illustrate one contribution from the GENERAL ELECTRIC CO. to contractors to enable them to put our preaching into practice. This standard (known as



THE "CORONET" COLOUR MATCHING STANDARD.

"Coronet," and described in Catalogue No. F. 2983) is arranged with two internal compartments to take an Osram gasfilled daylight lamp and an ordinary gasfilled lamp respectively. It is fitted with independent control so as to show colours. This design is registered and is listed at £12 10s., finished in real bronze colour.

The Products of Rogers, Foster and Howell.

There is no slump in "wireless," but there will be if we submit to the stampede of the lay Press. A slump may also come about if retailers do not keep off the "slippery slope" of handling indiscriminately rubbish in the form of so-called receiving sets. As in other lines of apparatus which the electrical retailer is likely to purvey there is every need to buy solely on quality, and from a

THE LATEST RECEIVING SET.

manufacturer who has established a reputation for quality. In the compilation of such a list ROGERS, FOSTER AND HOWELL must be included. We illustrate their Model No. 1 receiving set, which is a simple single valve set. This set can rightly be called inexpensive, owing to the fact that the list price is eight guineas. Briefly described, the model is a single valve set in polished walnut case, with spring locked cover, and with a separate compartment for telephones.

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"Superstitions and Customs in Our Own Time."

"Superstitions and Customs in the Electrical industry in the Twentieth Century." This is the title of a work which will be written long after this generation has passed hence and is free from the joys and sorrows of electrical merchandising. Among the many notes of interest will be the curious fact, that we of to-day all know, and that is the antipathy of electrical men to using a foot-candle meter. The average contractor will not, and yet he would never think of stirring from his door without a two-foot rule!

THE B.T.-H. FOOT CANDLE METER.

Would a surveyor practise his profession without a sextant? How, therefore can an electrical contractor sell lighting equipment without a foot-candle meter?

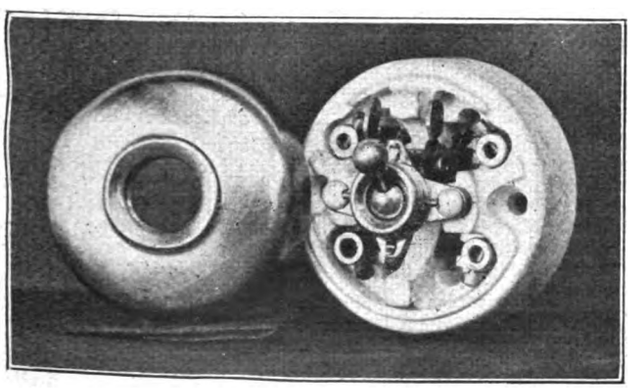
The BRITISH THOMSON-HOUSTON Co. offer a foot-candle meter which can be used with every confidence. It is not a "gadget," neither is it a "scientific instrument," in the sense that it requires a large amount of skilled attention before the result can be read. It is as simple as reading the time from a clock. Simply place the instrument on the table or bench, or wherever the measurement is to be taken, raise the hinged cover of the gradated screen, lift the nickel locking pin in the switch handle, turn this handle to the right until the pointer of the dial on the left comes to rest at the arrow. Then look at the screen and determine which of the round spots matches the background. The figure at the selected round spot gives the foot-candles.

The foot-candle meter shows exactly what amount of useful illumination there is at the point where light is wanted. It does not measure the power of the lamp or the efficiency of the reflector—except by implication—but simply the final result. It enables one to diagnose the lighting, and say definitely whether more or less is needed. If the trouble is simply insufficiency, it may often be corrected by using larger lamps. Sometimes the intensity is too great in some places and too low in others. In such cases it may be necessary to change lamps, reflectors, or spacing, or all three. The use of the foot-candle meter gives the exact knowledge which is the first and most important step in the direction of true lighting efficiency.

Our illustration reveals the simplicity and compactness of the instrument. It has many features to support the claim of the B.T.-H. that it is the simplest instrument ever designed for the purpose of measuring illumination, and it is extremely valuable to contractors, architects, lighting experts and others who from time to time need to measure the artificial illumination of workshops, offices, etc.

A D.P. Tumbler Switch by the "Craftsmen in Switches."

Reviewing the latest list of CRABTREE AND Co., we have to take note of many excellent wiring devices. The first to be mentioned



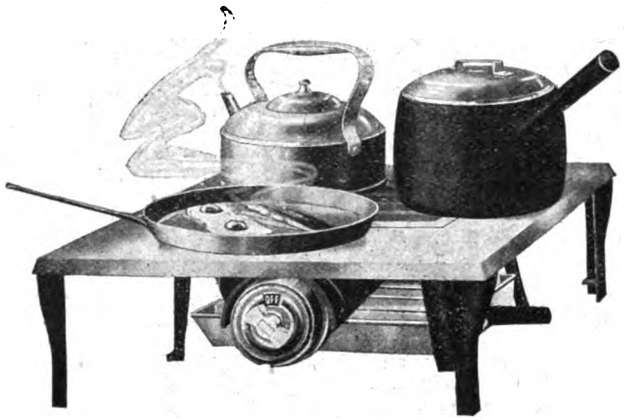
A NEW D.P. TUMBLER SWITCH.

is the single base double-pole tumbler switch. The design can be classified as entirely new, because although several manufacturers have attempted to market a single base double-pole switch we believe we are correct in saying that J. H. CRABTREE AND Co. are the first to produce a tumbler switch with a single dolly action and on a single base no larger than an ordinary single-pole tumbler switch. The switch will fill a long felt want, because there are many situations where the d.p. switch in the form of two s.p. switches coupled together cannot be used. Further the new type is much neater in appearance and is slightly cheaper. The action of the switch has been carefully designed to give a maximum double break on each pole. The metal covers are lined with fibre. It is of particular interest to mention that the terminals are specially coloured (bright copper for positive, and black for negative), as an indication to the wireman, to ensure correct connecting up. The switch is supplied in two capacities, 5 A and 15 A.

A Device for All-the-Year-Round Trade.

There is a market all the year round for a reliable and substantially made table plate and breakfast cooker. We call the attention of all electrical retailers to the Jackson contribution to this market.

We illustrate the No. 131 breakfast cooker manufactured by the JACKSON ELECTRIC STOVE Co., and it is a line which cannot fail to sell in large quantities. The cooker shown is listed at the very popular price of 40s., but the same device can be supplied with the



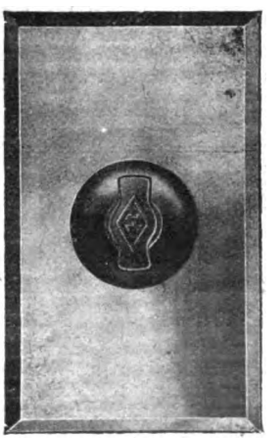
THE JACKSON BREAKFAST COOKER.

three-heats controlled by connectors, instead of a three-heat indicating rotary switch. The list price for this alternative type is 29s. 6d., but the three-heat switch control has so many talking points that no difficulty will be met with in securing the larger turnover with the 40s. cooker.

For those "domesticians" who have need of a larger hob than the standard cooker can provide, the Jackson Co. can supply a cast-iron hob surround for 15s. extra. With the hob surround, the whole forms a most useful and well-made equipment for a total of 55s.

A Rotary Flush Switch.

There are occasions when it is desirable to use rotary action switches in place of the more orthodox tumbler switch, but one objection to their use is the considerable and ungainly projection of the surface pattern. The HART MANUFACTURING Co. can,



A NEAT FLUSH SWITCH.

however, offer a rotary action flush switch which will meet this objection. As will be seen from our illustration, the switch is of particularly neat design, and as the switch plates can be supplied in a large assortment of finishes, it will be appreciated that the device has a number of uses.

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Legal Intelligence.

Tomlinson Lee *v.* Peel.

Mr. Lee Succeeds Again.

The hearing by Mr. Justice Darling and a special jury of this action for damages for slander was concluded on Thursday of last week.

Continuing the evidence for the defence, Mr. T. HATHERILL-MYNOTT, a stockbroker and member of Wimbledon Town Council, said he voted for Mr. Lee's dismissal. The ratepayers were complaining that the cost of electricity was high, and it was only after deep consideration and much regret that he voted for Mr. Lee to be superseded.

Mr. S. ALLEN said he had been a member of the Wimbledon Council for several years, and for some years was a member of the Electricity Committee, and chairman in 1919. He was always anxious to work with Mr. Lee, but in recent years he found it impossible to do so. He had told him that he wished to work amicably with him in the interest of the business. He had given plaintiff no occasion for his conduct towards him. After the homily was read to Mr. Lee, Witness asked him if he wished to make any comments, and plaintiff merely said, "Thank you," and walked out of the room.

Cross-examined: Sometime before the homily Witness said he was dissatisfied with Mr. Lee, mainly on the fixed-price supply business, by which the Council was losing money. Witness was opposed to it. The Council adopted it ten years ago.

Mr. MADDOCKS: From 1911 you have done your best to make Mr. Lee's life a burden?—That is totally untrue.

Ald. J. S. ABBOTT said he was a wine and spirit merchant. He had been a member of the Wimbledon Council for some years and was a member of the Electricity Committee. Mr. Lee's disposition to the committee was hostile, and he resented inquiries. He arrived at the conclusion Mr. Lee should be dismissed, notwithstanding that he had friendly motives towards him.

Mr. R. W. KLITZ said he attended on subpœna. He was now living in Hampshire. Before the war he was in the employ of the Wimbledon Electricity Department. In 1911 he recollected an incident at a time when Mr. Lee was his superior officer, and he asked for his orders in writing.

Mr. GREGORY: What was happening to Mr. Lee?—He was rather intemperate.

Why did you require an order in writing to obey his orders?—Because Mr. Lee was in the habit of giving orders when he was not in a condition to do so.

If you had carried out some of the orders under the circumstances what would have happened?—There was a danger to life and possibly damage to plant.

A Live Wire Round the Works.

On one occasion, Witness alleged, it was suggested a live wire at 2 000V should be put round the works.

His LORDSHIP: Who gave you the order?—Mr. Lee.

Was that a proper thing to do?—I considered it would endanger civilians and other people.

His LORDSHIP: Was he sober when he gave that order?—I cannot remember if he was sober at the time.

Before he joined the Army in 1915, Witness said Mr. Lee had changed. He had given up drink and smoking.

Mr. MADDOCKS, cross-examining: I say your story is a fabrication.

His LORDSHIP to Witness): You understand what that means—that you invented it?

Witness: I understand the allegation, and it is not true.

Mr. R. V. TREACHER said he was an accountant in the employ of the Wimbledon Town Council, and he gave evidence as to the alleged suggestion about the live wire. Witness said Mr. Lee said: "Mr. Klitz, we have orders to protect the works against German spies and other people. I want you to put a live wire round the works." Mr. Klitz said: "I shall certainly not do that." Mr. Lee said: "Will you carry out my orders?" and Mr. Klitz said: "When your orders are reasonable I will."

Mr. GREGORY: What was his condition?

Witness: I should say Mr. Lee at the time was getting over the effects of drink. Mr. Lee was frequently under the influence of drink.

Mr. GREGORY said he would call no more witnesses for the defence.

Mr. MADDOCKS then called evidence to rebut the allegations made against Mr. Lee.

Mr. W. J. OSWALD, chief assistant electrical engineer at Wimbledon, said he had been in the employ of Wimbledon Council since 1904, and had never seen Mr. Lee the worse for drink at the works. So far as he knew plaintiff was always very courteous, and willing to give information to members of the Council when they called there. He had never heard anything about a live wire. During the war there was difficulty in getting suitable coal, and that affected the boilers. Mr. Lee did not neglect his duty as to cleaning the boilers. Every effort was made to make the water-softening plant effective. The committee were not anxious to spend money, and everything possible under the circumstances was done to treat the water effectively.

Mr. CLIFFORD H. ARMSTRONG, electric-power engineer, of Wimbledon, said plaintiff was quite sober when he saw him at the Bradford convention.

Mr. F. T. JENKINS, wireman in the employ of Wimbledon Corporation, said he used to drive the car for Mr. Lee. He had never seen Mr. Lee drunk, or the worse for liquor.

Dr. VINCENT GREEN, who had attended plaintiff, said he had found no trace that Mr. Lee was a heavy drinker, and in his belief Mr. Lee had been a teetotaller since an illness in September, 1920.

Mr. FREDERICK TURNER, inspector of weights and measures to Surrey County Council, deposed to having known plaintiff for thirteen years, and said during that time he had never seen him drunk, or under the influence of drink.

Mr. A. NICHOLS MOORE, borough electrical engineer of Newport, Mon., said he sat opposite to Mr. Lee at the Electrical Engineers' Convention luncheon at Bradford in 1920. Plaintiff was quite normal and sober. Mr. Lee's criticisms of the report made by Messrs. Sparkes and Partners on the Wimbledon electricity plant indicated to witness that he was thoroughly competent.

Mr. W. M. SELVEY, consulting engineer, of London and Sheffield, said Mr. Lee must have been a competent and educated engineer to write the reply he did to Messrs. Sparkes and Partners' report. Scale in certain parts of the boilers might be no detriment to them, and it would be possible for a considerable amount of scale to accumulate in a short period.

The Summing Up.

His LORDSHIP, in summing up, said that there was no question whether the plaintiff was wrongfully dismissed, for his claim in that respect had been settled. What the plaintiff said was that his character had been defamed by the defendant. He had brought an action against the Mayor, had been awarded damages, and his character had been cleared. Now he was bringing this action, and it was doubtful whether even that would be enough, for they heard that other members of the council were being sued by the plaintiff. He (his Lordship) held that what was said by the defendant at the meeting of the town council was privileged, for meetings of local councils were privileged occasions, although their privilege was not so high as in Parliament, where it was absolute.

His Lordship put to the jury eleven questions which, after an absence of an hour and a half, they answered as follows:—

1. Did the defendant at a meeting of the Wimbledon Town Council, on March 6th, 1922, speak the words complained of, or words to that effect?—Yes.
2. If so, were the words spoken true in substance and in fact?—No.
3. In saying what he did was the defendant actuated by malice against the plaintiff?—Yes.
4. Did the defendant, at the South-Western Hotel on March 5th, 1922, speak the words complained of, or words to that effect?—Yes.
5. If so, were the words spoken true in substance and in fact?—No.
6. Did Mr. Hickmott in the defendant's presence, speak to Mr. Temple the words complained of, or words to that effect?—Yes.
7. If so, did Mr. Hickmott speak them by authority, express or implied, of the defendant?—No.
8. Were the words spoken on this occasion true in substance and in fact?—No.
9. Did the defendant speak to Mr. Gerrish the words complained of, or words to that effect?—No.
10. If so, were the words spoken on this occasion true in substance and in fact?—The words were not spoken.
11. Damages as to words complained of?—(*a*) £100. (*b*) £20. (*c*) £50. (*d*) £20.

On Monday Mr. Justice Darling entered judgment on the findings of the jury.

Mr. MADDOCKS, in asking for judgment for the plaintiff for £120 damages, read the questions left by his Lordship to the jury and the jury's answers. With regard to the issue raised in questions 6, 7, and 8, as to whether words were spoken so as to bind the defendant, Mr. Maddocks said that defendant would probably get any costs to which he was entitled on that issue, but on the fourth issue, counsel submitted that defendant was not entitled to any costs, because there was not any cross-examination.

Mr. J. D. CASSELS, for the defendant, asked for costs on the issues on which plaintiff had failed.

His Lordship gave judgment for plaintiff for £120 damages, with costs on the issues on which he succeeded, defendant having costs on the issues on which plaintiff failed. Defendant was given a stay of execution.

Postmaster-General *v.* Liverpool Corporation.

The dispute between the Postmaster-General and the Liverpool Corporation is shortly to be heard in the House of Lords. The former claimed the cost of repairing telephone plant which he alleged had been damaged by the defendant's electric light mains. The County Court judge found in favour of the defendants, the Divisional Court in favour of the plaintiffs, and the Court of Appeal in favour of the defendants.

Handcock and Dykes *v.* Tate and Another.

Mr. Justice Coleridge on Monday commenced the hearing of this case, in which plaintiffs claimed £141 3s. 11d. for professional services in connection with an electric light installation in a school, and the defendants put in a counterclaim for £220 5s.

Mr. THORNE DRURY, K.C., opened the plaintiffs' case, and Mr. Dykes and Mr. Townend gave evidence. The hearing was then adjourned until next term, in consequence of the illness of the Judge.

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Telegraph and Telephone Notes.

JOHANNESBURG (Transvaal) and BLOEMFONTEIN (Orange Free State) now have direct telephonic communication.

A NEW C.B. TYPE TELEPHONE EXCHANGE was opened last week at Holly Lodge, New Wanstead. It has room for 1 500 subscribers' lines and 200 junction lines, and actually has 800 subscribers' working lines and 160 working junction lines.

Karachi Municipality were asked recently for their consent to the BOMBAY TELEPHONE CO.'S assigning its business to a new company to be formed for the purpose. A committee was appointed to consider the question of taking over the concern or consenting to the transfer.

"Indian Engineering" states that good progress has been made in connection with the introduction of the State TELEPHONE SERVICE IN COCHIN. All the mains have been laid both in British Cochin and in Mattancherry, and the service will probably be available very shortly.

The UGANDA (East Africa) Government has received many complaints of the inadequacy of the telephone system at Kampala and elsewhere, and the "British and South African Export Gazette" states that certain improvements and extensions will probably be put in hand before the end of the current year.

The Lord Provost of Glasgow formally inaugurated on Monday a system of rotary automatic telephones (installed by the Western Electric Co.). This is designed to afford inter-communication between the various sections of the electricity department, officials at the City Chambers, and the sub-stations and power stations in and around the city. A 200-line switchboard has been installed, giving a reserve of lines for future extensions. The longest line is 10 miles in length.

The Licensing Justices at Glasgow have had before them an objection by Police Superintendent M'Phater to applications for the renewal of cinematograph licences to the Picture House, La Scala, and the New Savoy, Glasgow, on the ground that public telephones were installed on the premises. At the Picture House he stated that the public telephones in boxes in the entrance hall were USED BY BETTING MEN. The manager observed that betting men might also go to the Post Office telephones. The cases were adjourned for a month.

New Cable Steamers.

The twin-screw cable steamer "Mirror," built by John Brown and Co., Clydebank, for the Eastern Telegraph Co., was launched on Saturday, the launching and naming ceremony being performed by Mrs. J. C. Denison-Pender. The "Mirror" and her sister ship "Norseman," which is being built by the same firm, and will be launched shortly, are each 270 ft. 8 in. in length over all, 37 ft. 2 in. in extreme breadth, 25 ft. in moulded depth, and of 1 740 tons gross. They will be capable of a speed of 12 knots and are equipped with triple-expansion engines of 1 500 I.H.P., constructed by the builders. Each vessel will have three cable tanks of a total capacity of 16 000 cu. ft.—equivalent to about 530 miles of cable—two sets of the latest type of cable-working machinery, and large sheaves at the bow for cable-laying purposes.

Obituary.

Dr. John Cox.

The death is reported of Dr. JOHN COX, aged 72, late professor of physics at the McGill University, Montreal

Emeritus Prof. Charles Niven.

Emeritus Prof. CHARLES NIVEN died at Old Aberdeen on Friday last. For 42 years he occupied the Chair of Natural Philosophy at Aberdeen University, and retired only last autumn.

Herbert Tallock Wilkinson.

We regret to record the death of Mr. Herbert Tatlock Wilkinson, who had been managing director of the Wardle Engineering Co. since its formation in 1909. Mr. Wilkinson served his apprenticeship with Royce Bros., afterwards taking up an appointment with The Howard Asphalt Troughing Co., for whom he carried out several large contracts. Some time later he held an appointment with the Lancashire Electric Power Co., leaving them to take up a position with the Chloride Electrical Storage Co. In 1909 he acquired the business of Cutler Wardle and Co., in conjunction with Mr. C. H. K. Chamen, who is now the Chief Electrical Engineer for the Jammu and Kashmir State. Shortly afterwards the company was registered as a limited company under the title of the Wardle Engineering Co. From small beginning the business progressed, and at the present time it is recognised as one of the leading manufacturing companies of lanterns and reflectors in the country. Mr. Wilkinson spared no efforts in his endeavours to further the interests of the company, and his death is attributable in some degree to overwork. His loss is deeply regretted by his staff and a large circle of friends.

Personal Items.

Mr. R. L. BARCLAY has been elected Chairman of the Council of the London Chamber of Commerce.

Mr. C. G. MORLEY NEW (Cardiff), Mr. J. M. BOWMAN (Rhondda) and Mr. G. H. THOMSON (Neath) have been elected members of the South Wales Electrical Supply Committee.

Stafford Town Council have increased the salary of Mr. W. H. ROBINS, borough electrical engineer, from £550 to £650 as from April 1st last, rising to £700 on April 1st, 1924.

Mr. Wm. KIRKHAM, the late branch manager, on relinquishing his appointment with the company, was presented by his colleagues with an illuminated testimonial and silver tea and coffee service as a token of their esteem.

Mr. H. A. PRYOR, who has been on the staff of Siemens and their Associated Companies for the past fifteen years, has been appointed manager of the Manchester Branch of the Siemens and English Electric Lamp Co., who also act as selling agents for Siemens Brothers & Co.

The Council of Manchester University have appointed Mr. L. J. MORDELL, Fielden Professor of Pure Mathematics as from September next. Mr. Mordell has been Fielden Reader in Mathematics at Manchester since last September, having previously held Lectureships in the Universities of London and Manchester.

We are informed that Mr. S. G. MARTLEW, who was selected for the position of chief electrical engineer to Gillingham (Kent) Corporation, has not left the Kodak Company recently to take up the Gillingham post, as he vacated his position with the company two years ago. It is now stated in the local Press that Mr. Martlew will probably not be appointed at Gillingham.

To mark the completion of his 25th year of service as borough electrical engineer at Barrow-in-Furness, Mr. H. R. BURNETT was presented on Friday last with a silver salver and coffee jug. Mr. E. W. Armstrong made the presentation on behalf of the staff and employees, and Mr. J. F. Heslop, who presided, referred to the satisfactory progress of the electricity undertaking and of the great esteem in which Mr. Burnett was held by the staff.

Business Items.

Mr. F. HORSFALL, electrician, 51, Southgate, Elland, announces that he is retiring from business.

Mr. FREDERICK PRATT, switchgear specialist, 23, Queen Anne's Gate, is moving to larger premises at 66, Victoria Street, London, S.W.1, on June 1st.

Mr. F. C. Lawrence and Mr. F. A. R. Paton inform us that they have severed their connection with the Metropolitan-Vickers Electrical Co., and have entered into partnership as consulting cost accountants, under the style of PATON, LAWRENCE AND CO., with offices at 11, Victoria Buildings, Manchester (Central 732).

The RUNBAKEN MAGNETO CO. announces that owing to the great increase of work received by the Scottish branch of their repairs and spares service, that branch has been removed to much larger premises. In future the firm's Scottish address will be 367/369, St. Vincent Street, Glasgow (Central 672).

The HOTPOINT ELECTRIC APPLIANCE CO. are establishing a SCHOOL OF SALESMANSHIP. A series of six lectures for showroom managers, sales assistants, and demonstrators, will be given during the coming summer. Those present will be invited to ask questions concerning points upon which they require further information. After the sixth lecture there will be a written examination. The examination papers will be scrutinised by a sales expert, an electrical engineer, and two representatives of the Electrical Press, and prizes will be given. The lectures will cover the following subjects:—(1) Simple technical terms and calculation (by Mr. D. White, Head of Hotpoint Technical Department). (2) The Power House and Salesmanship (by a Station Engineer). (3) Salesmanship in the Showroom (by Mr. F. H. Howell, Sales Manager of Hotpoint Co.). (4) The lay-out of a domestic installation and the proper positions for Plugs and Appliances. (by Mr. G. Leevers, Manager of Hotpoint Co.). (5) Simple Cookery for Demonstration Days (by one of the lady demonstrators). (6) Special Campaigns and how to organise them. (by a Publicity Expert).

The Society of Merchant Venturers offer for competition 15 SCHOLARSHIPS tenable in day classes of the Faculty of Engineering of the University of Bristol. One of the scholarships is open to pupils in any secondary school receiving grants from the Board of Education; three are for pupils of secondary schools in Gloucestershire, Somerset and Wiltshire, ten for the sons of officers who were killed in the Great War, and one is restricted to a son of a citizen of Bethune who has passed either the B.L. or the B.Sc. examination. A War Memorial Scholarship is also offered with a preference to sons of former students who lost their lives in the Great War. Further particulars from the Registrar, MERCHANT VENTURERS' TECHNICAL COLLEGE, BRISTOL.

We regret that in our last issue the "Ballsok" beads supplied by Lionel Robinson & Co. were described as Balsok.

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Foreign Notes.

EUROPE.

Electrical Exhibition.

An electrical exhibition will be held at Ghent from June 16 to September 16.

Electrical Development in Switzerland.

Progress in Railway Operation. Stagnation Elsewhere.

The Commercial Secretary to H.M. Legation at Berne, Mr. E. C. D. Rawlins, in his report on the economic and financial conditions in Switzerland, states that the electrification of the Federal railway system is proceeding in accordance with the programme established in 1918, which provides for the electrification of the whole system within a period of thirty years. During last year 357 km. of railways were electrified and in operation. The lines so operating are Iselle-Brigue (22 km.), Brigue-Sion (53 km.), Berne-Scherzlingen (34 km.), Chiasso-Lucerne (225 km.), Arth-Goldau-Zong (16 km.), and Immensee-Rothkreuz (7 km.), whilst electrification work is in hand on the following lines:—Lucerne-Zurich (55 km.), Lucerne-Basle (92 km.), and Sion-Lausanne (92 km.). It is anticipated that in the near future electrification work will also be undertaken in connection with the Zurich-Olten-Berne (130 km.), Thalwil-Richterswil (27 km.), Lausanne-Daillens-Vallrobe and Daillens-Yverdon lines. In 1924, approximately 596 km. of railway will be operated electrically, representing 20·9 per cent. of the total length of the Swiss Federal railway system (2 843 km.).

Private Railways.

With regard to private railways, there have been no new extensions, with the exception of the Rhetian Railways (Canton Grisons), who have completed the electrification of their whole system by the opening of the electrically operated Reichenau-Disentis line (49 km.). The cost of the electrification of the 277 km. of line exploited by this company is estimated at approximately 120 million francs.

1922 the Worst Year Experienced.

Commenting on the Swiss electrical industry generally, Mr. Rawlins remarks that the most characteristic fact of the past year has been the decrease in the number of new orders. But for import restrictions over the German and Austrian frontiers and the electrification of the railways, matters would have been worse. In the heavy electrical industry the cost of labour is now about 100 per cent. above pre-war level. In the electro-technical industry 1922 was the worst year ever experienced, though matters have now improved somewhat owing to the fall in the price of raw materials and coal. Silk has risen in price, but rubber is now below pre-war level.

The general lack of confidence, the tendency of workmen to work less, and the unsound state of foreign exchanges are undoubtedly the cause of the present crisis.

The total imports of electrical machinery during the first nine months of 1922 amounted to 349 tons (value 1 287 000 fr.), as against 418 tons (value 1 785 000 fr.) for the corresponding period of 1921. Exports were in 1922 3 575 tons (value 18 994 000 fr.), and in 1921 5 359 tons (value 32 467 000 fr.). The chief buyers were France, Spain and the United Kingdom.

Electrical Accidents.

Mr. T. L. WALLWORK, mains superintendent at Blackburn, lost his right arm and sustained other severe injuries as the result of a shock received while he was investigating a leakage in a sub-station last week, and succumbed to his injuries on Monday morning.

At the inquest, which was opened on the same day, the house surgeon of the infirmary in which Mr. Wallwork had been under treatment, said deceased suffered from shock and burns when admitted. There was a circular burn on the scalp about 6 in. in diameter. The right arm was amputated by the current from the middle of the forearm, and there was a deep burn on the left side of the left knee. Gangrene developed in the arm which was amputated. Death resulted from shock. The inquest was adjourned.

A verdict of "DEATH BY MISADVENTURE" was returned at an inquest last week into the cause of the death of Thomas Collins, aged 17, of Pengam. The evidence showed that the deceased climbed a fence and a standard supporting a bridge which carries electric cables across the Great Western Railway and that he extended his arm and touched a cable. Mr. Thomas Anderson, electrical engineer of the Britannia and Pengam Collieries, said the cables carried 11 000 V. There was a projecting bar on the bridge carrying five strands of barbed wire. In the House of Commons, Major Kelley referred to the case, and asked whether the safeguards could not be increased, but the evidence seems to indicate that reasonable precautions are taken.

An Order was made on April 28th restoring letters patent No. 174 064, bearing date July 17th, 1916, and granted to ALBERT VAN TUYL DAY, for "Improvements in or relating to electric high-frequency signalling."

Imperial Notes.

AUSTRALIA.

LISMORE (N.S.W.) Council have asked the Government to report on the possibility of developing the power resources of the Richmond River.

The MERBEIN (Victoria) Ratepayers' Association have decided to urge Mildura Shire Council to proceed with an electric lighting scheme for Merbein.

Undertaking to be Transferred.

GAYNDAH (QUEENSLAND) Council are disposed to accept an offer by the local electric light company to dispose of their undertaking to the Council for £7 000. Steps are to be taken to borrow the necessary money.

Electricity Supply Loan.

BATHURST (N.S.W.) Council are recommended by the Finance Committee to accept the offer of the State Superannuation Board to lend the Council £40 000 at 5½ per cent. for the purpose of equipping electricity supply works.

Residents Eager for Electricity Supply.

For over two years HAY (N.S.W.) Council have been considering the question of equipping an electricity generating station. At a recent meeting of residents it was agreed to urge the Council to proceed with the works without delay.

Tasmanian Government Offer Declined.

BOTHWELL (TASMANIA) Council are not impressed favourably by proposals submitted by the Government Hydro-Electric Department for the lighting of the town. The cost is considered excessive, in view of the fact that the transmission lines are already passing through Bothwell.

Retail Supply by Victorian Electricity Commission.

The Victorian Cabinet has approved proposals by the VICTORIAN ELECTRICITY COMMISSION to give RETAIL SUPPLIES OF ELECTRICITY in country districts. The maximum cost of such works during the next 12 months is estimated at £100 000. Under the State Electricity Act municipalities may demand a bulk or retail supply.

Parliamentary Intelligence.

Wireless Communication with the Dominions.

On Tuesday Sir H. BRITTAIN asked what was the attitude of the several Dominions and India to the provision of wireless telegraphic communications with this country.

The POSTMASTER-GENERAL said that the Union of South Africa had entered into a contract with the Marconi Company for the erection of a high-power station. In Australia the Commonwealth Government had become the owners of a majority of the shares in Amalgamated Wireless (Australasia), Ltd., and arrangements had been made for the erection of a station for communications with this country. The Commonwealth Government had recently telegraphed for particulars of the proposed Government station in this country. The Canadian Government had issued licences to the Marconi Co. of Canada for the establishment of high-power stations at Montreal and Vancouver, but, like the South African Government, had expressed no views as to the ownership of a corresponding station here. The policy of New Zealand and India had not yet been settled. The Marconi Co. were offered a licence in January, 1919, for the erection of a station in this country for communication with the Argentine, on terms which they accepted the following month. So far as he was aware no steps had been taken by the company to erect such a station.

Lytham St. Annes Corporation.

All the rights of the Urban District Councils of Lytham and St. Annes were vested in the Borough of Lytham and St. Annes, which was incorporated in November, 1922. A Bill which was ordered to await report for third reading was considered by the Unopposed Committee of the House of Lords on Tuesday. This contains powers relating to the tramways and electricity undertakings of the new Borough. A number of the usual provisions with regard to future extensions of these undertakings are included. The maximum price to be charged for electricity per quarter is 13s. 4d. for any amount up to 20 kWh, and 8d. for each additional kWh. Discounts may be allowed up to 5 per cent. to consumers paying their accounts within a certain period.

Birkenhead Corporation.

The General Powers Bill of the Birkenhead Corporation, which has been under consideration by the Local Legislation Committee of the House of Commons, gives power to construct a tramway (a double line over five furlongs in length), connecting at each extremity with the existing tramway system. The Bill also sought power to run omnibuses, but this was disallowed by the Committee, and it also contains a number of model clauses applying to the electricity undertaking of the Corporation. The powers relating to the tramway and electricity undertakings were approved.

Metropolitan Railway.

The Metropolitan Railway (Various Powers) Bill was ordered by the Unopposed Committee of the House of Lords to be reported for third reading on Tuesday.

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Electricity Supply.

Extensions and Developments.

WEYMOUTH Corporation has applied for a loan of £9 199, for new generating plant, and £2 500 for services.

SUNDERLAND Corporation has decided to carry out mains extensions which will cost, respectively, £2 016 and £1 950.

HOVE Town Council had before it at its last meeting a proposal to extend the system of lighting central routes by means of electric swing lamps suspended over the centre of roadways.

STAFFORD Corporation have authorised the laying of a l.t. main to the Tillington area at a cost of £1 533, exclusive of services, and the purchase of a 1 000 kW rotary converter for £3 600.

MARGATE Corporation has approved a scheme under which the Isle of Thanet Electric Tramway and Lighting Co. will improve the electric lighting of the Westbrook district, in which important building developments are taking place.

Lieut.-Col. W. A. Vignoles, borough electrical engineer, has recommended that £773 be spent on cable for supplying electricity to new houses in and around Old Clee Road. The GRIMSBY Electricity Committee has adopted the recommendation.

BRISTOL Corporation last week decided to borrow £12 789 for excess expenditure on the extension of the buildings and plant at the Feeder Road station, for which the original loan was £76 000, and also £2 000 for works in connection with a sub-station at St. Edyth's Road, Avonmouth Road.

LICHFIELD City Council has decided to communicate with Cannock Chase Colliery Electricity Department regarding the cost and method of bringing their service into Lichfield. It was stated that an underground cable would cost about £9 000, but a saving could be effected by adopting the overhead system.

LYTHAM ST. ANNES Council is applying to the Electricity Commissioners for sanction to borrow £75 000 for the electricity undertaking. There are now 3 963 consumers of electricity at Lytham St. Annes, an increase of over 800 in the past year. This is due largely to the extension of the supply to Ansdell district.

The Northampton Electric Light Co. will shortly commence laying mains from the new power station in NORTHAMPTON to Wellingborough, Rushden, Higham Ferrers, and Irthlingborough, so that these towns can be supplied direct from Northampton. The power stations at Wellingborough and Rushden will be maintained as stand-by stations.

The first of the new Diesel engines which are being installed in REIGATE Corporation's generating station is expected to be running during the present month, and the second next month. The third cannot be installed until the steam boilers and condenser are removed, and Mr. Wordingham, the Council's consulting engineer, therefore considers it inadvisable to proceed with its installation this year.

The formal inauguration of the bulk supply by the South Wales Electrical Power Distribution Co. to CAERPHILLY took place on Wednesday, the 9th inst., Councillor E. S. Williams, chairman of the Council, switching on the current at the transformer station. About two miles of underground cable have been laid in the town, the remainder being overhead, and about £10 000 has been spent on the undertaking.

Alterations in Charges, Proposed and Actual.

The charge for current for lighting at YARMOUTH has been reduced by 1d. per kWh.

NELSON Electricity Committee have reduced the price of electricity by ½d. per kWh for lighting, and by ¼d. for power.

Reductions of 1d. per kWh, with 2½ per cent. discount, in the price of current for light, 1d. per kWh for heating, and ¼d. for power have been made by LOWESTOFT Corporation.

At a meeting of FLEETWOOD Electricity Committee the Chairman announced that the profit for the year was about £5 700. A further reduction of ½d. per kWh, making a total reduction of 2d. in six months, was recommended.

AINSWORTH Parish Council have received intimation that the Lancashire Electric Power Co. have reduced the charge for electricity from 7d. to 6d. per kWh, and the minimum quarterly payments from 10s. to 7s. 6d., as from July 1st.

Tapping New Areas.

The extension of the PORTSMOUTH distribution system to Havant and Emsworth is expected to be accomplished before the end of the present year.

The work of laying the cable for the supply of electricity in bulk by the North Wales Power Co. to Menai Bridge will probably be commenced this month.

CREWE Corporation has had under consideration the question of giving an electricity supply in Haslington and Shavington. The respective Parish Councils are to be asked to furnish particulars of the probable consumers.

The Urban Electric Supply Co. has erected demonstration lamps in two streets in PENZANCE, and the Council endorse the Lighting Committee's opinion that the time is opportune for going into the question of electric lighting.

HARROW WEALD Parish Council have notified the North Metropolitan Electric Power Supply Co. that the question of public electric lighting will be considered if the company can give an estimate of the cost of supplying the whole of the district.

The erection of the MINFFORDD sub-station, near Bangor, is nearing completion, and it will shortly be ready for the reception of high tension switchgear. The North Wales Power Co. expect to supply current to the sub-station before the end of the present month.

WOKING ELECTRIC SUPPLY Co. is applying to the Commissioners for a Special Order to extend the Company's area of electricity supply so as to include the parishes of Shepperton and Littleton, Objections to the Secretary, Electricity Commission, Whitehall. London, by July 29th.

Nuneaton Corporation has asked for the assent of ATHERSTONE Rural Council to the supply of electricity by the Corporation to Hartshill and Ansley. Atherstone Council decided to ask the Leicestershire and Warwickshire Power Co. upon what terms they would supply these areas.

MAESTEG Urban District Council is applying to the Electricity Commissioners for a Special Order to supply electricity in Maesteg urban district, to take a supply of electricity from North's Navigation Collieries (1889), Ltd., or other company, body or person. Objections to the Secretary, Electricity Commission, Whitehall, London, by May 22nd.

MANSFIELD Corporation is applying to the Electricity Commissioners for a Special Order to extend their area of electricity supply to the urban districts of Sutton-in-Ashfield, Kirkby-in-Ashfield and Huthwaite and the parish of Skegby-in-Skegby rural district. Objections to the Secretary, Electricity Commission, Whitehall, London, by May 22nd.

The Barrow Hematite Steel Co. have arranged to obtain a supply of electricity for their mines in DALTON-IN-FURNESS from the Barrow Corporation. At the last meeting of the Dalton Council, Councillor Crelling said if that Council did not decide to establish their own electricity works they should make their consent to the supply of large power consumers in the area by an outside authority conditional upon acceptable terms being offered for public and private lighting.

Inquiries and Orders.

HETTON Urban Council have decided to ask the Houghton-le-Spring and District Electric Lighting Co. for terms for the electric lighting of the Coal Bank Terrace and the road leading thereto.

SAFFRON WALDEN Corporation have applied to the Commissioners for a Special Order authorising the supply of electricity in the borough of Saffron Walden. Objections to the Secretary, Electricity Commission, Whitehall, London, by June 4th.

The Minister of Transport proposes to confirm the YEOVIL Electricity Special Order, made on the application of the Yeovil Electric Light and Power Co. Objections to the Secretary, Ministry of Transport, Whitehall, London, by May 12th.

Major B. J. Day and Lt.-Col. C. B. Bartley are applying to the Electricity Commissioners for a Special Order authorising the production and supply of electricity in CRANBROOK (KENT) RURAL DISTRICT. Objections should be sent to the Secretary, Electricity Commission, Whitehall, London, by June 4th.

The Electricity Commissioners have made a Special Order authorising SALFORD CORPORATION to bring into the areas of supply, under the Salford Electric Lighting Order, 1890 and the Prestwick Electric Lighting Orders, 1900 and 1903, electricity from a generating station to be erected in Swinton and Rendleburg Urban District.

Miscellaneous Supply Items.

The profit on the BURTON-ON-TRENT electricity undertaking for the past year was £13 000.

It was announced at BEBINGTON (Cheshire) Council last week that the question of public electric lighting was receiving attention.

SOUTH MOLTON Corporation has decided to apply to the Electricity Commissioners for sanction to promote a scheme for the supply of electricity in the borough.

NELSON Electricity Department made a profit during the past year of £6 933. The number of consumers connected to the mains is 2 694, and the motors installed on consumers' premises aggregate 1 708 H.P.

KING'S LYNN Corporation have asked the Electricity Committee to consider the desirability of organising, in conjunction with manufacturers, an electrical exhibition having as its main object propaganda work for cooking and heating.

The STOURPORT CORPORATION is urging that a clause should be inserted in the Shropshire, Worcestershire and Staffordshire Electric Power Co.'s Bill giving them the option of purchasing the station which the company wish to erect at Stourport. The company have agreed to lay mains in Stourport within three years of the passing of the Bill.

At the last meeting of CARNARVON Town Council it was stated that the Council's plant is now inadequate to supply the demands for electricity in the town. The Corporation has been directed to take a supply in bulk from the North Wales Power Co., and an agreement has been made with the company, but the supply has not yet been given. On the suggestion of the Mayor, it was decided to apply to the Electricity Commissioners.

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Tenders Invited and Accepted.

UNITED KINGDOM.

ECCLES CORPORATION, May 22nd.—1 300 kVA group of Scott-connected transformers. Specification from the Borough Electrical Engineer.

GLASGOW CORPORATION, May 22nd.—Electric light wiring and fitting in connection with Cathcart Road housing scheme. Specifications from the City Electrical Engineer.

ST. GERMAN'S GUARDIANS, May 23rd.—Electric light installation at the Poor Law institution, where the specification can be seen.

BASINGSTOKE GUARDIANS, May 24th.—Wiring and fitting at the Guardians' institution. Specification can be seen at the institution on Monday and Tuesday, 21st and 22nd inst.

BISHOP AUCKLAND URBAN COUNCIL, May 26th.—Electric light installation work at Waterworks Filter House, West Mill. Particulars from the Waterworks Manager, Town Hall Buildings.

BLEAN (KENT) GUARDIANS, May 28th.—Wiring the Poor Law institution at Herne Common for electric lighting. Tender forms from the Clerk, 39, Castle Street, Canterbury.

CROOK URBAN COUNCIL, June 4th.—Pole line, transformers and switchgear. Specifications from Mr. J. E. Favell, 22, Oxford Street, Newcastle-on-Tyne.

CARDIFF EDUCATION COMMITTEE, June 8th.—Electric light wiring and fitting of Splotlands school. Specification from the City Electrical Engineer.

DIRECTOR-GENERAL, INDIA STORE DEPARTMENT, June 8th.—Gutta-percha, brass-taped, electric cable. Forms of tender from the Director-General, India Store Dept., Branch No. 35, Belvedere Road, Lambeth, London, S.E.1.

LONDON COUNTY COUNCIL, June 11th.—Low tension cables (covering the supply of telephone and pilot cables, and withdrawing, relaying, and jointing of existing l.t. cables). Specifications, etc., from the Clerk of the Council, County Hall, Westminster Bridge, S.E.1 (Room 215).

IRELAND.

LIMERICK CORPORATION, May 21st.—Three Diesel oil engines direct coupled to three d.c. generators. Specification from Mr. J. Grant, Electricity Works, O'Curry Street, Limerick.

SOUTH AFRICA.

IRRIGATION DEPARTMENT OF PRETORIA, June 27th*,—50 B.H.P. hydro-electric plant.

SPAIN.

GENERAL POST OFFICE, MADRID, June 4th.—Telephones materials, carbons, etc. Tenders from British firms will only be considered for material not manufactured in Spain and local representation is essential.

The tender of the Stirling Boiler Co. for a water-tube boiler at £8 253, has been accepted by CARLISLE CORPORATION.

HULL CORPORATION have accepted the tender of the English Electric Co. for a tramcar body, £1 045.

The tender of Vickers, Ltd., for two boilers at £15 839 is recommended for acceptance by SWANSEA CORPORATION.

The Union Cable Co. has secured a contract for cable, £859 13s. 3d., and joint boxes £132 17s. 10d. for ILFORD URBAN DISTRICT COUNCIL.

WEYMOUTH COUNCIL have accepted the tender of Browett, Lindley and Co. for a gas engine, with producer plant and generator, for the electricity works, at £8 179.

TAUNTON CORPORATION have accepted the tender of Babcock and Wilcox for a boiler at £1 666, and for reconstructing the chain-grate of a mechanical stoker at £157 6s.

SALFORD CORPORATION are recommended to accept the following tenders: Babcock and Wilcox, chain grate stokers for two boilers £2 500, and 300 tubes for economisers, £458.

The tender of Page and Bloomer for fittings and controls for lighting the clocks at the Free Library Buildings and the Town Hall, has been accepted by STOURBRIDGE CORPORATION.

The tenders of the General Electric Co. for h.t., a.c., switchboard £285 has been accepted by WORTHING CORPORATION. Three firms tendered, and the amounts ranged from £256 15s to £350.

The tenders of the Sturtevant Engineering Co., for forced draught apparatus at £535, and the Hackbridge Cable Co., for 1¼ miles of cable at £397 and 2 310 yards at £1 290, have been accepted by YARMOUTH CORPORATION.

The following tenders have been accepted by GLOUCESTER CORPORATION:—English Electric Co., seven shunt regulators for switchboard, £129 10s., and motor pinions, £7 9s. 6d. each; Vickers, Ltd., tramcar tyres, £27 per ton.

BETHNAL GREEN (LONDON) BOROUGH COUNCIL have accepted the following tenders:—Measurements, Ltd., twelve months' supply of meters; Ferranti, Ltd., prepayment meters; and H. J. Cash and Co., wiring and fitting Bullen House.

The following tenders have been accepted by AYLESBURY CORPORATION: Ferranti Ltd., 24 slot electricity meters, £3 12s. 9d. each; Electrical Apparatus Co., 24 ordinary electricity meters, £1 15s. each; Johnson and Phillips, Ltd., cable.

* Particulars from the Department of Overseas Trade.

The tender of S. Reed and Co. (lowest tender) for electric light installation work at the Grove Hospital, at £1 476, is recommended for acceptance by the METROPOLITAN ASYLUMS BOARD. Nineteen tenders were received, the highest being £2 772 3s. 11d.

The contract for the whole of the coal-handling plant for the new power station of NOTTINGHAM CORPORATION, at Wilford, has been secured by W. J. Jenkins and Co., who recently supplied the coal-handling plant for the Barton power station of Manchester Corporation.

A note relating to TONBRIDGE in the "Tenders Accepted" column of our last issue, contained an inaccurate statement in regard to a contract for mains. The Western Electric Co. state that they are, and have been for some time, supplying all the Tonbridge Council's requirements of cable.

The tender of the British Thomson-Houston Co. for a 1 000 kW rotary converter at £3 846 has been accepted by GLASGOW CORPORATION, and the tenders of the Western Electric Co. for v.i.r. cable; Steel Co. of Scotland for steel tyres; and P. and W. McLellan for brass tubing have been recommended for acceptance.

MANCHESTER CORPORATION have accepted the following tenders: Ferguson, Pailin Ltd., 33 000 V and 6 600 V switchgear; Hollings and Guest, hydraulic tram-pole extractor; Equipment and Engineering Co., rail-joint grinder and phono-electric trolley wire; Forest City Electric Services Supply Co., portable arc welder.

LANCASTER CORPORATION have accepted the tenders of British Insulated and Helsby Cables, Ltd., for main from Caton Road to Marton Street; Ferguson, Pailin Ltd., for h.t. switchgear, £1 500; Metropolitan-Vickers Electrical Co., for rotary converters, and rewinding alternators, £11 800; B. and J. Weir, boiler feed pumps, £294.

LONDON COUNTY COUNCIL have accepted the tender of Wm. Griffiths and Co. for tramway trackwork in Amhurst Park, £35 746 4s. 2d., and reconstruction of bridge, etc., £6 376 16s. 4d.; total £42 123 0s. 6d. This was the lowest tender for the two contracts combined; four others were received, the highest being £53 493 5s. 9d.

LONDON COUNTY COUNCIL have accepted the tender of Aiton and Co. for pipework, £2 504 15s., and that of Worthington-Simpson, Ltd., for a feed pump, £962 18s., for Greenwich power station. Seven tenders were received for the pipework, varying from £2 343 2s. 9d. to £3 012 6s. 2d., and eight for the pump, these ranging from £959 to £2 110.

LIVERPOOL CORPORATION have extended the contract with the Western Engineering Co. for electric light wiring and fitting to a further 200 houses on Walter Clubmoor and Edge Lane Drive estates respectively, at £7 18s. 6d. per type A house, and £8 13s. 6d. per type B house. The contract with H. Jones has been similarly extended, the prices being—for the A type, £7 18s., and for the B type £8 14s. per house.

Ateliers de Constructions Electriques de Charleroi have received orders from the Belgian Post and Telegraph authorities, Brussels, for various sizes of telephone cables up to 400 pairs, with boxes and accessories, at a total cost of about 2 500 000 francs; and from the Municipal Authorities of Schaerbeek, Brussels, for 2 750 metres of 3 core, 6 600 V, armoured cable and 1 375 metres of telephone cable, with junction boxes and accessories.

Amongst tenders accepted by BERMONDSEY (LONDON) BOROUGH COUNCIL are those of the Union Cable Co., cable, £141; Enfield-Ediswan Cable Co., cables, £21; Pirelli-General Cable Works, cable, £34 10s.; Siemens Bros. and Co., feeder pillar, £60; Universal Electrical Manufacturing Co., ironclad cut-outs, two sets each 200 A, £8 15s. each, 300 A, £9 1s. 2d. each; Chamberlain and Hookham, two-rate meters, £4 15s. 3d. each.

The tender of Ferranti, Ltd,. for twelve months' supply of prepayment meters, at £727 10s., is recommended for acceptance by HAMMERSMITH (LONDON) Borough Council. Tenders for meters of German or Austrian manufacture were received, the lowest being £560, and the lowest of the original tenders for English meters £767 10s.—viz., that of the British Insulated and Helsby Cables, whose revised quotation was the same as that of Ferranti, Ltd., and Chamberlain and Hookham, £727 10s.

CARDIFF CORPORATION have accepted the following tenders:—Metropolitan-Vickers Electrical Co., switchgear for Great Western sub-station, £759; Ferguson, Pailin Ltd., control panels for 1 500 kW rotary converter at Hayes sub-station, £294 13s. (provisionally); General Electric Co., truck-type switchgear for Docks sub-station, £545; Babcock and Wilcox, watertube boiler and mechanical stokers, £6 375; Davidson and Co., induced draught plant, £855; Clayton and Shuttleworth, steel stack, £692.

For electric wiring and fitting of 12 schools, for WEST HAM CORPORATION, the tender of F. Craft (Castleford), Ltd., is recommended for acceptance. The following are the figures for the several schools: Whitehall Place, £405 3s. 9d.; Upton Lane, £392 3s. 8d.; Water Lane, £351 11s. 3d.; Maryland Point, £296 17s. 3d.; Bridge Road, £322 18s. 7d.; Manor Road, £496 17s. 8d.; Balaam Street, £453 3s. 3d.; New City Road, £419 3s. 9d.; Russell Road, £482 4s. 8d.; Beckton Road, £402 18s. 11d.; Star Lane, £541 13s. 10d.; Hermit Road £488 4s. 6d. Thirteen tenders were received for all schools, stating definite amounts, one tender for all schools at cost plus 4 per cent., and two tenders for certain selected schools.

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Electric Traction.

Tramway Extensions and Developments.

Operations have been commenced in relaying BURNLEY Corporation's tramway track in Padiham Road. This work has been deferred from time to time for financial reasons.

BOLTON Corporation have informed Westhoughton Council that when a start is made upon the widening of Bolton Road the Corporation will be prepared to construct the tramway extension. The road improvement will cost over £9 000.

Fares, Receipts and Passengers.

There was a profit of £2 994 on the past year's working of the DARWEN tramways.

In an endeavour to make a reduction of the Nottingham rates possible the Tramways Committee decided on Friday last to hand over £10 000 to the relief of rates.

Penny tram fares came into operation at BELFAST on Monday. Considerable concessions have been made to passengers on workmen's cars and in the issue of children's tickets.

SHEFFIELD Tramways Committee have decided not to issue WEEKLY TRAMWAY TICKETS. Mr. Fearnley (the general manager) states that when he was in Bradford 25 years ago weekly passes were issued, and were used by whole families.

In his report on the accounts of LONDON COUNTY COUNCIL for the year 1921-22 the District Auditor says, in regard to the TRAMWAYS, income on revenue account was £5 160 320 and working expenses were £4 386 891, showing a surplus of £773 429. After deducting half the cost of renewals, a credit balance is carried to net revenue account of £570,581. The remaining half-cost of renewals has been charged to capital account, with the approval of His Majesty's Treasury. The provision for debt charges, income tax, interest on overdrafts, the proportion of gross profits due to Leyton Urban District Council and other minor expenditure items, created a deficiency for the year of £88 757, which becomes a charge on the special county rate. The previous year's deficiency was £590 579. The net contribution out of the rates since the inception of the undertaking in 1897 is now £404 559.

Railway Notes.

The work of electrifying the SOUTH EASTERN AND CHATHAM RAILWAY COMPANIES' suburban lines is now being taken in hand. It is expected that the line from London to Dartford, via Croydon, will be completed in about two years. Conductor rails are to be tested on a section of the line, and a first order has been placed.

An electric train is being used in the Crofton Pit, Northumberland, to convey miners from the shaft bottom to their working places. Each carriage seats twelve persons, and 120 can be carried on the train. Power is supplied by accumulators on the locomotive. The journey takes eight minutes, instead of 20 minutes on foot.

Leeds Tramcar Disaster.

Six Passengers Killed.

Serious accidents on the electric tramways of the West Riding have been comparatively few, considering the steep gradients which exist on most of the systems, but we regret to record that an accident in which six persons lost their lives and thirty-five were injured occurred on the Leeds municipal tramways system early on Saturday morning.

The car concerned left Churwell at about 7 a.m., and when it began the long descent of Churwell Hill, on which the permitted speed is four miles an hour, the maximum gradient being 1 in 11, the car got out of control and ultimately left the track and crashed against a stone wall at the bottom of the hill. Up to Sunday night nine of the injured passengers remained in hospital, the others having been removed to their homes.

The driver of the car, Geo. Knight, is reported to have told his wife and a passenger that the brakes refused to act, but, doubtless, an official inquiry will be held to discuss the precise cause of the accident, and it is difficult to see what further safeguards can be recommended, as all the cars are equipped with three brakes—two mechanical and one electrical—and the car involved in the Churwell Hill disaster had been stopped on the hill, before it got out of control, which showed that the brakes were then operating.

Two of the passengers, one being Robert Faulkner, aged 50, bricklayer, died heroic deaths in consequence of their remaining on the front platform and endeavouring to apply the brakes until the crash occurred.

An inquest was opened by the Leeds City Coroner on Tuesday, and adjourned until June 6th. Evidence was taken from passengers and eye-witnesses and from doctors who attended the injured. It was stated that the driver of the car, GEO. WM. KNIGHT, had not yet recovered sufficiently from the experience he had undergone to be able to give evidence.

NORMAN P. EVANS, a passenger, said the driver appeared to have difficulty with his brakes, and he (the driver) dashed through to the back and got hold of the brakes there.

SAMUEL BUTLER, another passenger, said the car stopped twice on a down gradient after leaving Lane Side Mills.

All the victims in the Leeds Infirmary, with perhaps one exception, are progressing favourably.

Wireless News.

The wireless station established by the Russians at HARBIN, MANCHURIA, has been redeemed by the Chinese Government for £20 000. The service is at present only available for official and Press communications, but it is intended to extend it to private messages.

King Christian of Denmark formally opened on Saturday the new WIRELESS TELEPHONE SYSTEM between COPENHAGEN and the island of BORNHOLM, in the Baltic, a distance of about 100 miles. The service is linked up at each end with the ordinary telephone system, and on Saturday, on the occasion of the inauguration of the system, it was demonstrated that communication could be carried on with ease. The Poulsen wireless system is being used.

Japanese Enterprise in China.

In constructing a wireless station at Shuanghias for the Chinese Government, at a cost of £536 267, on condition that no other firm shall erect a station in China in the next 30 years, Mitsui and Co. are said to be contravening the principle of the open door. But the Japanese state that the Nine Power Treaty is not yet in force, and, even if it were, the exceptions in Article 3 justify the action taken.

Copyright and Wireless.

The question of the COPYRIGHT OF NEWS SENT BY WIRELESS is occupying the Courts in Holland. "Reuter" states an agency which has intercepted news intended for another agency has been ordered, subject to judicial confirmation, to pay 25 florins per item.

Broadcasting Items.

Conferences with Entertainment Industry Broken Off.

In spite of the lull in newspaper discussion, the Broadcasting Co. is still having an anxious time, especially with the theatrical interests. During the past, the Entertainments Broadcasting Joint Committee has met to receive reports of the four sub-committees, which were set up a few weeks ago to consider what steps should be taken to safeguard the interests of the industry, in view of the development of broadcasting.

Complaint was made that the Postmaster-General, in his agreement with the British Broadcasting Co., had dealt with the right to broadcast concerts and theatrical entertainments without having consulted any of the organisations representing the entertainment industry, and refused to give representation to the entertainment industry on the Broadcasting Committee.

No Further Negotiations.

It was unanimously recommended "that no constituent body or any member thereof, should enter into any arrangement with the British Broadcasting Co.," and that "no evidence should be tendered to the Broadcasting Committee on behalf of the entertainment industry unless and until the industry is represented on the Committee set up by the Postmaster-General." The meeting also decided that no further negotiations with the British Broadcasting Co. should take place until the Postmaster-General acceded to the request to represent the industry on his Committee.

In connection with the dispute which has arisen between the theatrical and musical interests and the Broadcasting Co., it is stated that the latter is making arrangements to form its own company of artists to take the place of those who have been banned. Mr. Percy Pitt is to be the musical director.

The Concert Artists' Association has decided to break off negotiations with the Broadcasting Co.

In spite of an ultimatum from Chappell and Co., the artists of the National Opera Co. have decided to stand by the Company and carry out their broadcasting contract.

Much the same position has arisen in France, where, according to the Paris correspondent of "The Times," the Orchestra de Paris has refused to allow its performances to be broadcasted. M. Delaunay the conductor, made it clear there was no objection to wireless transmission in itself, and if the broadcasting companies would pay, an agreement could be come to.

The Broadcasting Co. has applied to the Postmaster-General for permission to erect a station at Bournemouth.

Home Counties Industrial Council.

The annual meeting of the Home Counties Industrial Council was held on May 9th at Whitehall, London.

Ald. WILKINSON (Luton), who had been chairman of the Council since its inception in 1920, said that he took that opportunity of placing on record the general spirit of good will and amicable relations which had throughout characterised the meetings, and that their work for the past three years had built up a mutual understanding between the two sides of the Council which he was confident would serve them in good stead in the future.

Ald. Wilkinson was unanimously re-elected chairman for the ensuing year, and Mr. I. J. Hayward (National Union of Enginemen, Firemen and Electrical Workers), vice-chairman. Mr. T. W. Cole (Employers' side) and Mr. M. T. Greenwell (Trade Union side) were appointed joint secretaries.

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Companies' Reports, Dividends, etc.

Shropshire, Worcestershire and Staffordshire Electric Power Co.

The ordinary general meeting of the SHROPSHIRE, WORCESTERSHIRE AND STAFFORDSHIRE ELECTRIC POWER CO. was held on Wednesday at the Electrical Federation Offices, 88, Kingsway, London, W.C.

Mr. E. GARCKE, chairman of the company, presided, and in moving the adoption of the report and accounts, said that the revenue account for the past year showed a marked improvement compared with 1921. The net receipts from sales of current, dividends and other revenue were £140 000, compared with £95 000. General expenses totalled £75 700, or £5 500 more than in the preceding year. The available balance was £91 500, compared with £41 000, and, after payment of the preference dividends, they were able to place £40 000 to reserve—nothing having been placed to reserve in the preceding year—and to carry forward £37 700, compared with £27 200 brought in. The revenue account therefore showed a considerable improvement, but they did not recommend the payment of an ordinary dividend, it being thought better to apply a large proportion of the undivided profits to strengthen the position of the company by increasing the reserve.

Rapid Extension of Business.

The business of the company had expanded rapidly during the past few years, and there was every indication that the rate of progress was likely to continue. In 1914 there had been 14 500 kW connected to the company's mains; in 1918, at the time of the armistice, there had been 37 400 kW, in 1921 58 500 kW, and at the end of the year under review 61 200 kW. Eight years ago it had been an undertaking of similar size and output to many electricity supply schemes. It was now, with regard to plant capacity and output, second in point of size in the Midlands, ranking next to the city of Birmingham Electricity Undertaking. Following the demonstration given during the war of what electricity could do and the subsequent work of the Electricity Commissioners in the delimitation of areas, the demands for electricity had been greatly accelerated. The generating stations of the company at Smethwick, Dudley and Kidderminster would, it was anticipated, be fully loaded next winter.

Reduction of Charges.

They depended to a great extent for the revenue on industry being good, and therefore they had endeavoured to assist in the improvement of the trade situation and had reduced their charges for electricity even before they had received any benefits from reductions in prices of wages, fuel, etc. The closing months of the year had witnessed a slight but general improvement, and since October the demand for electrical energy in the area which the company served had greatly increased. During the year they had agreed with the Redditch Urban Council to acquire their electric supply undertaking. The Council had the option to re-purchase in 72 years. That represented an expansion of the company's enterprise which would reduce its all-round costs of generation and distribution while affording supplies of current in areas which had hitherto not had the advantage of electricity supplies.

The Company's Bill.

The company had a Bill before Parliament, in which, amongst other things, it was asking for lighting powers in the whole of the remainder of its statutory area in the South-West Midlands electricity district not covered by lighting orders held by other bodies. The scheme provided for inter-communication between the generating stations of the City of Birmingham and those of the company, and also for the erection by the company of a power station at Stourport. The guarantee by the Treasury of the capital required, and interest thereon, had been obtained, and a loan of £700 000 had been raised at 5½ per cent. interest, payable over a period of 30 years. To comply with the requirements of the Treasury, that station and its auxiliary works had been constituted a separate undertaking of the company. Provision had been made for the allocation to the separate undertaking out of the general capital of the company of 150 000 shares of £1 each and £850 000 borrowing powers. Out of the latter £700 000 had been exercised by the acceptance of the loan, and out of the 150 000 shares 25 000 ordinary shares had been issued. It was anticipated that the first portion of the plant would be ready for service towards the end of 1924.

The report and accounts were adopted.

Manufacturing Companies.

SIEMENS BROS. AND CO.—The profit for 1922 amounted to £14 041 (against £200 994 for 1921), and £334 112 was brought forward, making a total of £348 153. Deducting preference dividend for first half of year, £15 000; payments on account of E.P.D., £100 000; interest on and redemption of 4½ per cent. debenture stock, £67 439; and income tax liability, £38 405; there remains a balance of £127 310, which the directors propose to carry forward, in view of the unsettled liability for E.P.D. The pending proposals for additional submarine telegraph cables to be laid in the Atlantic and Pacific Oceans obliged the directors to order a new cable ship to replace the old c.s. "Faraday" and it was delivered on April 13 last. The expenditure of about £200 000 on additions to the lead cable shops and their equipment with machinery has been decided upon. The company's business in metallic filament incandescent lamps has been amalgamated with that of the English Electric Company, under the name of "Siemens and English Electric Lamp Company." A dividend of 10 per cent., tax free, was paid for 1921.

ANCHOR CABLE CO., LTD.—The report for 1922 states that profit was £7 081, and £104 132 was brought forward. After deducting interest on debenture stock (£2 250), it is proposed to pay a dividend forthwith of 10 per cent., less tax, making a total dividend for the year of 20 per cent., leaving £95 963 to be carried forward.

CALLENDER'S CABLE AND CONSTRUCTION CO., LTD.—The report for the year 1922 shows a record net profit of £207 788, an increase of £34 776. Gross profit was £443 210, against £414 812 for 1921 and £381 100 for 1920. Balance available, after deducting £100 000 for interest, dividend and depreciation, and including £150 112 brought in, is £301 901, compared with £225 112, and the directors recommend payment of a dividend of 15 per cent. less tax, for the year, making the fourth year in succession that such a rate has been paid, leaving to be carried forward £226 901.

JOHNSON AND PHILLIPS, LTD.—The accounts for 1922 show profit on trading, etc., after making provision for bad and doubtful debts, and charging to revenue £9 000 for maintenance of buildings, plant, etc., of £82 977, making with balance brought in and profit on realisation of investments (£4 779) £102 894. Directors', auditors' and trustees' fees, interest on debenture stock, reserve *re* debenture sinking fund, income-tax and corporation tax and depreciation of machinery and plant required £62 905, leaving available £39 989. A dividend of 5 per cent. on the ordinary shares, less tax, is recommended, carrying forward £18 114.

Telegraph Companies.

GREAT NORTHERN TELEGRAPH CO.—The directors' report for 1922 states that the restoration of the company's cables broken during the war is now complete. The old cable steamer "H. C. Orsted" was sold for breaking up after the company had taken over the new steamer, the "Edouard Suenson" in October last. During November the new cable steamer destined to replace the "Store Nordiske" (after which ship it has been named), left directly after her completion for the Far East with a full cargo of spare cable. The company has fully resumed its former activities in Russia. In January, 1922, the office at Petrograd was re-opened, and in March the through service to the Far East *via* Petrograd-Irkutsk-Blagowestchensk-Harbin-Peking was resumed. After the restoration of the Kiachta line in September the company was in possession of two reliable routes between Irkutsk and Peking. In November last, the company opened its new office at Moscow, which is connected by a direct wire with the company's Petrograd office, thus establishing a quick and reliable telegraphic service between the Russian capital and Western Europe and America. The Moscow office, also, participates in the transmission of traffic between Europe and the Far East by a wire between Moscow and Irkutsk, which the Russian Administration places at the company's exclusive disposal whenever necessary. The company has thus two independent routes between Petrograd and Irkutsk. Both the Russian Government and the company have within one year fully carried out the programme for the latter's operations in Russia, as laid down in the Concession. The lines are maintained in perfect order by the Russian Government, with whom relations have been completely satisfactory. There is a steady increase in the traffic ordered by the public for transmission *via* the Great Northern route. The financial results thereof have, however, only partly manifested themselves in 1922. Negotiations with the United Kingdom and Sweden in connection with a prolongation of the company's concessions in these two countries have been continued, but have not yet been brought to a conclusion. Negotiations with China for a prolongation of the agreements between the Chinese Government and the Eastern Extension Australasia and China Telegraph Company and the Great Northern Company, which agreements expire in 1930, have been postponed. The Chinese and Japanese Governments some time ago entered into an agreement for the joint ownership and joint working of a cable which, during the war, was laid by Japan between their respective countries. The opening of this cable for correspondence would constitute a violation of the company's concessions; the negotiations for a settlement of this matter are pending. Wireless telegraphy has deprived the cable companies of a certain amount of traffic. The Governments own the wireless stations in question, and do their utmost to improve the financial results of the working by directing the traffic *via* radio instead of *via* privately-owned cables. Traffic receipts are down about £194 000; interest is £10 850 less. Sundries show an increase of £16 800, and the net decrease in revenue is consequently £188 000. Expenditure shows a decrease of £61 200, exclusive of rates and taxes, after allowing for contribution to the Pension Fund. The taxes paid by the company amount to £53,600, or £257 800 less than in 1921 in consequence of decrease of assessable income and reduction of dividend (24 per cent. for 1920 against 22 per cent. for 1921) which resulted in lower taxes being paid in France, where the rate of taxation varies in accordance with the dividends paid, and, finally, the income tax has been reduced both in Denmark and in other countries. Notwithstanding the considerable decrease in revenue, the Board propose the distribution of a total dividend and bonus of 22 per cent., to allot to the reserve and renewal fund £33 333 6s. 8d., and to carry forward £309 760, practically the same amount as the previous year.

SUBMARINE CABLES TRUST.—Revenue for the year to April 15th last was £36 013, and expenses were £1 831, leaving a balance of £34 182, to which is added £50 brought forward, making an available balance of £34 232. After providing £6 948 for the payment of coupons, £27 229 has been transferred to redemption fund.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

MOUNTSTEPHEN, SPRINGHAM AND CO., 8A, Clarence Street, Richmond, electrical engineers. £11 7s. 10d. March 27th.

WRIGHT, Robert (trading as ROBERT WRIGHT AND CO.) 34/6, Oxford Street, W., electrical engineer. £27 12s. February 2nd.

Deeds of Arrangement.

GARDNER, William Alfred, and HARRY, Alice Hester, trading as GARDNER ENGINEERING CO. at Greyhound Works, Milton, general and electrical engineers. Filed May 10th. Trustee, A. C. Towers, Guildhall Road, Northampton, I.A. Secured creditors, £1 795; liabilities, unsecured, £5 333; assets, less secured claim, £2 700.

WHITE, Alfred, 4, Norfolk Street, Sunderland, electrical engineer. Filed May 2nd. Deed of Inspectorship, with licence to debtor to carry on the business with a view to gradual payment of debts by rateable distribution. Inspector, W. Davison, West Sunniside, Sunderland, C.A. Liabilities, unsecured, £2 434; assets, less secured claims, £2 870. The following are creditors: Sun Electrical Co., Ltd., £78; Pritchett and Gold and E.P.S. Co., Ltd., £66; India Rubber Gutta Percha Co., Ltd., £71; Siemens Bros. and Co., Ltd., £55; Mullard Radio Valve Co., Ltd., £65; Siemens and English Electrical Lamp Co., Ltd., £126; Telephone Manufacturing Co., Ltd., £91; Metallic Electrical Engineering Co., Ltd., Birmingham, £81; Oldham and Sons, Ltd., Denton, £129; Metropolitan-Vickers, Ltd., Manchester, £95; North British Engineering Equipment Co., Ltd., Newcastle-on-Tyne, £69; General Electric Co., Ltd., £62; Concordia Electric Wire Co., Ltd., New Sawley, £56; Davison, W., Sunderland, £50.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

NICHOLLS, Charles James, 7, Park Street, Bridgend, electrical engineer. A meeting of creditors was held on May 10th, at the offices of Clarke Dovey and Co., Cardiff, when the statement of affairs showed total liabilities £867 (trade creditors £496), and assets £435, a deficiency of £432. It was reported that the debtor commenced business in September, 1920, with a capital of £40, while he had borrowed small sums from his wife. Books of account had been kept and the debtor attributed his present position to want of capital and pressure by creditors. He desired to continue the business and made an offer of a composition of 6s. 8d. in the £. After discussing the position, it was decided that the debtor should be given time in which to find security for the payment of a composition of 10s. in the £ by three equal instalments at three, six and nine months. A committee of inspection was appointed, consisting of Mr. E. M. Lewis, Cardiff, and representatives of the General Electric Co., and Simpson, Baker and Co. The following are creditors:—Simpson, Baker and Co., Bristol, £46; Electromotors, Ltd., Manchester, £42; General Electric Co., Cardiff, £62; Pritchett and Gold, London, £54; Simplex Conduit, Ltd., Birmingham, £19; Watson, A., Bridgend, £70.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-Up Voluntarily.

RADIO INSTALLATIONS, LTD.—Geo. W. Askew, 14, St. Mary Axe, London, E.C.3, Chartered Secretary, appointed liquidator. Meeting of creditors at the office of the liquidator, 14, St. Mary Axe, London, E.C.3, on Monday, May 28th, at 1 p.m.

Bankruptcy Information.

THORNE, George John Cecil, and THORNE, Albert Harry, lately carrying on business at 159, High Street, Notting Hill Gate, London, W.8, under the style of LAWRANCE ELECTRICAL TRADING CO., electrical engineers. Receiving order, May 9th. Debtor's petition. First meeting, May 24th, 11.30 a.m., and public examination, June 26th, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

WILKINSON, Sam George, electrician, lately carrying on business at 76, High Road, Wembley, Middlesex. Receiving order, May 7th. Creditor's petition.

Notices of Dividends.

DAVIS, William Aaron, lately at 3, Coronation Street, but now 14, Basinghall Street, Leeds, electrical engineer. Supplemental dividend of ½d. per £, payable May 24th, Official Receiver in Bankruptcy, 24, Bond Street, Leeds.

HUMPHRY, George William, 24, Broad Quay, Bristol, under the style of HUMPHRY ELECTRIC COMPANY, electrical engineer.—First and final dividend of 5½d. per £, payable May 22nd, Official Receiver's office, 26, Baldwin Street, Bristol.

Notice of Intended Dividend.

CHADFIELD, Cecil Richard Almas, 12, Nottingham Street, Melton Mowbray, Leicester, electrical engineer. Last day for receiving proofs, May 26th. Trustee, E. Barlow, Official Receiver, 1, Berridge Street, Leicester.

Edinburgh Gazette.

MACMILLAN, John Gibb, trading as THE GLASGOW ELECTRICAL SUPPLIES CO., 138, Bath Street, Glasgow. Estates sequestrated, May 8th. Meeting to elect Trustee and Commissioners, at 12 noon, on Tuesday, May 22nd, in the Faculty Hall, St. George's Place, Glasgow.

Bankruptcy Proceedings.

PILBROW, Frederick Arthur, trading as H. AND J. WEST, 7B, Stoke Road, Gosport, electrical engineer. The public examination of this debtor took place at Portsmouth on Monday, on a statement of affairs showing liabilities £320 (£293 expected to rank), and assets £94. Debtor in February, 1920, purchased the stock and trade effects of the business of an electrical engineer at 52, King's Road, Gosport, which had been carried on in the name of H. and J. West. No figure was agreed upon, but he was to take over the effects at cost price. In December, 1920, he removed to his present premises, 7B, Stoke Road, Gosport. Since taking over the business there had been a scarcity of work and for the last two years he had known he had been insolvent. Recently he had been sued by creditors and executions levied which caused him to file his petition. He had kept no cash book, or creditors' ledger and had never at any time prepared any accounts which would have shown him the result of his trading or his financial position, and the figures in his deficiency account, which on last year's trading showed a profit of £15, were mainly estimated. He was unmarried and had no household furniture. The examination was closed.

RUKIN, Pearson, Manchester Road Station, Bradford, electrical engineer. The statement of affairs shows gross liabilities £3 952 (£3 777 expected to rank), against assets £1 289, or a deficiency of £2,488. At their statutory first meeting the creditors decided to appoint Mr. John Draper, I.A., of Bradford, as trustee, while a committee of inspection was also nominated.

Prices of Metals, Chemicals, etc.

TUESDAY, May 15.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£70 0 0	—	£3 15 0
Electro Wirebars	,,	£77 0 0	—	£3 0 0
H.C. Wire, basis	per lb.	10⅜d.	—	⅛d.
Sheet	,,	11⅜d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2¼d.	—	⅛d.
Brass 60/40—				
Rod, basis	,,	7⅛d.	—	—
Sheet, basis	,,	10⅛d.	—	—
Wire, basis	,,	10⅛d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£6 10 0	—	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 10 0	—	—
Lead Pig—				
English	,,	£26 5 0	—	
Foreign or Colonial	,,	£25 2 6	2s. 6d.	
Tin—				
Ingot	,,	£199 10 0	—	£11 0 0
Wire, basis	per lb.	2s. 7½d.	—	1⅛d.
Aluminium Ingots	per ton	£115 0 0	£5	—
Spelter	,,	£29 15 0	—	£2 7 6
Mercury	per bottle	£10 10 0	10s.	—

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2½d.
,, (Roll-Brimstone)—,, £8 5s. *Sulphuric Acid* (Pyrites, 168°) per ton, £7 10s.
Copper Sulphate.. ,, £26 10s.
Boric Acid (Crystals). ,, £50 *Sodium Bichromate*.—Per lb. 4⅛d.
Rubber.—Para fine, 1s. 2½d.; plantation 1st latex, 1s. 2d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

172 935 SIEMENS AND HALSKE AKT.-GES. Closed circuit relays. (11/12/20.)
192 476 W. R. BULLIMORE. Thermionic valves. (1/11/21.)
192 484 THREE STAR ACCUMULATORS, LTD., and F. C. GRUND. Storage batteries. (3/11/21.)
171 983 GES. FUR DRAHTLOSE TELEGRAPHIE. Wireless receiving systems. (24/11/20)
171 097 DR. E. F. HUTH GES., and K. SCHWARZ. Signalling by high-frequency oscillations over line wires. (2/11/20.)
192 518 JOHNSON AND PHILLIPS, S. A. STIGANT, and E. BARTON. Tapping switches for changing voltage ratios of transformers. (11/11/21.)
192 519 C. A. and F. J. MILLER. Electric cycle lamps. (12/11/21.)
192 521 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Electric terminals. (14/11/21.)
174 043 GES. FUR DRAHTLOSE TELEGRAPHIE. Thermionic oscillating generators (11/1/21.)
174 335 C. BOURGEOIS. Electric warp stop-motions for looms. (13/1/21.)
192 565 C. J. EVANS. Intermittently-operating circuit-closing devices. (3/1/22.)
192 573 E. C. R. MARKS (GOODMAN MANUFACTURING CO.). Controlling devices for electric locomotives. (4/1/22.)
192 574 W. GEE. Fuse-carrier for distribution boards. (5/1/22.)
192 587 METROPOLITAN-VICKERS ELECTRICAL CO., N. E. NORTH, and J. P. CAMPBELL. Air-connections for electro-magnetically-actuated valves. (17/1/22.)
192 589 G. H. SCHOLES, A. W. and L. B. CLAREMONT (legal representatives of E. A. CLAREMONT, deceased). Fusebox. (19/1/22.)
192 590 A. C. SMITH. Spring contacts for switches, fuse holders, etc. (19/1/22.) (Cognate Application, 2 791/22.)
192 592 L. G. PRESTON, B. HODGSON, and H. G. HUGHES. Thermionic valves. (24/1/22.)
175 612 SIEMENS AND HALSKE AKT.-GES. Telephone systems. (19/2/21.)
192 614 BERRY'S ELECTRIC, LTD., and H. H. BERRY. Switches. (8/2/22.)
180 635 FELTEN AND GUILLEAUME CARLSWERK AKT.-GES. Apparatus for measuring intensity of cross-talk between lines of multiple-wire telephone system. (26/5/21.)
192 636 E. SCHRODER. Electric welding and heating devices. (22/3/22.)
180 984 METROPOLITAN-VICKERS ELECTRICAL CO. Systems of electrical distribution. (3/6/21.)
192 673 PHILIPS' GLOEILAMPENFABRIEKEN and DR. G. HOLST. Electric discharge tubes with two or more electrodes. (20/9/22.)
191 084 J. B. ENTZ. Electric power transmission systems for vehicles. (5/11/20.) (Divided Application on 171 090.)
168 049 R. BOSCH AKT.-GES. Magneto-electric machines. (23/8/20.)
192 730 G. F. JOHNSTON and E. G. SCHWUCHOW. Electrical etching-machines. (13/9/21.)
192 735 H. H. CARELLI and E. SORDELLI. Radiological table for examining body by X-rays. (6/10/21.)
170 573 R. BOSCH AKT.-GES. H.T. ignition systems. (23/10/20.)
170 574 G. W. HOAR. Canopies for electric-light fixtures. (22/10/20.)
192 744 G. S. KEMP. Electrical condensers. (13/10/21.)
192 755 W. E. KNORR. Electrically-controlled locks. (4/11/21.)
192 761 H. FOXTON. Dynamo-electric machines having variable-speed drives for motor vehicle lighting. (7/11/21.)
179 890 HENGELOSCHE ELECTRISCHE EN MECHANISCHE APPARATENFABRIEK. Induction motors. (12/5/21.)
171 388 ALLGEMEINE ELEKTRICITATS GES. H.T. paper-insulated lead-covered cables. (8/11/20.)
192 785 L. G. PRESTON and G. SHEARING. Signalling apparatus for wireless telegraphy. (9/11/21.)
171 394 G. SOMAJNI. Dynamo-electric machines. (10/11/20.)
192 795 L. G. PRESTON and N. SHUTTLEWORTH. High frequency coils for wireless telegraphy. (11/11/21.)
192 796 C. A. and F. J. MILLER. Bulb-holders for electric lamps. (12/11/21.)
192 797 C. A. and F. J. MILLER. Dynamos. (12/11/21.)
192 798 C. A. and F. J. MILLER. Friction-driven dynamos for attachment to bicycles. (12/11/21.)
192 806 A. S. CACHEMAILLE (WESTINGHOUSE LAMP CO.). Voltage regulating systems. (15/11/21.)
192 815 H. WELD-BLUNDEL. Adapters and wall sockets. (17/11/21.)
192 817 J. STONE & CO. and A. H. DARKER. Electric heaters. (17/11/21.)
192 835 A. L. DAVIS. Electric telegraphs. (24/11/21.)
192 852 ALLOY WELDING PROCESSES, LTD., and E. H. JONES. Electrodes for soldering and depositing metals. (1/12/21.)
192 861 H. S. COOKE. Electric switches. (7/12/21.)
192 885 G. E. LOUBIERE. Electric heaters for water and other liquids. (23/12/21.)
192 894 J. H. RUNBAKEN and W. TORRANCE. Commutators or current distributors of ignition systems. (16/1/22.)
192 918 FERRANTI, LTD., and A. H. HIGGS. Protective arrangements of electrical generating, transmission, and distribution systems. (6/2/22.)
192 922 S.E. AND C. RAILWAYS MANAGING COMMITTEE and G. ELLSON. Live-rails or conductors in systems of electric traction. (8/2/22.)
192 923 J. R. P. LUNN. Concentric cables. (8/2/22.)
192 932 A. HEWER and A. A. SHARPLES. Apparatus for generation of electricity. (20/2/22.)
176 004 R. BOSCH AKT.-GES. Switches. (25/2/21.)
192 936 W. E. BARBER and H. J. WARNER. Coils for wireless apparatus. (25/2/22.)
192 940 R. and J. G. STIRK. Control of motors. (1/3/22.)
192 959 H. W. UNDERHILL. Electrical operation of automatic weighing-machines. (23/3/22.)

APPLICATIONS FOR PATENTS.

April 30th.

11 559 F. I. HOFFMAN. Magneto dynamos for motor vehicles.
11 564 W. E. POOLE. Crystal detectors.
11 578 G. BRANGHALL. Electric clocks.
11 580 B. W. HECHT (KAUFMAN). Device to be fixed to clocks for opening and closing electric circuit.
11 583 D. GIBSON AND CO. and E. SCOTT. Electric couplings.
11 585 H. MCKENZIE. Cutting metals by electric carbon or oxy-acetylene processes.
11 588 T. H. KINMAN. Wireless systems.
11 594 GENERAL ELECTRIC CO. Electric luminous discharge lamps. (20/1/23, Germany.)
11 610 G. CLARK and S. G. LEACH. Electric fans, etc.
11 622 SOC. ANON. POUR L'EQUIPMENT ELECTRIQUE DES VEHICLES. Limiting intensity of current. (14/6/22, France.)
11 638 ENGLISH ELECTRIC CO. and E. S. RAYNER. Electric vehicles.

May 1st.

11 657 TEMPLE COX RESEARCH CO. and R. TEMPLE. Protection and functioning of thermionic valves.
11 681 A. S. JONES. Microphone relays and receivers.
11 682 A. S. JONES. Loud speakers and receivers.
11 683 G. J. R. JOYCE and J. ROBINSON. Wireless direction finder.
11 684 H. W. PEARCE and J. F. POLLARD. Loud speaking wireless sound box.
11 691 W. H. COLLINS. Variometers for wireless receivers.
11 699 SHAFTESBURY WIRELESS AND ENGINEERING CO. Terminals for electrical apparatus.
11 701 ENGLISH ELECTRICAL CO. and W. E. M. AYRES. Arrangements for phase compensation and slip adjustment in asynchronous motors.
11 711 A. F. SEARLE, C. C. GARRARD and A. H. RAILING. Switches.
11 715 SIEMENS BROS. AND CO. and D. A. CHRISTIAN. Telephone systems.
11 716 SIEMENS BROS. AND CO. and W. G. PATTERSON. Telephone systems.
11 722 WESTERN ELECTRIC CO. Loaded signalling conductors. (2/5/22, U.S.)
11 747 AUTOMATIC TELEPHONE MFG. CO. Electromagnetic relays, etc.
11 748 AUTOMATIC TELEPHONE MFG. CO. Telephone systems. (6/7/22, U.S.)
11 756 W. H. HEISE and J. SCHURCH. Electric vehicles.
11 778 PHILIPS' GLOEILAMPENFABRIEK. Cutting continuously moving glass tubes. (3/5/22, Holland.)
11 786 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Filaments for lamps, etc.

May 2nd.

11 814 T. P. RENNOLDSON and H. W. HUTCHINSON. Electric starting gear for engines.
11 793 G. B. BURNSIDE. Electromagnetically actuated acoustic diaphragms.
11 795 C. E. CASTELLAN and E. H. CHAPMAN. Inductance coils for wireless receivers.
11 819 P. A. MCCARRY. Winding electric coils.
11 827 G. S. WILSON. Loud speakers.
11 830, 11 831 and 11 832 T. W. CASE. Electrical translation of sound waves into light waves and reproduction of photographic record of same.
11 836 R. C. WATKINS. Lead-in wires for wireless apparatus.
11 837 A. P. PORTWAY. Thermionic valves.
11 842 K. ROTHERHAM and H. N. SMITH. Connecting devices for conductors.
11 843 D. GRIMES. Receiving circuits for wireless telegraphy. (19/9/22, U.S.)
11 857 B. PEEBLES AND CO. and G. HENDERSON. Motor converter starter.
11 864 R. H. RICE. Connecting wires to terminals.
11 865 T. F. GAYNOR and E. S. JOHNSON. Crystal detector.
11 869 L. LUMIERE. Loud speakers.
11 870 R. O. MCGOWN. Outdoor aerials.
11 874 IGRANIC ELECTRIC CO., A. H. CURTIS and A. H. MACKLEY. Motor controllers.
11 876 A. W. COATES and A. SOUTHGATE. Thermionic valves.
11 878 H. S. COLEMAN. Electric advertising devices.
11 881 RADIO COMMUNICATION CO., R. E. BESWICK and R. FERGUSON. Panel boards for wireless apparatus.
11 896 A. J. P. MCCARTHY. Circuit-connecting devices.
11 897 H. K. WHITEHORN. Insulation of conductors.
11 901 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO.). Filaments for lamps, etc.

May 3rd.

11 914 J. KNIGHT. Electric lamp holder and shade.
11 924 and 11 925 A. T. HARROP. Trolley heads.
11 930 J. H. JONES and H. J. JOHNSON. Electric lamp shades.
11 947 F. ASHWORTH. Prevention of infection by telephone mouthpieces.
11 952 F. HORRIDGE. Apparatus for producing rhythmical variations of intensity in constant electric currents.
11 957 W. J. POLYBLANK. Insulators.
11 961 R. GARRETT AND SONS. Control of electric vehicles.
11 964 P. CLARK AND CO., P. R. CLARK, E. E. EDWARDS and G. G. KOOP. Automatic cut-out for electric boiling vessels.
11 979 J. H. RUNBAKEN and W. TORRANCE. Changing accumulators.
11 982 WIRELESS EQUIPMENT, LTD., and G. W. HALE. Interlocking devices for controlling electric circuits.
11 986 ELECTRIC PROPULSIONS CO. and W. H. SHORTER. Transmission or reproduction of sound.
11 988 C. R. HODGSON. Electric furnaces.

May 4th.

12 011 F. AKISTER. Inductance coils for wireless telegraphy.
12 015 E. A. AND E. Y. WALSH. Trucks for tramway vehicles.
12 020 J. A. G. HARRISON. Tumbler switch attachment.
12 028 E. JOST. Electric liquid heaters.
12 029 WALSALL HARDWARE MFG. CO., A. E. MILLARD and A. E. READ. Switch plates.
12 032 J. H. BRADLEY. Electric couplings.
12 034 H. B. C. POLLARD. Time switches and signalling devices.
12 042 E. D. YOUNG. Telephone receivers.
12 046 G. EDWARDS. Wireless crystal holders.
12 051 J. S. JAYES and R. W. R. PHILLIPS. Wireless receivers.
12 064 DUBILIER CONDENSER CO. and P. R. COURSEY. Switches.
12 080 E. GRAICHEN. Electrical machines. (4/5/22, Germany.)
12 085 PHILIPS' GLOEILAMPENFABRIEK. Simultaneously sealing a number of glass tubes. (19/3/23, Holland.)

May 5th.

12 028 FALKIRK IRON CO. Electric fire-bars.
12 124 H. BERTELSEN. Head bands for telephones.
12 128 A. R. WOOD. Electric fire-bars.
12 132 A. FORD-LLOYD and A. STAGG. Wireless receivers.
11 151 A. REYROLLE AND CO. and F. H. LINSTOW. Electric time element devices.
12 159 A. F. SYKES. Electric insulating apparatus.
12 160 W. T. HENLEY'S TELEGRAPH WORKS CO. and H. W. BREEZE. Fuse fittings.
12 161 W. M. EDWARDS and O. E. YEO. Crystal detectors.
12 171 E. GRANAT. Electric transmission systems. (24/5/22, France.)

Arrangements for the Week.

FRIDAY, MAY 18th. (To-day.)

ROYAL INSTITUTION OF GREAT BRITAIN.

9 *p.m.* At the Institution, 21, Albemarle Street, Piccadilly, London, W. Lecture by Mr. W. M. Mordey on "Recent Studies on Alternating Magnetism."

ELECTRICAL POWER ENGINEERS' ASSOCIATION.

7 *p.m.* At the Institution of Electrical Engineers, Victoria Embankment, London, W.C.2. Lecture on "Combustion of Fuel," illustrated by film, by Mr. Charles Erith.

THURSDAY, MAY 24th.

ROYAL INSTITUTION OF GREAT BRITAIN.

3 *p.m.* At the Institution, 21, Albemarle Street, Piccadilly, W.1. Lecture by Prof. E. G. Coker on "Engineering Problems Solved by Photoelastic Methods."

FRIDAY, MAY 25th.

PHYSICAL SOCIETY OF LONDON.

5 *p.m.* At the Imperial College of Science, South Kensington, S.W. (1) Paper by Prof. C. H. Lees and Mr. J. E. Calthrop on "The Effect of Torsion on the Thermal and Electrical Conductivities of Metals." (2) Paper by Mr. A. Rosen on "The Use of the Wien Bridge for the Measurement of Dielectric Losses." (3) Demonstration by Mr. C. R. Darling on "The Production of an Intermittent Pressure by Boiling Water." (4) Demonstration by Dr. N. W. Maclachlan on "A Novel Instrument for Recording Wireless Signals."

INSTITUTION OF ELECTRICAL ENGINEERS.

7 *p.m.* At the Institution Building, Savoy Place, Victoria Embankment, London, W.C.2. Paper by Mr. V. S. Manyam on "The Supply and Distribution of Electricity," preceded by Annual General Meeting.

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CONTENTS.

Notes of the Week	551	Three Electricity Schemes Considered	575
Research and Selling	553	Merchandise to Sell and Profit By. Illustrated	576
Industrial Research. By Clifford C. Paterson	554	Parliamentary Intelligence	578
New Research Laboratory for Sheffield	556	Legal Intelligence	579
Magnet Steels. By J. Ferdinand Kayser. Illustrated	557	Electrical Imports and Exports	579
The Make Up Feed Question. By James Maclean	559	Books Received	579
New A.S.E.A. Locomotives. By Paul Friebel	560	Rating of Machinery	579
The Manufacture of Electric Motors in Quantities. By W. F. Higgs. Illustrated	561	Imperial and Foreign Notes	580
		Exhibitions Booming	580
		Business Items	580
Expeditious Handling of Work in the Winding Department. By W. J. Hiscox	563	Electricity Supply	581
		Personal Items	581
Electricity Supply at Crowborough	564	Obituary	581
Protective Devices Against Earthing	565	Tenders Invited and Accepted	582
India's Electrical Requirements	566	Leeds Tramway Disaster	582
Railway Electrification in South America (continued). Illustrated	567	Electric Traction	583
		Institution Notes	583
Renewing Electric Lamps. By E. Gamba. Illustrated	569	Wireless News	583
An "All-Electric" House at Manchester	570	Commercial Intelligence	584
The Royal Society Conversazione	571	Companies' Meetings and Reports	585
Sub-station Advertising	571	Prices of Metals, etc.	585
Selling Wireless. By D. M. Wilson	572	Patent Record	586
The Drive of Power Station Auxiliaries	573	Arrangements for the Week	586
Advertising in the Engineering Press. By Hugh M. Goody	574		

Notes of the Week.

The Position of Technical Education.

We gather from Mr. W. R. Bower's presidential address to the Association of Teachers in Technical Institutions, which was delivered on Monday last, that the position of these useful elements in our sociological compound is not a happy one. The good they do, and the greater good they might do, remain equally almost unrecognised, and though since 1859 the number of pupils in our technical institutions has increased from 500 to nearly 1 000 000, this rather exaggerates the true development in that field which Mr. Bower calls the Poland of education. We are not at all clear what it is suggested should be done to improve matters. The idea of the secondary schools seems to be to pass students to the Universities. In fact, only about 3 per cent. do so pass, and the curricula is ill adapted to the remaining 97 per cent. This indictment is probably true, and so long as scholarship chasing and the passing of examinations are the aim and object of those in charge it is likely to remain true. At present the aim of every bright, and otherwise, boy, is to do something in a black coat. We look forward to the Utopia when only those will work with their brains who are fitted to do so. Or rather, to the time when to do good work with the hands (which requires the exercise of the brains as well) will be looked upon as an object in life instead of a disgrace.

The Worth of Evening Classes.

We agree with Mr. Bower when he deplores the veiled contempt for evening classes implied in the refusal of some University authorities to recognise the work done in them. We have recently had the opportunity of inspecting at their work some of the evening classes in the technical institutions under the control of the London County Council. We have nothing but admiration for them. Both the teachers and students are keen, the organisation is good, and the results are satisfactory. At the same time, at the expense of accusing Mr. Bower of inconsistency, we feel this lack of recognition may be a good thing in view of what we have just stated. Universities are not a serious competitor in the field of technical education proper, and so long as no obstacle is placed in the way of those wishing to attain them doing so, this might be recognised and matters arranged accordingly. Technical educationists have more than enough to do in carrying out their own work of increasing the "scientific temper" without troubling over much with what is going on elsewhere. This applies with some force to the burning question of degree equivalents, about which there is a tendency to make too much. We commend those who disagree to certain lines by W. S. Gilbert.

China and Engineering Development.

More than one speaker at the recent Annual Dinner of the British Electrical and Allied Manufacturers' Association called the attention of the electrical industry to the need for developing its trade within the Empire. Important as this is it is not the end of that Association's duties; and more and more attention should also be given to increasing our trade with foreign countries. The less the country has been tapped from the industrial point of view the more the need for getting to work without delay to realise its electrical possibilities. This particularly applies in the case of China, where, as we showed some months ago, the electricity supply industry is making rapid progress—a progress which must carry with it, a greatly increased demand for cables, motors, fittings and other electrical apparatus. But if this progress is analysed we discover two things—one that most of the development is within the spheres of foreign influence, such as Shanghai, and the other that a great deal of the business is going to the United States. Both these things suggest that a policy of greater activity

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is necessary both for B.E.A.M.A. and for individual electrical firms.

How to Solve the Problem.

In this connection attention may be drawn to an article on "British Engineering and the Chinese Market" which recently appeared in "The Engineer." The writer shows that the present organisation is inadequate to deal with real development, that existing firms of merchants for various reasons cannot be expected to tackle the problem and that what is required is a thorough investigation of the potential market with a view to learning as much as possible about its conditions. This is necessary if the establishment of agencies only is considered, but what is urgently required is greater co-operation between the manufacturer on the one hand and the merchant organisations in China on the other. This co-operation includes the attachment of manufacturer's experts to merchant firms, and independent manufacturers' organisations to which technical experts shall be attached. The writer insists that sales policy in China must be determined *de novo* and that the present time is especially opportune for such an investigation to be made. We should like to see these recommendations adopted and at any rate we hope that more attention will be given to the possibilities of a market whose richness and wideness can hardly be overrated.

The Use of Reflectors.

In view of the many discussions before the Illuminating Engineering Society on different aspects of lighting it may seem superfluous at the present time to emphasise the value of reflectors. Yet it is often found that principles endorsed at headquarters take a long time to penetrate to the rank and file, and anyone who has had occasion to visit large numbers of workshops must often have noted cases where the value of reflectors is strangely overlooked. The paper on the subject recently read by Mr. N. Thornton before the Junior Institution of Engineers, while summarising points familiar to experts, is therefore useful. It is a pity that the public does not as yet sufficiently appreciate the fact that in many cases quite 80 per cent. of the light yielded by an unscreened lamp may be wasted. The essence of good illumination is proper direction of light and in general this can only be effected by the use of suitable reflectors. In a new factory, where the lighting is planned out on modern lines from the start, the use of reflectors is accepted by workers as a matter of course. But when improvements are made in existing installations it is sometimes found that there is a singular tendency amongst workers to remove reflectors and rely on the bare lamp, even in cases of local lighting where this practice must greatly diminish the illumination available on the work. Theoretically the practice is indefensible, but from the psychological standpoint it deserves study. We fancy that in some instances, especially in the case of workers who are advanced in age, the practice might be traced to special defects in the eyesight. It has been stated that glare may occasionally produce a temporary improvement in the acuteness of vision, though in the long run this benefit is more than counterbalanced by the continual strain on the eyes. Such cases deserve investigation and the patient illuminating engineer might occasionally get a useful hint from the "cussedness" of those who refuse to obey well-established principles.

A Lesson from Italy.

When, as periodically occurs, an agitation breaks out in this country against our Government telephone system there are never wanting demands that the whole thing should be handed over to private enterprise for reasons which our readers can imagine and which we need not describe. It is, therefore, interesting to learn that a recent Italian Royal decree empowers the Government to transfer the telephone system of that country to private enterprise, though we learn from the "European Commercial" that a hitch has occurred, partly owing to political reasons and partly owing to the stipulation that the concessionaires must obtain their new materials from the home industries. This latter stipulation not unnaturally renders the proposition unattractive, as there is no free market for telephone material in Italy, and the result would be a general increase in price. The terms of the transfer themselves are a little curious. The Government will still indicate what new constructional work is to be undertaken and may even require that it shall be undertaken. Twenty-five years is the term of the concession, subject to one year's notice by the State, the price being determined by arbitration. Five per cent. on the gross takings are to be paid to the State plus one-third of the net profits in excess of 7 per cent., one-half of the excess over 8 per cent., three-fifths over 9 per cent., while if the dividends exceed 10 per cent. the tariffs must be reduced. We learn that there is no great rush to take advantage of this offer, and at that we are not surprised.

Electric Houses and Water Supply.

The so-called "All-Electric" houses which are now springing up all over the country generally suffer from the disadvantage that the hot-water problem is circumvented by providing a coke boiler or by placing a similar device behind the grate in the sitting room. This grate incidentally is another sacrifice to convention. We are glad to see that an advance from this half-way position has been made in the "All-Electric" House which is now being demonstrated at Manchester. Although a supply of hot water can be obtained from a small fire-heated range in the living room, the hot water cistern is provided with an electrically heated circulator with three-heat regulation, and this gives an ample supply of hot water for all domestic needs. This is all very well, but we want to go further, and we would remind our readers that we are attempting to assist this advance in a practical way. We are giving three prizes, one of twenty-five guineas, one of fifteen guineas, and one of £5, for the best designs for an "all-electric" hotwater system in the house. These designs must be submitted for the consideration of Mr. J. Horace Bowden and Mr. C. G. Nobbs before June 29th next, and we shall hope shortly after that date to publish a real contribution to the problem. No time must be lost by those who have ideas on the subject.

Water Supply and Tariffs.

Inextricably mixed up with the problem of an electric water supply is, of course, the question of tariffs. At Manchester we are pleased to see an effort has been made to encourage electrical development by the provision of a low running charge. But if electrical hot water is really to become feasible we must either go a good deal further on these lines than has yet been done or, what is almost the same thing, we must alter our basis of charging. We still look forward with some optimism to the time when it will be possible for the owner of an all-electric house to buy his electricity by the kilowatt instead of the kilowatt hour, to keep his water heater continually in circuit and to have some automatic arrangement to ensure that the number of kilowatts for which he has paid shall not be exceeded. Until that time comes a low running charge, combined with a properly devised fixed charge, is the best substitute, and supply engineers would do well to do more in this direction.

Power Supply Progress.

In his speech at the annual meeting of the Shropshire, Worcestershire and Staffordshire Electric Power Co. last week Mr. Emile Garcke made two interesting observations. The one was to call attention to the rapid recovery of the company from the post-war slump. The figures for connections, in fact, hardly indicate that there was a slump

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at all. In 1914 an aggregate of 14 500 kW were connected to the company's system. In 1918 this had risen to 37 400 kW, in 1921 to 58 500 kW, and in 1922 to 61 200 kW. There is little indication of check here, and we hope the progress will continue. As it is the company has changed from an undertaking of normal size fit for supplying a town into one whose capacity is only limited by the enterprise and hard work which is put into its development. The second point made by Mr. GARCKE is not the less interesting and is even more significant. At first he said it had been a struggle to obtain consumers, now ordinary consumers were coming in satisfactorily and there was an increasing tendency on the part of those with distributing powers to ask for the bulk supply. We are delighted to hear it. Only by the concentration of generating plant in adequately large stations can satisfactory development be obtained, and even were this not the case there is a great deal to be said for confining the work of generation to those who are experts on the subject rather than that it should be undertaken by those who do not and cannot adequately understand the problem.

Research and Selling.

The trading results of the past year show that the electrical industry has weathered the depression. Calm weather and sunshine have not yet been attained in commerce any more than in meteorology, but without being too optimistic it may be said that the worst is over, and that there is every prospect of better times to come. This is confirmed by the ease and celerity with which money is being subscribed for new electrical issues. But arduous as the past few years have been in every branch of the electrical industry, the struggle has not been without its uses. It has enabled us to discover our strength and our weak spots. It would be in the highest degree unwise to neglect these lessons or to fail to apply the necessary buttresses to those parts which experience has shown require support. This is the more necessary as experience has indicated that the electrical industry has a great future before it, if those concerned will only revise their organisation in certain respects and exert greater energy and enterprise.

Two Points for Revision.

In this, the fourth Manufacturers Issue of THE ELECTRICIAN, we indicate one major and one minor way in which this revision can be effected. In an article on industrial research which we publish on another page of this issue, Mr. CLIFFORD PATERSON defines that branch of work as the experimental study of the principles underlying phenomena. This experimental study may lead to no results which can be expressed in pounds, shillings and pence, but at its worst it will add to our knowledge of the materials and processes which are more or less intelligently being used in engineering. We agree with Mr. PATERSON that "the greatest asset of an industry is technical knowledge of all sorts regarding its activities, and above all the knowledge of the principles or the reasons which underlie even its simplest details."

Is Research Any Use?

In opening the Research Laboratories of the General Electric Co. a short time ago, Sir J. J. THOMSON expressed surprise that anyone should question the value of research. We think that no electrical engineer would question its value, and if he did so it would be easy to confound him. Still it is not a little startling to find it argued that though in particular cases pure science (which is only another word for research) has been of benefit to industry, it cannot generally be said to have been of much assistance to engineering progress. In our opinion the whole of recent progress proves the contrary. In some cases practice has outrun theory, but when the latter has caught up, notable further progress has been made. In others theory has been far in advance of practice, but when the two have come together progress has been equally definite. There is such a thing as the pursuit of knowledge for its own sake, and that pursuit is to be encouraged. It is futile, as it is absurd, to try and strike at any moment a balance sheet between the values of work that has been done in the scientific and technical fields. But the fact remains that the more we can get to know about the true inwardness of things, whether it be in science, philosophy or art, the more likely are we to help material progress and bring about better conditions of existence.

Research Must Be Supported.

Research, therefore, must be supported by the electrical industry, supported, if it be necessary to argue so, as an investment. This is the major way in which the ideas of the electrical industry must be revised. And no time is better for doing so than when we seem at last to have reached the opening of a more prosperous era.

Research and Magnetism.

The other articles which we publish in this issue deal with more practical questions. Mr. J. F. KAYSER writes on "Magnet Steels"; Mr. W. F. HIGGS on the "Manufacture of Motors in Quantities," and Mr. W. J. HISCOX on "The Expeditious Handling of Work in the Winding Department." The first is a link with Mr. PATERSON'S article. Until recently permanent magnets were manufactured with very little knowledge of the metallurgical or magnetic properties involved. The work both of metallurgists and electrical engineers have changed this, and though finality has not been reached, it is not inopportune to give a review of the position. In the advances that have been made, the most important factor is the judicious use of the metal cobalt. Unfortunately its price is high, and that suggests in itself a line of work which might profitably be taken up.

The Economic Employment of Materials.

Having found out all there is to be known about the materials available for use, the next thing is obviously to employ them in the most economical way. This should be easier the more the product becomes standardised, and both Mr. HIGGS and Mr. HISCOX have some useful suggestions to make from this point of view. The object of these articles, and indeed the object of all the ingenuity that is being put into works organisation is, as Mr. HIGGS expresses it, to show that one penny saved on the selling price of a standard motor worth, say, £30 each working day for ten years, is equal to over £13, and represents a reduction of 43 per cent. These are points also to which manufacturers would do well to give increased attention.

The Most Important Problem of All.

The major point and the minor point which are specifically dealt with in this issue do not take into account the most important problem which faces the electrical industry at the present time. Research and works organisation are means to an end rather than the end itself. The end is to sell the product of the works to the consumer. What the electrical industry wants more than anything else at the present time is a selling policy. Such a policy has recently been put forward. It has good points; it also has points which are open to criticism. But at least it is effort to do something which badly wants doing. It is therefore disappointing to find that it has been received as little more than a pious expression of opinion. Yet increased business will not come simply through sitting down and waiting for it. We must advertise our wares, and we must make the way from the manufacturer to the consumer as smooth as possible. The public is beginning to take a great interest in electrical matters. That interest can be stimulated by a greater support of the British Electrical Development Association. But what is also wanted is a cheaper selling price, a greater good will, and a stimulation to buy, which can only come from efficient organisation and hard work.

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Industrial Research.

By CLIFFORD C. PATERSON.

(1) Tangible Results.

The conception of the nature of industrial research which is ordinarily in people's minds is worth examination, because one feels that it is frequently lacking in precision, and it is very important that a correct conception should prevail of industrial research, its aims, and the conditions under which its success is fostered. We can all visualise the results of research—when we turn to some of the greater advances which have been made in electrical engineering, most of which appear to be the direct outcome of physical research. But the confusion of research with the tangible results of its application leads inevitably to a wrong perception of what research comprises.

What Research Is.

First of all we may say that research is the experimental study of the principles underlying phenomena. It is not the production of new and valuable inventions. If the result of this study leads someone to apply these principles to the production of new or improved articles, well and good, but these efforts at application are not in themselves research, although they are constantly and rather naturally confused with it. It is true that research workers often have to apply the principles which they have been studying, but this is generally because there is no one else who has sufficient understanding of, or faith in the principles to do it.

Research and Application.

Frequently also, the only object of research which many people recognise, is some tangible new production—and they fail to realise that their research worker is trained and paid to seek out knowledge, not necessarily to apply it. Very often the man who seeks out the knowledge is the last man in the world to apply it successfully. When a principle is discovered or a scientific explanation found, of some process or phenomenon in engineering, those immediately responsible for using the process or applying the principle must make the new knowledge a part of their essential mental equipment, in the truth and practical value of which they place as much reliance as on the every-day proved facts of their existence. Even though the worker, who has discovered the knowledge, helps, as he usually has to do, in its application, the people whose real responsibility it is to produce the article or handle the process, should not feel that they are in any way relieved of the necessity of thoroughly mastering the knowledge regarding it. Thus the first application of research is to people rather than to processes.

The greatest asset of an industry is technical knowledge of all sorts regarding its activities, and above all, the knowledge of the principles or the reasons which underlie even its simplest details—knowledge, not merely in reports or in the brains of experts, but in the minds of people responsible for the industry. It is upon this knowledge that security for the present and progress in the future depends, and it is the primary object of research continually to add to it.

The Most Practical Result of Research.

The commercial man is reputed to be ever seeking, from the research worker, so called " practical results," by which are meant arresting and tangible applications of his knowledge. This is often, but not always, true. Many responsible industrial leaders realise that the most " practical result " of research is the knowledge gained for the use of themselves and their staffs, thereby permitting a more efficient and intelligent evolution of their industry. True, direct applications in the form of entirely new products or processes are very welcome to both industry and research. We like to see these pieces of definite evidence of the benefits brought about by research, but it is so often forgotten that these are merely isolated pieces of evidence which indicate the existence of a much greater movement which is in progress—i.e., the better understanding of the processes and phenomena of an industry by all concerned in it. It may be difficult to follow out the thousand ways in which this leaven—the leaven of enhanced knowledge—working through the industry, brings benefit to it through its own general engineering or production personnel. As often as not, this personnel is unconscious whence its knowledge has come, but that is not the important point. The reward of the research man has often come, when he, who preached alone two years ago to an incredulous industry, has heard his own sermon preached back to him by the aforetime sceptics.

If there is any truth in all this, and I am profoundly convinced that there is, then the man who looks always for the direct and arresting application of research is confusing the evidence of the movement with the movement itself, and has no true perspective of the bearing of research on industry. The research worker may, and often must, himself apply some of his discoveries in knowledge, but consider the enormously greater potency of that knowledge, when every engineer, in the factory or drawing office or supply organisation, has assimilated it, and uses it consciously or unconsciously, whether in his daily routine, or in those flights of imagination in which he has to formulate his own ideas for the improvement and development of the section of the organisation for which he is responsible. If we contemplate only the things he will have learnt *not* to do, a saving of money and energy is revealed which staggers the imagination.

Unfortunately in this imperfect world it often happens that circumstances prevent the industrial engineer from working out the application of research in his own realm. Factors which are often lacking are the necessary keenness or leisure, and sometimes even the mental equipment to grasp the knowledge to which he is introduced and which is essential to enable him to apply the results of research. Sometimes the reason is the danger of mixing production and development.

The Lot of the Research Worker.

And so in practice it often falls to the lot of the research worker to push right up to the point of practical adoption and even into production or operation, the results of his work. If he is a man whose temperament fits him for this, he is almost sure of success if given a reasonable chance; if not, he is often at the mercy of an unsympathetic works or operating engineer, and his work, excellent though it may be, is never applied. Here is the weakest point in all our research organisations, whether connected with the electrical industry or otherwise, whether run privately or publicly, and it is therefore this point that we ought to bear constantly in mind in connection with all schemes and organisations for research. But let not the fact that research workers frequently undertake certain applications of their own research lead us to think that such cases constitute the sum total, or even the chief part of industrial research.

Thus it is that when criticisms are levelled, and people ask where are the results, it is well to scrutinise very carefully the conditions under which successful application is expected to take place—and not too hastily to blame " Industrial Research." Have these conditions been studied as carefully as the research problems themselves?

(2) Conjoint Research.

Apart from the Universities, there are, at the present time, two principal kinds of agency for research in the electrical industry. The first is the type which is under the control of a single corporation and whose work is mainly directed towards the securing of knowledge bearing on the problems of that corporation. For instance, the Government services, as well as the larger electrical manufacturing companies, have usually strong research

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organisations for dealing with their own problems. But there is the second type of research agency, not yet so large as the first, but with very important functions for the whole industry, and within this category may be classed the electrical sections of the National Physical Laboratory and the Electrical Research Association. Of the N.P.L. little need be said—its record and work are known to everyone. It is desirable, however, at this time, to bring strongly before the industry the importance and the claims of the Electrical Research Association.

There are many problems in the electrical industry which cry out for attention, but which are either of such a general character as to lie outside the scope of the individual research organisation, or else which concern the electricity supply side of the industry. For such research there are at present no organised institutions with resources commensurate with the amount of research to be done.

Until now the Electrical Research Association has been financially supported by the electrical manufacturers and the Department of Industrial and Scientific Research, and has been responsible for a great deal of valuable research work of common interest to different branches of the industry. Sometimes this work has been of common interest to electrical manufacturers, at other times it has been of greater importance to the purchasers and users of electrical plant. The period during which this association can be exclusively supported by the manufacturers and the Government cannot continue indefinitely, and a strong movement is on foot to broaden the basis of the Association so that those corporations engaged in the industry, other than manufacturers, may throw their influence, financial and otherwise, into the support of the Association.

A Plea for a Broad Outlook.

I hope I may be permitted to put forward a plea for a broad outlook upon the question of such research as is of common interest to the whole industry. The time is rapidly passing when each individual or corporation engaged in some particular branch of the industry can look upon his concern merely as the agency from which, in competition with others, he extracts all he can. Hitherto the industry has grown up in a somewhat fortuitous way by individual effort seizing those chances of development and extension which seem to promise the best return for money invested. I do not question this principle of procedure. It is probably the only effective one. But it has resulted in some very weak spots in the industry, which it has been no one's business to remedy. In some directions it is essential to the welfare of the industry to seek to mitigate the ill effects of this extreme individualism by a certain amount of conjoint action. This is already being achieved in one direction by the co-ordinating work of the Electricity Commissioners. But in the realm of conjoint research we are far behind the real requirements of the industry. Research, experimental and statistical, into the big problems of the industry is urgently required.

Stimulating the Electrical Appetite.

To take one problem only in statistical research. The application of electricity all over the country is not increasing at a sufficiently rapid rate. The private citizen ought to be using more electrical gear and demanding more electrical energy. His appetite for the blessings of electricity is not sufficiently stimulated. Why is this? One of the first things we need in order to answer the question is a statistical investigation and comparison of the use of electricity for different purposes throughout the country, in order to find out why one district is ahead of another—and how we compare with other countries as regards the various electrical demands per head of the population. We should then begin to see where our weak spots are, and who or what is responsible for them. I do not want to suggest that there are at present no statistics, but what there are appear to be incomplete and uncoordinated.

Now the point I want to urge is, that each corporation which supports an organisation which is carrying out work of this kind does so for the purpose of advancing the whole industry, and the supporter along with everyone else will benefit by the work. And so it is with experimental research done for remedying a weak spot in the industry, be it the discovery of knowledge of insulation, the working out of proper testing conditions for a product or the determination of the carrying capacity of electric cables. What benefits one section of the industry helps everyone in it, because products or their conditions of use are improved or cheapened and further demand is created.

A Bright Suggestion.

This may seem an obvious contention, but when it comes to practice there is a temptation to forget it. Money spent on conjoint research may become the cause of serious difference of opinion, because one section of the industry would not consider that research was being done on what it deemed its own work in a degree commensurate with its contribution. If this attitude should become at all general it means the end of conjoint work, where conjoint work is required for everyone's benefit. How striking it would be to hear, let us say, of the cable makers voting sums for research on lamps, because they thought they could not hope to see their cable business increasing as they would like until electric lamps were more efficient and popular! Candidly, I cannot say that I expect anything to come of this particular suggestion, bright though it undoubtedly is, but there is one important truth to be remembered—i.e., that it might even pay one branch of the industry better to give money for research on another branch than to spend it directly on itself. We all pay lip service to the principle that backwardness in one part of the industry hinders all, and *vice versa*—but when it comes to the contribution and allocation of money for conjoint research, a less statesman-like view sometimes prevails. The Electrical Research Association is undertaking research which is of benefit to all manufacturers, but often the research is of more direct benefit to supply authorities than manufacturers. It is seeking now also to secure support from other sections of the industry as well as from manufacturers, and the movement deserves the most serious consideration from everyone whose interests are wrapped up with the progress of electrical engineering.

The Application of Research.

In the opening part of these notes I touched on the subject of the application of research to the factory or elsewhere. In what form is research to leave the laboratory? The answer to this question must, of course, depend on the circumstances, but where research is carried out for the assistance of a factory the matter deserves careful study.

In a good deal of the work in my own company (The General Electric Co.) the principle is adopted that research and experimental development should be kept out of the factory. We have, therefore, in the laboratory small factories where the articles in question are produced from beginning to end. At present we have four such laboratory-factories. A typical one is that for making tungsten wire. Here we start from the tungsten ore, chemically extracting the metal, pressing the metal powder into slugs which are formed into ordinary crystalline metal, hammered in swaging machines and drawn down through diamond dies into the finest wire. The whole of the processes are carried out by two men and a girl, and through this plant we can put wires with any ingredients we want, and study out, under rigid control, how tungsten is built up into a metal, and how its properties can be modified by heat, work and composition.

The influence on the wire of different conditions met with in lamps or in thermionic valves, is subsequently studied out in similar experimental lamp or valve factories, and at any stage in these factories, the research man can himself step in and manipulate the process and institute any measurements, or introduce whatever modifications

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seem to him desirable. Such factories combine a double purpose. They are tools for research, and they also constitute a means by which the application of our research can be thoroughly tried out, the product tested, and a demonstration given for the satisfaction both of factory and laboratory, of the practicability of new proposals. Even then, however, there is often a large step to take before factory production on the new lines is accomplished. In the first place the factory personnel has not had the same opportunity to familiarise themselves with the new methods as the laboratory personnel has, and they need help to understand them, just as the research personnel needs the help of the factory personnel. Secondly, there are sometimes troubles which show up when articles are made by the 10 000 in full production, but which are not discovered when they are made only by the 100.

So that even when the most complete arrangements have been made to try out things thoroughly in the laboratory, there is still needed the laboratory man who can see that things go properly in the works, and there is also needed the equally important factory man who can assimilate the laboratory work in spite of all his other preoccupations. And here we meet the greatest need of all in the application of research—the man who, knowing all about the research, can enter the field of factory production or of practical utilisation, not afraid to face awkward facts, having patience and sympathy with the difficult practical problems with which the people there are faced—but maintaining withal an unflinching belief in the knowledge he intends to apply, and a determination that it shall be applied under conditions which shall ensure success.

Without these characteristics there will be much failure and disappointment, and conditions will begin to arise in which managements ask where are the results, and why is so much money being spent on research. The answer usually is that the research is simply not being taken advantage of. It is stagnant—there is no pressure driving it from the laboratories, or no vacuum drawing it towards the factory or other field of application.

"Take It or Leave It" Research.

Unfortunately, research carried out at Universities and similar places has necessarily a "take it or leave it" character—and more often it is left than taken because, necessarily, research workers there have not to, and in fact cannot, consider the precise form of results which will make application easy. It is no one's business energetically to handle such research knowledge and force its application, and its utilisation depends on its coming to the attention of one of those exceptional production engineers or managers who have leisure to study and foresight and courage to apply.

The remedy is not easy to see, unless it be to secure more and more, in electrical production and utilisation, the services of men who combine with good driving and organising power a truly scientific education and mentality.

New Research Laboratory for Sheffield.

Thanks to the munificence of two local dignitaries, the Applied Science Department of the University of Sheffield has acquired research laboratories for investigations in magnetism, the magnetic properties of materials and allied subjects and for the mechanical testing of materials. The first of these is known as the Edgar Allen Laboratory after the late Mr. Edgar Allen who left £5 000 in his will for the purpose. The second is named after the late Mr. Joseph Jonas, who subscribed a similar sum. The work in connection with these laboratories has been delayed by the war, and they are even now incomplete, but sufficient has been done to enable a start to be made. The formal opening took place recently, the ceremony being performed by Sir Oliver Lodge.

The Edgar Allen Research Laboratory.

The equipment and organisation of the Edgar Allen laboratory has been designed and carried out by Dr. T. F. Wall for the purposes mentioned above. Several investigations have already been commenced. A variety of types of electricity supply are available, and from the main distributing board ring mains are installed round the laboratory, and are tapped off to four subsidiary terminal boards, from which the supply for any experiment is obtained at any convenient part of the laboratory.

In order to obtain in an economical manner very heavy alternating currents at low voltages, a 4 kVA transformer has been installed, of which the primary is normally connected to one phase of the 200 V, 50 frequency supply. The secondary winding is in sections, which may be coupled together in a number of different ways so that currents from 400 A at 10 V to 100 A at 40 V may be obtained.

A motor driven high frequency single phase alternator which is capable of generating current at frequencies up to 400 cycles per sec. is also installed. The frequency may be varied as desired so that a complete range of frequencies is available from about 3 cycles per sec. up to 400 cycles per sec. This set is useful for a large number of purposes, notably for investigating iron losses at high frequencies.

A Powerful Electro Magnet.

A very powerful electro-magnet has been built in the department, and is capable of excitation up to 60 000 AT. By the aid of this electro-magnet tests on small specimens may be carried out in very intense magnetic fields. Further, special pole pieces have been provided, so that investigations may be made on the influence of strong magnetic fields on certain electrical properties of materials.

A bar and yoke permeameter has also been constructed for testing magnetic specimens of about 7 in. in length. There is an Epstein square for measuring iron losses in laminated specimens, and also a Grassot fluxmeter which is useful for measuring the magnetic conditions of permanent magnets.

For calibration purposes a standard solenoid has been constructed of length 5 ft. 6 in., and having a search coil inserted and supported at the middle of its axis.

There is a Cambridge and Paul vernier potentiometer, comprising six dials and capable of measuring voltages from 1·8 V down to $\frac{1}{100\,000}$ V.

For measuring very low values of a.c. pressure, a series of vacuum thermo-junctions has been provided, by means of which alternating potential differences down to about $\frac{1}{10\,000}$ V may be measured with a high degree of accuracy. For measuring very low values of condenser capacities there is a Campbell (Carey Foster) Bridge, by means of which capacities down to about one-millionth part of a microfarad and inductances down to about 0·2 microhenry may be measured.

As standards of capacity there are two precision mica condensers, each of capacity 0·1 microfarad, and one subdivided precision mica condenser of 1 microfarad capacity. For general purposes there are several Helsby 600 V oil immersed condensers of a total capacity of 150 microfarads. As standard resistances for galvanometer work there are one subdivided megohm, one adjustable plug type manganin resistance of 5 000 O, and one adjustable plug-type box of 20 O resistance.

Heavy Current Apparatus.

For heavy current work a complete range of standard shunt resistances of carrying capacity up to 300 A is available. For general measurement purposes there are a number of Weston and Siemens precision type a.c. and d.c. instruments, and a large range of hot-wire ammeters and voltmeters.

Ballistic and other galvanometers of high sensitivity have been provided, including a Campbell standard galvanometer, and a Muirhead ballistic galvanometer which has a period of swing about 16 secs. In order to relieve the galvanometers as far as possible of all extraneous vibrations, special anti-vibration supports have been fitted.

Finally, there is a double high frequency Duddell oscillograph, with falling-plate and cinema photographic attachments, and terminal boards have been fitted at various places in the laboratory so that connections may be made to the oscillograph where most convenient.

The laboratory is provided with a library comprising carefully selected standard works of reference and foreign technical journals.

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Magnet Steels.

By J. FERDINAND KAYSER.

During the last few years the close co-operation of electrical engineers and metallurgists has resulted in important developments in the manufacture and use of permanent magnet steels. Although it is probable that Hopkinson realised the general principles underlying the use of permanent magnets as a source of magnetic energy, his attention was chiefly directed to the development of electro-magnets, and permanent magnetism has remained a little-understood science for many years. At various times formulæ for use in the design of permanent magnets have been used to some extent, but usually those formulæ took no account of the magnetic properties of the magnet and only endeavoured to connect the dimensions of the air gap with the dimensions of the magnet. Such formulæ were of little real value to either the magnet user or the magnet maker, as they gave no indication whatsoever of the relationship between the magnetic properties of a magnet and its performance, and hence arose the widespread view that a permanent magnet should have as high a remanence as possible in order to obtain the maximum flux, and that

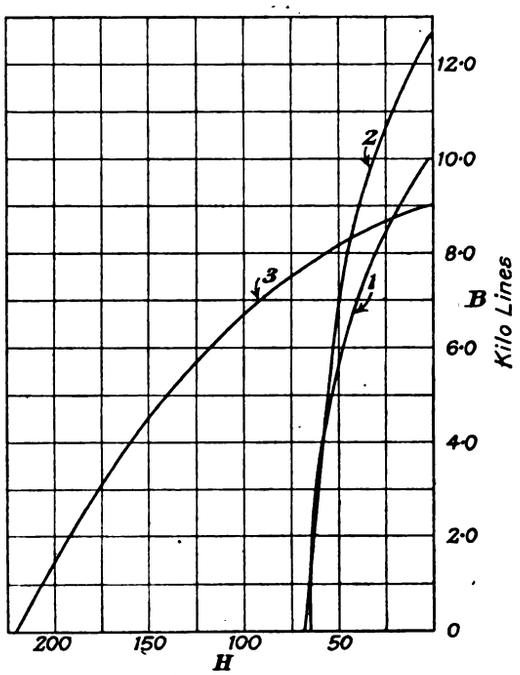

FIG. 1.

a coercive force of about 60 to 70 was quite sufficient to give permanency.

The True Criterion of Magnetic Efficiency.

Permanent magnet theory has now been thrashed out to a very great extent, and as a result of the publications of S. Evershed and E. A. Watson and the discussions arising therefrom, it has been generally agreed that the true criterion of magnetic efficiency and at the same time the key to economic design is the maximum available energy per cub. cm. The volume, and hence the weight, of magnet steel necessary for a given energy requirement is in every case inversely proportional to the maximum available energy, the necessary length and cross section being inversely proportional to the corresponding magneto-motive force and flux density respectively. It follows that if a magnet is working economically it will be maintaining a flux density equal to the flux density corresponding to the maximum available energy.

From time to time suggestions have been made that various other constants should appear in a specification, but up to the present no reasons have been put forward as to why they should be included. Needless to say, for a proper appreciation of the magnetic properties of a magnet, a complete BH loop should always be available, but there are yet no grounds for including anything other than the maximum available energy previously mentioned, together with the corresponding flux density and magneto motive force. It is interesting to note that this criterion of efficiency has not yet been adopted in Germany, and E. Gumlich, in his article in "Stahl und Eisen" entitled "Untersuchung an Chromkohlenstoff-stählen für permanente Magnete," only gives the remanence and coercive force. During the war the value of the product H_c by B_{rem} was used to a considerable extent in this country, but it is now realised that it is no indication of utility.

Four Types of Steel Available.

At the present moment four types of steel are available, the tungsten steel and chromium steel types giving coercive forces of from 60 to 70, and remanence from 10 000 to 12 000, and the cobaltcrom and cobalt magnet steels giving coercive forces of from 180 to 300 and remanences of from 8 000 to 10 000 according to composition.

Ordinary tungsten magnet steel usually contains 5 per cent. tungsten and from 0·6 to 0·8 per cent. of carbon, together with sometimes ½ per cent. of chromium. There is considerable controversy as to the utility of ½ per cent. chromium, but no definite data giving conclusive evidence of its effect upon the magnetic properties. The carbon content of the steel depends generally upon the heat treatment it is desired to use. The steels lower in carbon, containing from 0·6 to 0·65 per cent. carbon, require quenching in water from approximately 900 deg. C. in order to give the optimum results, whereas if the carbon is higher, say 0·75 to 0·8 per cent., oil hardening can be used, and the supporters of the high carbon analysis state that there is then less risk of cracking. That contention is, however, scarcely borne out in practice, and cracking must in all cases be prevented by the accurate control of the rate of heating and final quenching temperature, and by suitable methods of submerging the magnet in the hardening medium, the methods adopted being varied according to the shape and size of the magnet.

A partial loop of a good tungsten magnet steel is shown in Fig. 1, curve 1, and its properties are given in Table 1.

Chromium Steels.

In Dr. Gumlich's article in "Stahl und Eisen," previously referred to, numerous analyses of chromium steel and the effect of various heat treatments upon magnetic properties are given, and according to his figures the best results are given by a steel containing approximately 6·24 per cent. of chromium and 1·14 per cent. of carbon. When quenched in water from 900 deg. C. that composition gave a remanence of 9 200 and a coercive force of 72·5, while oil hardening from 850 deg. C. gave a remanence of 12 270 and a coercive force of 66·3. Unfortunately neither a BH loop nor the maximum available energy is given, but it is probable that the BH loop would take the form shown in Fig. 1, curve 2, and that the maximum available energy will be something of the nature of 13 500 ergs per c.c., which is a great improvement upon anything hitherto reached.

That steel has not been adopted to any considerable extent as far as is known, and the chromium steels usually used contain not more than about 2 per cent. chromium together with about 1 per cent. carbon. Such chromium steels are used to a very great extent in the United States, and when correctly hardened give a remanence of about 10 000, coercive force about 50 to 60, and a maximum available energy of approximately 9 000 ergs per c.c.

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High Coercivity Steels.

The cobaltcrom steels are essentially high chromium carbon steels to which various percentages of cobalt have been added according to the magnetic requirements, and they are in all cases air-hardening steels quite free from any risk of cracking. The chromium ranges from 0 to 14 per cent., together with about 1 per cent. of carbon, and the cobalt usually ranges from 1 to 18 per cent.

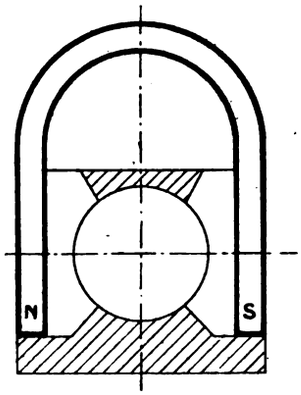

FIG. 2.

The de-magnetisation loop for steel containing some 15 per cent. of cobalt is illustrated by curve 3 (Fig. 1).

The cobalt magnet steels (often referred to as Japanese steels) require a considerably higher percentage of cobalt for a given magnetic output than do steels of the cobaltcrom steel type. The cobalt content is frequently as high as 36 per cent., the carbon ranges from 0·5 to 0·8 per cent., tungsten 3 to 9 per cent., and chromium 1·5 to 3 per cent. It is not essential that both tungsten and chromium should be present together, and useful alloys can be produced with either one or the other absent. It is possible with such a steel to obtain a coercive force of from 280 to 300, a remanence of from 9 000 to 10 000 and a maximum product of 1 000 000. Those steels require quenching in either oil or water.

Magnetic Standards.

In most cases the standard by which a magnet is judged is the cost of maintaining a required magnetic energy. That cost is made up of two components—(*a*) the cost of the steel of which the magnet is made, and (*b*) the cost of housing the magnet. The cost of housing a magnet includes the cost of making the magnet itself, and the other components of the magnetic circuit, as well as any protection that may be necessary to protect the complete magnetic circuit from either mechanical or magnetic damage. Provided that a lower grade steel can be employed without the necessity for additional cost being entailed in housing it, reference to the last two columns in Table 1 shows that the use of a more expensive alloy is not economically justifiable. In many instruments, however, the housing of a low-grade magnet steel is much more expensive than the housing of a high-grade cobalt steel magnet. The length of a tungsten steel magnet is usually so great that it must be bent into the form of a U or otherwise folded, and considerable further cost is entailed not only by the cost of poleshoes, but also by the cost of the various other components necessary to secure rigidity and protection. Figs. 2, 3 and 4 show magnetic circuits suitable for magnetos or moving coil instruments. Fig. 2 exemplifies the use of a tungsten steel magnet as a source of magnetic energy requirement, and Figs. 3 and 4 shows two alternative arrangements using straight bar magnets made from high-grade cobalt steel. The simplicity of design illustrated in Fig. 4 is very apparent, particularly so as it is a design that enables laminated pole shoes to be fixed as cheaply as solid pole shoes.

Finality Not Yet Reached.

In spite of the vast advances which have been made during the last few years, it is not thought that finality has been reached in either the theory or practice of permanent magnet manufacture. The theory of design of magnets and magnetic circuits has been firmly and definitely established by Evershed and Watson, but up to the present little, if anything, has been done concerning the permanency of a magnet and the relationship of permanency to some other more easily measured property. What little has been done tends to show that permanency is more or less proportional to coercive force, especially so when there are large differences between the coercive forces of the various magnets compared. Crapper has suggested that the ratio $\frac{H_c}{I_r}$ (coercive force to remanent intensity of magnetisation) may give some indication of probable permanency, and that seems a useful line to follow, but progress must necessarily be slow on account of the fact that all the better class magnets of the present day show only very small changes over periods of a few weeks, or even months, and tests will have to continue over several years before anything can be put forward.

Alloys with Greater Coercive Force.

Magneticians and metallurgists are working closely together, and the magnetic properties of numerous different compositions are being continually investigated. Most of the experiments have been with the object of finding an alloy with a still greater coercive force, and there is every probability that the figure of approximately 300 which has now been reached may soon be exceeded.

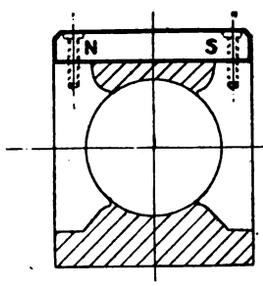

FIG. 3.

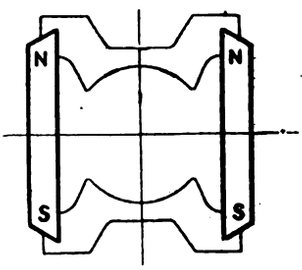

FIG. 4.

It would be as well if some attention were directed to increasing the remanence (and hence the flux density associated with the maximum available energy) of the available alloys. Any increase in remanence would not, however, in general be justified if it entailed an increase of cost of the steel per unit of available energy, as an increased economical flux density would not reduce the costs of housing, which depend upon the magneto-motive-force associated with the maximum available energy.

TABLE 1.

		Hc	*Brem*	*BHmax*	Max. available energy per cc. $\frac{BHmax}{8\pi}$	Flux density associated with maximum available energy.	Ergs per 1d.	Cost of 100 000 ergs.
1.	2 per cent. Cr Steel	55	10 000	220 000	8 760 ergs.	6 000 lines (approx.)	49 000	2·04d.
2.	5 per cent. W Steel	65	10 000	280 000	11 140 ,,	6 000 ,, ,,	41 000	2·44d.
3.	6 per cent. Cr Steel	66·3	12 270	340 000	13 520 ,,	7 000 ,, ,,	36 000	2·78d.
4.	Cobaltcrom (15 per cent. Co)	220	9 000	700 000	27 850 ,,	5 500 ,, ,,	26 000	3·85d.
5.	Cobalt Steel (36 per cent. Co)	280	9 500	900 000	35 800 ,,	6 000 ,, ,,	24 000	4·17d.

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Some Considerations of the Make-up Feed Question.

By JAMES B. MACLEAN, C.B.E.

Notwithstanding the considerable amount of research expended in investigating the chemical aspect of steam raising, it is not disputed by those who have done the best work, that little is known of the multitude of reactions which occur when water containing foreign matter in suspension and solution is brought to the temperatures and pressures now prevailing.

Could the feed circuit be maintained free of loss and thus return to the boiler the whole of the steam raised, care being taken to exclude contamination by contact with the atmosphere, the repeated distillation would give us a boiler fluid which might reasonably be considered innocuous. Unfortunately these conditions do not obtain, and it is a well-supervised power plant in which the make-up feed is less than five per cent. of the total. The question, then, for the engineer if the evils of scaling, corrosion, priming and excessive blow-down are to be avoided, lies in how closely his treatment of the make-up feed water sets up conditions approximating to such ideal state.

Softening v. Distillation.

There are two available practical methods of attack; chemical treating or softening, as it has been called, and distillation of the raw feed. Each of these will be considered in its relation to the difficulties to be avoided, and the writer will endeavour to show the various attendant problems which these two methods involve.

Chemical treatment of the make-up feed is divided into the use of "boiler fluids" added to the feed or introduced into the boilers, and the pre-treatment usually described as softening. The "boiler fluid" method may be dismissed in a word. Sold at prices ranging from 1s. 6d. per gallon upwards, an analysis of some that are offered shows that water constitutes 98 per cent. of the total. The disadvantages, apart from the danger of using an unknown fluid in the boiler, lie in the rapid rise in the concentration of the boiler contents from the precipitate produced. Excessive blow-down is necessary, while the danger of priming and entrainment of foreign matter in the steam is considerable. The use of these compounds is rapidly and rightly disappearing, and is to be strongly deprecated.

Advantages of Softening.

The softening of water as it is called still finds considerable support and demands more lengthy examination. Speaking in a general way, the temporary hardness, which disappears after boiling for a certain period, is that due to the contained carbonates, while the permanent hardness is that due to the sulphates, chlorides and nitrates. As the hardness of any given water may be also termed its soap-destroying power, we have the method of measuring hardness laid down by Dr. Clark many years ago. It is perhaps unfortunate that the soap test should ever have been placed in the hands of engineers as much erroneous treatment has been the result. At best the test is an approximate one, and expert chemical knowledge must be brought to bear on the analysis of the water, in conjunction with the soap test result. Further, the treatment of all natural waters demands that this supervision be continuous as seasonal changes and variations in the rainfall will demand parallel changes in the measures adopted.

In a handbook recently issued by a well-known authority* the danger attending other than expert attention has been treated at considerable length and the folly of laying down such arbitrary rule as not softening below some selected degree of hardness, so often met with, pointed out. Many instances are given showing how waters softened in the wrong manner can be actually more dangerous to the boiler than if used without treatment.

The important point lies in what the remaining hardness in a treated water is due to, a point on which, of course, the soap test alone is silent. The only safeguard lies in an excess of treatment in skilled hands leaving the water with some measure of alkalinity. It is a remarkable fact, and gives some indication of the obscurity with which these reactions at high temperature are still surrounded, that the make-up feed may be alkaline and yet the main condensate show an acid reaction.

Chemical Treatment only a Palliative.

The chemical treatment of water, therefore, cannot be considered as more than a palliative, as it demands constant expert supervision, is easily susceptible to serious error involving danger to the boilers, and at best will require excessive blow-down, while priming and entrainment with their consequent evils may be the price which has to be paid if safety to the boilers is sought by excess treatment to ensure alkalinity.

The Distillation Method.

Turning now to the distillation of the make-up feed water, we have a method which at once brings the limits of the problem within practical control. By distillation the make-up feed water is deprived of its mineral salts, and the only remaining difficulty arises from the contained gases, which for all practical purposes may be taken as nitrogen, oxygen and carbon dioxide. The inert nitrogen need not be considered.

The danger of corrosion attending the presence of carbonic acid and oxygen in the make-up feed is a subject which is still highly controversial, and it would require much more than the available space to give in detail the varied views held on this important subject. Of five different theories of corrosion which have been proposed and examined at considerable length, three have been dismissed in the light of patient research, leaving the acid and the electrolytic theories with a free field. The latter theory holds that pure oxygen and water are alone essential for the production of corrosion, while the acid theory demands the presence of an acid. A veritable army of able investigators has attacked the remaining problem, and while at first sight the decision might be supposed easy, it is beset with difficulty although the present state of knowledge tends to favour the acid theory. As air is always found to contain some carbon dioxide, which will produce carbonic acid when dissolved in water, the practical conclusion for the engineer is that carbonic acid must be entirely eliminated from the feed, and the contained oxygen reduced to the smallest practical amount.

Types of Distillation Apparatus.

Believing that the distillation of the make-up feed is much in advance of any other method of treatment now available, it will be profitable to examine and compare the types of apparatus offered having in mind economy of performance, purity of output and absence of incrustation, as it will obviously not be a satisfactory solution which merely transfers the deposits or scale from the main boiler-heating surfaces to those of the evaporator.

Of the three types of plant from which a choice may be made, the oldest is the well-known marine type, which consists essentially of a suitably shaped body about half filled with the crude feed water, in which steam-heated coils are immersed, the space above the surface serving as a steam dome. As regards the merits of this plant nothing can be said other than that the first cost is small. In respect of economy, as over wide pressure limits the heat in the steam available for producing evaporation is merely sufficient to evaporate its own weight, the output when the coils are clean cannot exceed one pound of make-up vapour per pound of steam used. In actual practice the output as observed by the writer is less than this, so that if the make-up feed amounts to 5 per cent. of the total, something like 7½ per cent. of the main boiler capacity has to be set

* "Boiler Chemistry," by Paul (Longmans).

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aside to effect its evaporation, and this requirement may be greatly exceeded if continual cleaning of the coils is not maintained. This is a very uneconomical solution.

Some Disadvantages of the Method.

The purity of the vapour cannot be considered satisfactory. From the nature of the apparatus it must contain the deleterious gases dissolved in the crude feed water, and as the vapour must be condensed somewhere in the system and added to main feed, the only method by which they could be eliminated successfully would be by adopting some form of de-gassing plant, a solution which the writer cannot recommend. The vapour is usually condensed in a direct contact heater by the main feed, and it is often stated that de-gassing takes place as a result of this operation, the gases escaping from the atmospheric outlet on the heater. This is often incorrect, as the amount of contained gases depends on the partial pressure of the gases—i.e., the difference between the pressure reigning in the heater and the vapour pressure corresponding to the temperature of the water. Given a sufficiently low main condensate temperature and a low proportion of make-up feed, the atmospheric outlet in the heater may actually introduce more air into the system. This may be largely avoided if sufficient exhaust steam is available to bring the whole feed to nearly the boiling point.

It is not possible to prevent considerable incrustation of the coils, as owing to the relatively small surface scaling must take place rapidly, and cleaning must therefore be frequent. Duplication of the plant may help to maintain the best results, but when the crude water supply is bad the labour expended on cleaning may become very considerable.

Cascade Type of Equipment.

The second type of evaporating apparatus offered, such as that manufactured by Mirrlees Watson, Scott, Fullerton Hodgart and Barclay, Kestner and many others, may be referred to as the cascade type of plant, and aims at greater economy of fuel consumption, much greater purity of output and a greater measure of freedom from incrustation.

The disadvantages are considerable first cost and the amount of space occupied. They consist essentially of a series of tubular evaporating bodies, the first being heated by live or exhaust steam of suitable pressure, and each succeeding body being heated by the vapour from the body preceding it. There is accordingly a progressively reducing pressure in each body, and the whole range may extend down to atmospheric pressure, or commence there and extend below the atmospheric pressure. The latter type requires, of course, condenser and extraction pumps, and may be dismissed as too costly for the problem under consideration. The output of these evaporators in quadruple effect, which may be regarded as the maximum economic unit, does not exceed four pounds of water per pound of steam used; and with proper design and operation, the distilled water reaches a high degree of purity and freedom from dissolved gases. Incrustation is dealt with by different methods, some makers only relying upon making the heating surfaces readily accessible for cleaning purposes. In general, the velocity of circulation is high, and as the scale is soft owing to the low temperature at which it is formed, much of it is carried into suitable receptacles, and the heating surfaces require cleaning at much longer intervals than in the case of the marine evaporator.

The Regenerative Evaporator.

The last remaining type to be considered may be called the regenerative evaporator, which has been developed by Prache and Bouillon. In this apparatus the latent heat of the vapour is utilised for increasing the output of the plant by an ingenious device. The live steam used is expanded through suitable nozzles and entrains at the same time several times its own weight of vapour from the boiling chamber. This mixture is discharged into the heating chamber, and produces further evaporation. By this method the plant recommended for boiler feed purposes produces well over six pounds of distilled water per pound of live steam used, while the space occupied is very considerably less than that required by the type just described. By suitable design non-condensable gases are continually discharged to the atmosphere, and to prevent deposit mechanical circulation is adopted, and a small quantity of quartz sand or other suitable abrasive is added to the water, which keeps the tubes quite clean and does not set up erosion. All scale-forming compounds are automatically discharged to drains.

The distilled water is discharged at 100 deg. C., and as at this temperature the vapour pressure is almost equal to the total pressure, the partial gas pressure is such that the distillate for boiler feed purposes is gas free. This plant has met with very great success on the Continent, and is now being manufactured in England.

In conclusion, the writer believes that he has given in broad outline enough to show that by the adoption of apparatus already available the make-up feed can be produced in a manner which will maintain the main heating surfaces free from corrosion and at maximum efficiency, while priming and entrainment will disappear and blow down may be reduced almost to the vanishing point.

The New A.S.E.A. Locomotives for the Riksgrans Railway.*

By PAUL FRIEBEL.

The Allmänna Svenska Elektriska Aktiebolaget (A.S.E.A.) of Vesteras, Sweden, has delivered ten D goods and two 2 BB 2 passenger locomotives for the Riksgräns Railway. The mechanical parts were supplied by the Aktiebolaget Svenska Järnvägsverkstäderna in Falun. The chief particulars of the locomotives are given in Table I. Power is transmitted through gearing to the driving wheels by means of jack shafts, elasticity being obtained by means of springs in the pinions. The mean track voltage is 14 000 V and the frequency 15 cycles. Only necessary apparatus and instruments are in the driver's cabins.

TABLE I.

	Goods.	Passenger.
Axle arrangement	D	2 BB 2
Length over buffers in m.	11·25	21·4
Maximum width in m.	3·0	3·0
Height of roof above railhead in m.	3·8	3·8
Diameter of driving wheels in mm.	1 350	1 350
Diameter of pony wheels in mm.	—	960
Weight of locomotive in tons	68·6	123·2
Weight of mechanical part in tons	42·1	70·6
Weight of electrical part in tons	26·5	52·6
Load per driving axle in tons	17·15	15·8
Load per pony axle in tons	—	15·0
Maximum speed in km. per hour	60	100
Tractive effort at starting in kg.	18 000	16 000
Tractive effort on hourly rating in kg.	9 300	8 500
H.P. on hourly rating	1 130	2 260
Number of motors	2	4
Motor voltage in volts	295	295
Motor current in amperes	1 700	1 700
Weight per motor without gears in tons	5·6	5·6

The passenger locomotives are articulated, each half having the same electrical equipment as one of the freight locomotives. Control is effected by means of contactors. There are 11 positions, of which 10 are running positions for a goods locomotive, while for a passenger locomotive there are 20 positions.

The switching operation is as follows: A bow is raised by means of a hand pump and the transformer oil switch is closed. Voltage now being available, the compressor runs up, and as soon as enough air pressure is available the second bow is raised. The reversing switch is now placed in the "forward" or "backward" position, which connects the fan and compressor in circuit. The high-voltage oil switch can be closed electro-pneumatically, or opened by means of battery current. Interlocks are used to prevent wrong operation of the contractors. The contactors are specially designed for the conditions of locomotive operation and are mounted so that an individual contactor can be easily and rapidly removed by one man for inspection.

The locomotives have proved very satisfactory in service.

* Abstracted from "Elektrotechnik und Maschinenbau."

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The Manufacture of Electric Motors in Quantities.

By W. F. HIGGS.

During the centuries man has inhabited this globe he has never succeeded in creating or disposing of one atom of matter, nor is he likely to do so in the future. His powers are limited to changing its form. Firstly, we have the scientists, many of whom have spent practically their whole life in seclusion endeavouring to persuade nature to give up another of her jealously guarded secrets, and to discover how matter can be changed from the form in which Nature presents it to a form in which man considers it more serviceable to himself. But the scientist's existence and energies are wasted if the information discovered by him is not used by another important class of society, that is, the manufacturer.

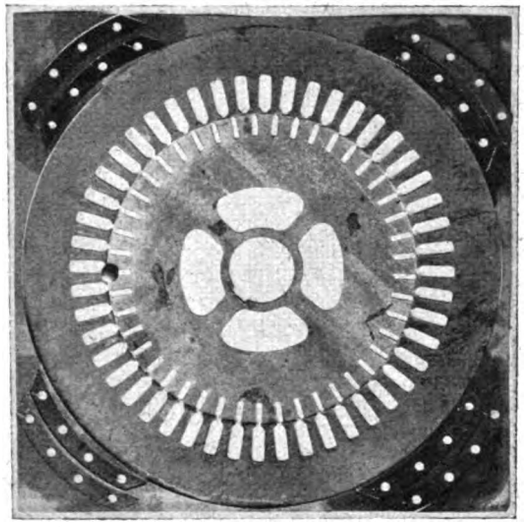

FIG. 1.—AN ECONOMICAL STAMPING.

The world's products are daily becoming more complicated; if the length of man's life increased as the world progressed, it would give him more opportunity to learn about these additional complications. It is a debatable point as to whether his mental powers improve. I believe they do not. Therefore, the way for an individual to become more efficient is to specialise to a great extent or, in other words, to confine his energies to a smaller number of subjects. This principle is of enormous importance to manufacturers and it is surprising how few realise the great advantage of specialisation.

When considering the production of electric motors in quantities it is not sufficient to limit the article of production to electric motors, the additional limits being weight, class voltage, etc. This article deals with enclosed ventilated commercial motors, for mill driving up to 600 V, weighing between 30 and 2 000 lbs. With machines weighing less than 2 000 lbs., all the components can be conveniently handled without the aid of expensive lifting tackle.

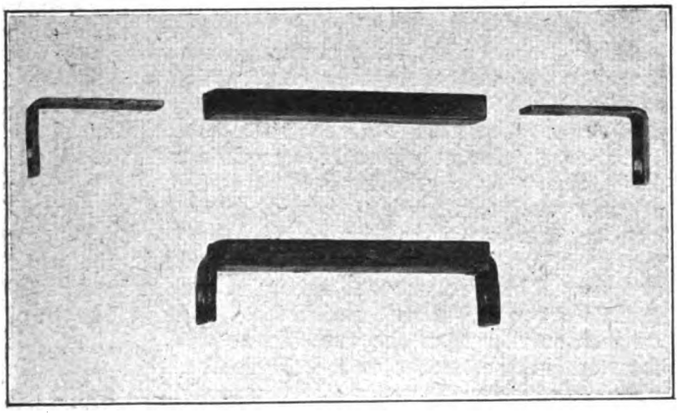

FIG. 2.—SAVING 35 PER CENT. ON A TERMINAL BAR.

The electrical design of the machine is of enormous importance and is now becoming standardized. When constructing a range of motors it is wrong to endeavour to design them for specific horsepowers, they should be designed with progressive core volumes.

The Importance of Good Space Factors.

Copper to iron ratios must be fixed at the most economic point and good space factors obtained. This latter point does not always receive the attention it deserves. The most difficult portion of the winding to insulate is that embedded in the slots. The space factor for slots may vary between 0·2 to 0·45; the gauge of wire has something to do with this but it is not everything. The most common cause of slot windings breaking down to earth is protruding stampings. Generally speaking, insufficient care is taken in the preparation of the core, the result being that an excessively thick slot lining is used.

Double Cotton Covered.

Wires are generally employed in slots and afterwards impregnated in vacuum. Why not put the varnish in place before winding, or in other words use enamelled wire?

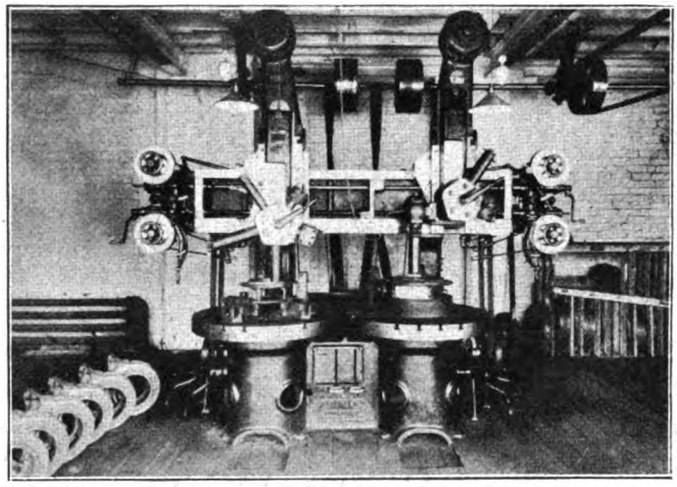

FIG. 3.—EFFICIENT STATOR GRINDING.

Enamelled wire made by the leading makers has excellent insulating properties and will stand 1 200 to 1 500 V between layers in water. This with a single covering of cotton forms one of the best insulations for small sizes, but for the larger size wires d.c.c. is necessary. Enamel is the insulation, and cotton the mechanical protection. Bare enamelled wire is absolutely safe for field coils, with this a space factor of 0·6 can easily be obtained against 0·3 or 0·4 for single cotton covered wire. Another place where space factors requires particular attention is in the core. Many different insulations are used for stampings, but I am convinced there is only one successful way and that is by spraying a solution of chalk, whiting, etc., mixed with an adhesive substance. A solution composed of 1 gallon of water, 5 lbs. of whiting, 1 lb. of concentrated size, gives very satisfactory results, it is best applied while the stamping is hot, a coating of 0·00075 in. is satisfactory; if No. 24 S.W.G. steel is used, this gives a space factor of 0·970. As a matter of fact more space is lost through the buckles in the plate than with the insulation.

Points in Construction.

An enormous amount of money wasted is due to faults in the designing of castings, etc. As the electrical design of motors offers so much scope, mechanical details are generally considered of secondary importance and often as much money is wasted on the mechanical design as

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is saved in the electrical design. I refer to such considerations as:

How is a casting to be held in the chuck for machining?
Should a certain hole be drilled or cored?
Are the feet to be milled or planed?
Can loose pieces on patterns be entirely eliminated?
Can core boxes be reduced to a negligible quantity?
Should a certain part be made from a casting or from the bar?
Where can die castings and stampings be used?
How is it possible to construct a shaft with the least number of shoulders?
What is the most economical and efficient way of fitting ball bearings?

All these points and a host of others are of great importance and a lot of experience and time is required before they can be satisfactorily answered.

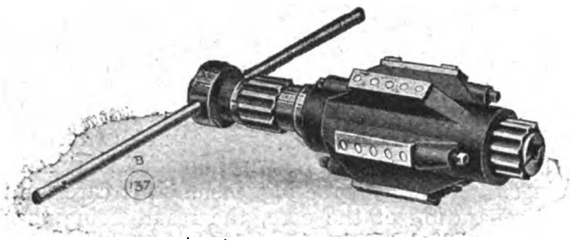

FIG. 4.—A JIG FOR REAMING BEARING HOUSINGS.

Another mistake some manufacturers of d.c. machines make is to reduce the length of the commutator end cover to such a size that it will only admit high and medium voltage commutators; when a low voltage motor is required they find it necessary to fit a long end cover, thereby making the machine special. I advocate always fitting this long end cover and a short commutator when it is suitable. In such cases practically the only material used in excess of that which is necessary is air.

By giving consideration to all details the motor can be produced much cheaper and better; herein lies one of the many secrets of success. Success is not achieved by cutting wages and using inferior materials—just the reverse. The motor should be sold to a specification, whether it be B.E.S. report No. 72/1917 or No. 168/1923 I am not going to discuss. But there is an economic price at which machines can be produced to either. This price being the

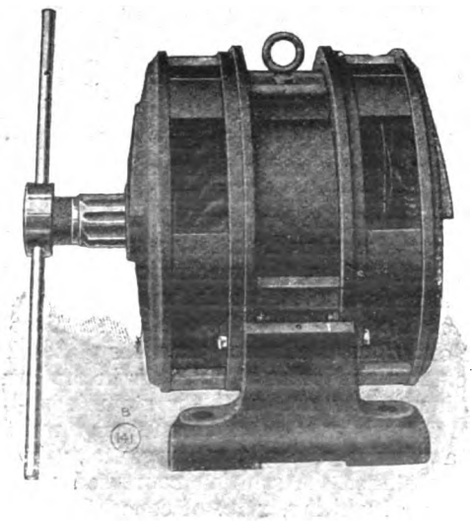

FIG. 5.—VIEW OF REAMING DEVICE IN POSITION.

cost of the last considerable quantity that is required to supply the demand. It is by giving attention to details as mentioned above, and with efficient organisation, that the motor can be produced below this economic price.

Reduction of Waste.

Waste cannot be eliminated, but it is a very fascinating proposition to endeavour to reduce it to a minimum. The firm making motors with the least amount of waste stands a good change of selling them at a low price. By waste I refer to material and labour. Remember, all material is valueless until labour has been spent upon it. Materials in their original position have no more value than air or sea water, they can only be made of service to the community by the expenditure of labour, mining, transport, refining, etc. It is the product in a semi-finished condition that generally concerns the motor manufacturer; his function is to direct labour as economically as possible and use as little semi-finished product as is consistent with efficiency. Such an example is illustrated in Fig. 1 where 67 per cent. of the sheet steel supplied by the mill has been used. This is high considering the amount of air spaces, slots, etc., that must be more or less scrap.

With mild steel bars, 99 per cent. can be used in the motor excluding parting cuts and swarf. This is achieved in the following manner; but the purposes for which it is used vary according to the diameter. Take a 16 ft. by 2½ in. bar, shafts are cut off until the last length is too short. This is used for interpoles as far as possible, the remaining length is made into small pulleys, and the last inch or so into discs for tool work, etc.

A case came to my notice recently where a firm of motor makers fitted fans to a range of machines. Each fan just overlapped the one a size larger, whereas with a little consideration a larger number of rings could have been cut out of one sheet, thereby saving probably 30 per cent. of the material used. It is by considering each component on

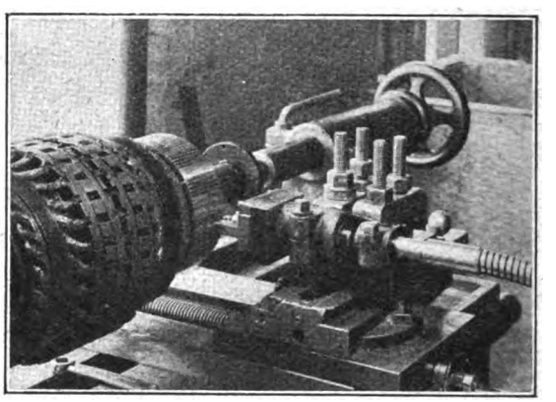

FIG. 6.—SIMPLIFYING THE UNDERCUTTING OF COMMUTATORS.

these lines that the finished article can be produced more economically.

Fig. 2 illustrates how 35 per cent. of the cost was saved on a terminal bar, the original idea being for the bar to go through the entire length of the insulation. With this type of construction insulation was difficult and not very reliable, the bottom view shows how scrap has been utilized to replace this bar.

Hints on Manufacturing.

As all makers of induction motors are aware, the most important proposition in their construction is to obtain a small and uniform gap; by the following method it is possible to work within 10 per cent. of calculated dimensions. The stator is ground internally concentric with the spigot. An efficient way of grinding is illustrated in Fig. 3. The advantage of this method over a specially constructed grinding machine is that any available mill is suitable for the operation. The rotor must be ground in the usual manner. The jig illustrated in Fig. 4 has hardened steel faces, the over-all diameter of which is about 1/1 000th of an inch smaller than the bore of the stator. The jig is inserted in the stator and held in position with six plungers which are forced radially outwards by turning the square-headed pins. The end covers are now screwed on to the shell, whose bearing housings are bored about 15/1 000ths of an inch small. They are reamered as shown in Fig. 5.

It is generally admitted that the undercut commutator gives better results than flush mica, to saw it out on a milling machine is heavy on saws. With a point tool it is

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a hopeless proposition, and undercutting by hand is very laborious. Some makers have tried to build up a commutator with mica below the bars, but I believe with little success. Fig. 6 indicates a neat way of overcoming the difficulty. The armature is inserted between the centres of a lathe, and in the tool holder is fixed the rig which by a crank motion rocks the hacksaw blades to and fro (scrap hacksaw blades being used). The rig is driven with a motor through the flexible shaft. No matter what care is taken when building commutators it very often happens that all the bars are not parallel to one another. To overcome this difficulty the head can be swivelled in either direction by slacking off the square head pin.

Conclusion.

One penny saved on the selling price of a standard motor worth, say, £30 each working day for ten years, is equal to over £13 and represents a reduction of 43 per cent.

By giving attention to details this is a feasible proposition and explains briefly how a firm which concentrates on a particular product can become more efficient than those who do not.

Handling Work in the Winding Department.

How Expeditiousness May be Encouraged.

By W. J. HISCOX.

In the factory interested in the manufacture of electrical equipment, the winding department occupies an important position, for, in estimating deliveries, particularly in connection with small motors, the work of this department must be specially considered. So far as mechanical construction is concerned, the product may be labelled "standard," and yet it cannot be delivered from stock owing to the variations in the winding specification.

Where the records show a steady call for a motor wound to a certain specification, there is no reason why a given number should not be held in stock for immediate delivery, but if the line covers a great many different sizes, it is apparent that, even if a comparatively small number of each size is stocked, the aggregate figures will reach a high level. Apart from this, the fact that in many instances the product must be returned from store to the fitting shop for certain additions to be made to cater for the special requirement of the customer, such as fitting a pulley, end shield covers, etc., suggests that the stocking of a completely wound unit does not in all cases accelerate delivery.

Storage Facilities.

The storage facilities, too, call for consideration, for a wound motor occupies a deal of space, seeing that it must be easily accessible, and cannot be stacked. Racks may be provided for the smaller sizes, in order to conserve floor space, but then the handling becomes difficult, and even if a hoist is used, at least two men are engaged—one to hoist and the other to guide or swing the unit into position, whilst the risk of damage must not be overlooked.

In some factories, no attempt is made to stock the complete product, but, in order to facilitate delivery, parts wound to given specifications are carried. Thus it may be that armatures, stators, and rotors are stocked in various sizes, these being utilized when the specification permits, and when delivery is of the utmost importance. The drawing of a complete stator from stock, when the rotor has to be specially wound, may not appear to have any significance from a delivery standpoint, seeing that the winding of the rotor is the longer operation; but it may be that the firm handles, not only the wound type of rotor, but the squirrel cage type, and it is in this latter connection that time is saved by drawing a wound stator from stock.

As before mentioned, therefore, it is the winding which has the greatest effect upon the delivery estimate, and, assuming that wound parts are carried in stock, it must be known, before an intelligent estimate can be given, whether or not any wound part can be taken from stock. It may be observed that many firms advertise "delivery from stock," well knowing that this cannot apply to every enquiry or order received, and it is obvious therefore that a hustle must be made, and not more than a week must elapse in most cases from the receipt of the order to the despatch of the unit, if the goodwill of the customer is to be retained.

Organisation to Cater for Emergency.

The organisation of the winding department then must be such as will cater for any emergency, and in the first place the department must be sectionalised in order to handle efficiently and expeditiously each type of manufacture. Assuming for the purposes of illustration that a.c. and d.c. motors are handled, a separate section to deal with each is necessary. This, however, is not sufficient, for the a.c. section must again be divided so that a sub-section is concerned with stators and rotors respectively, whilst the d.c. section must have sub-divisions for the winding of armatures and frames.

The department has to handle the hand wound machines (that is to say, those when the former is fixed in position, and the cable wound round and fed through the slots by hand) and those which are wound with coils which have already been wound to a former by machine. So far as the first named are concerned, these do not come within the category of "delivery from stock," on account of the special nature of the winding and the time involved in the operation. Even here, however, delivery is of the utmost importance, and the work cannot be retarded to allow the "delivery from stock" machines to take precedence. This suggests still another sub-division in order to ensure the necessary attention being given.

The section devoted to "former wound" stators deals with those for stock, and also with those for definite customers' orders. The latter must of course take precedence. In this respect, however, the winding of stators for stock must not be unduly retarded, otherwise the object will be defeated, and the stock windings might just as well be cut out. The section foreman must see that the requirements of the store are met, and it may be deemed advisable for one or more operators to be kept exclusively upon work for stock.

The sub-dividing of the d.c. sections is a more simple proposition, for the range and variation is not so pronounced as in the case of a.c. machines. It may be that (excepting in rare instances) all armatures may be wound for stock, whilst for the frames practically the whole of the spools may be drawn from stock. The building of the commutator is, of course, handled in a separate section.

Machining Section.

The machining section must be sub-divided in like manner, in order to ensure the requirements of the winders being met. The activities of this section may cover a very wide range, many of the articles being wound for other departments, whilst the experimental work is a factor which cannot be ignored. Each definite line must receive adequate attention, and the sub-division must follow the most careful consideration.

The connecting up of these various sub-divisions, in order to ensure all requirements being met, necessitates a strong and efficient departmental administration. It may be observed that the winding department has to cater for the needs of most of the other departments in the factory, and is, as a matter of fact, a definite factory in itself. Just as the factory as a whole is divided into departments, each of which is definitely identified with a specific branch of industry, so likewise is the winding department divided, and each division has its own responsibilities.

Details of Departmental Organisation.

The foreman of the department appoints an under-foreman, or a charge hand at the head of each section, whilst there may be a leading hand at the head of each sub-division, this individual working to the instructions of his section leader. As an example, the under-foreman may control the a.c. motor section, and he has one leading hand for handling the stators and another for the rotors. If the volume of work is large, it may be necessary for two under-foremen to control the a.c. section, one for the stators and another for the rotors. The under-foreman in each case would have the assistance of a leading hand, who would have control of one division

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(say the hand winding) whilst the section leader himself would be intimately connected with the more rapidly moving parts, at the same time being responsible for the whole of the work in his section. The specific circumstances must obviously determine the precise nature of the supervision, and the two instances referred to are quoted as examples of what may be considered necessary.

It is of course apparent that the foreman of the a.c. section has nothing whatever to do with the d.c. section, for the lines handled are not in any way connected, each section catering for quite different departments. There is, however, one point at which they may possibly come into conflict, and that is in connection with their requirements from the machine winding section. Here again supervision and sub-division both play an important part, and, for the purposes of illustration, we will assume that an under-foreman is in charge of the entire section.

This individual may be assisted by one or more leading hands, but, the range of work being wide, and the actual operation in each case being fairly rapid, it is certain that each sub-division must be comprised of several different classes of apparatus. In other words, it would not be economical to have one division for a.c. work, another for d.c. work, a third for arc lamp work, and so on, and so it becomes necessary to group the work in such a way as to avoid the clashing of the various interests.

Range of Work the Determining Factor.

In all probability, the number of divisions need not exceed three, but care must be taken in selecting the constituent parts of each division. The range of work handled by a certain machine is the determining factor, but if the machine is wanted for urgent delivery work of one class, and can also be used for experimental work of another class, care must be taken to see that one class of work does not get through at the expense of the other.

It is here that the various section foremen are likely to come into conflict, for each is concerned only with his own requirements, and the machine section must cater for all. Even assuming that the requirements for a.c. windings are handled in a specific section, the fact that both stator and rotor coils are wanted, means that the requirements of the two divisions must be catered for, and as those in charge of these divisions have no authority over the machine section, it follows that there must be someone to act as a link.

Delivery Instructions.

The instructions relating to delivery and details are in the first instance received in the winding department office, and from these instructions the necessary orders being issued to the sections concerned. For example, an order is received for the winding of a certain stator and rotor to a given specification, and this specification states whether the winding is done by hand or by machine. If the former is the case, then instructions are issued to the section leader, these instructions giving the date for completion, but when former windings are required, an order must be issued to the machine section, in addition to the orders for the actual winding of the stator and rotor.

It may be observed that when the orders are issued, the stator and rotor cores are not in the winding department, as these have to be assembled elsewhere. It is necessary therefore to show upon the orders the date upon which the cores are due in the department, whilst at the same time, the machine section should be informed as to the time at its disposal. It is of no use for this section to go ahead immediately upon receipt of the order, and so probably retard other work, when the cores will not be received into the department for a week, or even longer. An intelligent interpretation of the instructions is essential, so that each section, whilst adequately catering for requirements, shall not be working upon orders which are not urgently wanted, to the exclusion of more urgent matter.

Duties of the Chaser.

The department chaser, or link, can be of assistance here, for he can get from the various section heads a list of their requirements, and arrange for these to be executed in consecutive order by the machine section. It may be that a certain core arrives before the date expected, but owing to a shortage of work in the winding section, it is deemed advisable to put the work in hand at once. The machine section may be unaware of this until the fact is pointed out by the chaser, and so the necessity for the linking up of the various sections is apparent.

It must not be forgotten that, after winding, comes the dipping process, and that this is included in the official delivery date. The section leader must allow for this, by completing his winding a day or so before the date given. The winding section leader too, has work to do after the dipping process is accomplished, for there is the connecting and testing to be handled. It will be seen by this that there is plenty of work for the department chaser, and it is when this individual is non-existent that troubles and delays occur. The section leaders spend the major portion of their time in endeavouring to obtain supplies, and as a consequence, actual production suffers. The necessity for a department chaser is recognised in the mechanical departments, but often in the winding department his importance is overlooked. In the interests of economical production, this must not be permitted.

Electricity Supply at Crowborough.

New Plant Started at the Gasworks.

Crowborough must now be added to the number of those places where electricity and gas is supplied by the same undertaking. Powers for this purpose were obtained by the Crowborough Gas and Electricity Co. in 1913, but it was not until last year that Sir Charles Bright and Partners were called in as consulting engineers, and the work definitely put in hand. A scheme suitable for such an area was prepared by Mr. A. Hugh Seabrook, and the supply was formally inaugurated by the Hon. Osmund Scott on May 16th.

The new plant is capable of supplying the wants of 300 consumers. It is housed in a plain brick building erected at a cost of £700; and with £4 000 for installing the mains the total cost has been £10 000. By February last over three miles of cable were laid. The current is supplied at 240 V to consumers, the transmission pressure being 2 400 V. For the sake of simplicity and cheapness the use of single phase alternating current at 50 periods was decided upon.

The main contractors for the plant and switchboard were Crompton and Co. A 100 kW multi-cylinder medium speed horizontal type gas engine is installed, manufactured by the Premier Gas Engine Co. There is also a 25 kW Crossley twin-cylinder horizontal gas engine. Regulation is effected by a Taylor-Scotson automatic voltage regulator, supplied by Cox, Walker. This will obviate the employment of switchboard attendants.

The engines are driven by town gas, and consume from 14 500 to 20 000 B.T.U.'s per kWh, according to the load on the generators.

The pumping equipment for the cylinder cooling water is worked in conjunction with the general works pumping requirements. The compressed air starting arrangements also provide a ready means for blowing dust from the electrical plant without the installation of special apparatus.

The whole of the erection and installation of the new plant has been carried out under the supervision of Mr. A. G. Cheal, who is the engineer, manager, and secretary of the Crowborough Gas Co.

Sir Charles Bright, speaking at the opening ceremony, said he would not discuss the relative merits of gas and electricity, but he had always felt strongly that the combination of forces, turning each method to account, in its most useful sphere was a desideratum. Many economic advantages were gained by producing both gas and electricity on the same site, and with the same staff. He anticipated that the new light would effect a great improvement, but for heating purposes he felt that gas would still be very largely used. When future development made electric heating economical, he was quite sure that the Crowborough Gas and Electricity Supply people would be ready to meet the demand.

The Federation of British Industries, having regard to the fact that the British Empire Exhibition will be held that year, have circularised their affiliated associations asking their opinion as to whether it is necessary to hold the British Industries Fair next year as well. The majority of the replies are against holding the British Industries Fair in 1924, and the Federation have informed the Department of Overseas Trade of the fact. At the same time they regard the fair as of great importance to British industry.

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Protective Devices Against Earth.

Faults in Electrical Installations.*

Earth faults are a dangerous cause of pressure surges and the commonest cause of troubles in electrical installations. The following is a sketch and criticism of the means used to combat the troubles through such faults.

The A.E.G. Earthing Coil.

The A.E.G. earthing coil (Petersen's coil) consists of a coil with an iron core, and is connected between the neutral point of a system and earth, as shown in Fig. 1. The inductance of the coil is arranged so that under phase pressure it takes a current equal to the capacity earth current of the network. When a fault to earth occurs, the neutral point assumes phase pressure and the sound phases assume the line pressure to earth. The inductive current of the coil compensates the capacity current of the network, and any residual current due to leakage of the network is insufficient to maintain the arc. This is a good solution to prevent troubles from earthing in overhead lines, but suffers from the disadvantage of raising the potential of the sound phases to earth.

The B.B.C. Dissonance Coil.

The B.B.C. dissonance coil is due to Jonas, who regards the resonance condition with Petersen's coil as inadmissible. If, for example, the several capacities to earth are unsymmetrical, there will be at the neutral point an unsymmetrical pressure to earth. This pressure acts on the resonant circuit formed by the earthing coil and the network capacity, permitting resonance pressures to be set up even in normal

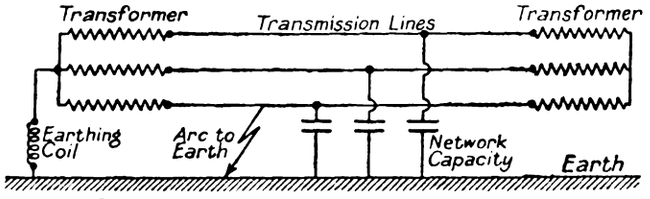

FIG. 1.—INSTALLATION WITH EARTHING COIL.

working. Jonas therefore adjusts his earthing coil so that under phase pressure the current is not equal to the earth current of the network—hence the name, "dissonance coil." Experiments have shown that even with a considerable amount of dissonance—i.e., deviation from resonance, in the earthing coil, the arc to earth is extinguished. This method also suffers from the disadvantage of raising the potential of the sound phases to the line potential with respect to earth.

The Oerlikon Earthing Impedance Coil.

The Oerlikon Co.'s earthing impedance coil does not differ in principle from those of the A.E.G. and B.B.C., but damping is artificially increased by resistance in series or parallel with the coil. The object of increased damping—some damping is always present owing to the leakage current of the network—is to render harmless the oscillations in pressure set up by the dissymmetry of the earth circuit when an earth fault occurs.

S.S.W. Extinguishing Transformer.

The S.S.W. extinguishing transformer (Bauch's extinguishing transformer) differs from the former extinguishing coils, which can be used in either single- or three-phase networks, in being suitable only in three-phase systems. Bauch no longer uses the neutral for earthing, because this method is apparently not faultless as regards travelling waves and pressure resonance. The extinguishing transformer is connected directly to the phases—Fig. 2—and its star point is earthed. The secondary winding is connected in mesh through an adjustable choking coil, and carries no current so long as there is no fault to earth. When an earth occurs, currents of the same phase and magnitude flow in the primary phases. These currents, which meet at the star point, are not able to return through the transformer coil, but combined they flow to earth and compensate the network capacity. Here again the sound phases attain line potential to earth.

Criticism of Above Devices.

As viewed from the firm's respective publications, all these extinguishing devices act admirably, but an interesting controversy has arisen among experts. The lead was given by Jonas, who emphasised the dangerous resonance condition with Petersen's coil. Biermanns opposed this view, maintaining that for reasons of economy the iron in Petersen's coil must be saturated, so that only inconsiderable resonance pressure surges can be set up. Petersen holds this view, but Roth (B.B.C.) supports Jonas's contention by experiments. Benischke maintains that, owing to the close magnetic coupling in the transformer or generator, there is practically no danger of pressure resonance with the fundamental frequency. If, therefore, with the best adjustment of the extinguishing coil to compensate the reactive components there are no pressure resonances, this is to be attributed to the magnetic coupling of the transformer or generator, and not to the saturation of the choking coil. With Bauch's device, therefore, there is still less danger of resonance, because the extinguishing transformer is also a coupled system.

Earthing the Neutral Point.

The above devices are not suitable for protecting cables against breakdowns to earth; first, because an earth on a cable means a hole in the insulation, so that the cable should be cut out as rapidly as possible, and secondly because they permit

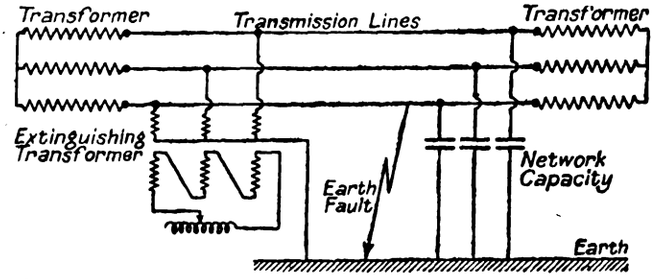

FIG. 2.—INSTALLATION WITH EXTINGUISHING TRANSFORMER.

the pressure on the sound lines to assume line potential to earth, which is not permissible for high-voltage cables. (During oscillations, and with insufficient damping, the line potential is even exceeded.) The best protection for cable networks is the direct earthing, or the earthing through a low resistance, of the neutral point. Sensitive relays will at once cut out the faulty cable. Also the potential of the sound phases does not rise provided that the power of the earthed units is practically equal to the total output of the generators. In America, earthing the neutral is preferred for all networks, but this may not prevent interruption of service.

Horn-arresters may limit pressure surges when earth-faults occur, but cannot suppress such surges. Moreover this can happen only when they are installed in sufficient number. The number of horn-arresters needed is fairly large, especially when leakage water resistances are used. Owing to the large space required and the expensive metal resistances in oil, and of the feeble protective action, the use of horn-arresters will decrease. Other forms of arc conductors have already been discarded as protection against excess pressures owing to their great disadvantages.

The Nicholson Devices.

The Nicholson arc extinguisher and earthing device are based on earthing the faulty phase and thus extinguishing the arc to earth. They are little used although they suppress the feared pressure surges on faults.

* Abstracted from the "Schweizerische Bauzeitung."

Track Circuit in Wet Tunnels.

An Interesting Installation on a French Railway.

The "Railway Gazette" gives an interesting account of the track circuiting arrangements in the Meudon tunnel between Paris and Versailles. This tunnel, which is 3 677 yd long, runs under the Bois de Meudon and is very wet, the ballast resistance being as low as 2 Ω per 1 000 ft. Owing to these conditions the track circuit could not be fed in the tunnel, and the installation is therefore the longest track circuit in the world that has to operate under such difficult conditions at so low a ballast resistance with direct current traction return.

This success has been mainly achieved by the use of resonated impedance bonds. These bonds have an impedance of over 2 Ω at 25 cycles, and provision is made for 200 A unbalanced current between the two rails. Each half of the winding has an ohmic resistance of 0·00018 Ω. The condensers are fixed in separate cases. An alternating current supply of 110 V at 25 cycles was available for the track circuit, which is fed from track transformers through an adjustable impedance coil. The secondary voltage of the track transformer is 10 V.

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India's Electrical Requirements.

[FROM A CORRESPONDENT.]

The present is said to be the age of electricity, and the best proof thereof is to be found in the progress that India has made and is making in the matter of her electrical equipment in all directions, in spite of her proverbial slowness to adapt herself to changing conditions. That India's natural resources are large has too often been admitted, and in his authoritative paper on "The Development of Water Power in India," read recently in London before the Royal Society of Arts, Mr. Meares remarked that "it is perfectly safe to say that at least seven million e.h.p. is in sight on the most conservative estimate and on the basis of absolute minimum continuous power." This is only the probable "ordinary minimum power." If the occasional short-lived droughts are taken into account, as they are generally taken into account in all estimates, the probable power for maximum development will be about 17 million e.h.p. These are large figures and will provide for industrial needs for a considerable time. At present, some 350 000 e.h.p. have been developed or are under construction. There is thus a vast scope for development. The advantages of cheap power are now so well realised by Indian industrialists that the one talk in the country is about hydro-electricity. Projects are being conceived, thought out and worked in details. There are not a few schemes to-day in India both large and small, which are only waiting for better financial times. Smaller projects are materialising easily. Every week we hear reports of some town or other getting electrically equipped for lighting or other purposes or increasing her electrical resources. When we speak of "power," in common parlance it has come to mean electrical power. The electrification of railways, at least on suburban lines in some of the large cities and especially in Bombay, has long progressed beyond the stage of talk or consideration, and is fast growing to be a reality. The majority of Bombay mills have begun to receive electric power from Tata Hydro-Electric companies, most of which have begun to function. On all sides, there is "electric" activity. The electrical age has indeed dawned in India.

Proofs of Activity.

The best proof, perhaps, of this activity is to be found in the large imports into India of her electrical requirements. In the case of electrical machinery for example, while the pre-war and war averages of the imports thereof (in value) into India were Rs. 40 lakhs per annum, the imports rose to Rs. 1·24 crores in 1919–20, to Rs. 2·19 crores in 1920–21, and to Rs. 3·90 crores in 1921–22. Considering that the growth is of recent years, it is very remarkable, and it has the seeds of potential growth. This is only about the electrical machinery proper. In the case of the electrical instruments and apparatus, the growth is equally remarkable. The pre-war average of annual imports into India was Rs. 70 lakhs and the war average Rs. 1·09 crores. The imports rose to Rs. 1·44 crores in 1919–20, to Rs. 4·18 crores in 1920–21, and to Rs. 4·06 crores in 1921–22.

British Manufacturers' Share.

It may be instructive to know the share of British manufacturers in these large imports into India, with a view to know where the United Kingdom stands in her trade in these articles with India in competition with other countries. As regards electrical machinery, the following tables deserve notice :—

	1920–21. (Rs. in lakhs.)	1921–22. (Rs. in lakhs).
United Kingdom	149	296
United States of America	67	81
Other countries	3	13
Total	219	390

The position, therefore, of the United Kingdom is strong enough, she having been responsible for 76 per cent. of the machinery imported into India. Even then the competition from the United States is keen, and with the recent improvements in her representation in India, that competition may grow.

As regards electrical instruments and apparatus, the position in 1921–22 stood as follows :

	Rs. in lakhs.
United Kingdom	284
Netherlands	7
Italy	16
Japan	4
United States	80
Other countries	15
Total	406

In 1919–20 the United Kingdom supplied 51 per cent. and the United States 36 per cent. The next year, that is in 1920–21, the United Kingdom supplied 69·2 per cent, the United States 22·7 per cent. In 1921–22 the United Kingdom supplied 70 per cent., the United States 20 per cent. The relative position, therefore, is improving in favour of the United Kingdom.

Progress not Sufficient.

It would not be right, however, for the United Kingdom to rest satisfied with the progress she has been able to make. The competition is keen from all countries. Even to keep up her position efforts are necessary. It will be useful to know some details in the case of the electrical instruments. The following table gives the details under various heads of the imports of electrical instruments in 1921–22 :—

	Rs. in lakhs.
Electric fans and parts thereof	55
Electric wires and cables	109
Telegraph and telephone instruments	5
Electric lamps and parts thereof	28
Batteries	2
Carbons, electric	1
Accumulators	8
Electric lighting accessories and fittings, including switches	30
Meters	8
Electro-medical apparatus, including X-ray apparatus	1
Switchboards (other than telegraph and telephones)	13
Unenumerated	146
Total	406

In the case of the electric fans, out of the total of 55 lakhs' worth of imports, the United Kingdom supplied 18 lakhs, United States 21 lakhs, and Italy 14 lakhs. British progress under this item is only recent and therefore satisfactory. In the case of wires and cables, the share of the United Kingdom reached 93 lakhs, while that of the United States was only 12 lakhs. In the case of the electric lamps, the United Kingdom supplied 15 lakhs, Holland's share coming next with 6 lakhs, the competition of Dutch lamps made by Phillips being still very keen. Accumulators were supplied almost wholly by the United Kingdom. Of the lighting accessories, 25 lakhs came from the United Kingdom, and only 2½ lakhs came from the United States. Meters worth not less than 6 lakhs out of 7½ lakhs came from the United Kingdom, and only 1½ lakhs from other countries. Again, in the case of the switchboards, out of 13½ lakhs, 11 came from the United Kingdom, and two from the United States. Under the last item in the table above—namely, unenumerated goods, not less than 100 lakhs' worth were supplied by the United Kingdom, and 37 lakhs by the United States.

Need for a Technical Staff.

These details have been given at some length, and may serve to show wherein the United Kingdom is supreme, and where she lags behind. That, on the whole, she is supreme is acknowledged. But she should not rest on her oars. In two directions where possible may British activity take shape. British engineering manufacturers may open their own offices and selling organisations in India and at the same time keep a technical staff attached thereto, who will be useful in two ways—to advise probable purchasers on the spot as to the lay-out of a scheme, to draw up specifications and to furnish the fullest technical information, and secondly to demonstrate the value of the machines and instruments, to put right defects in previous deliveries, etc., by constantly travelling in the country. It is such things as these that appeal to Indian industrialists, and the firms that are thus well equipped may hope to succeed better. Let it be remembered that the Indian market is by no means small. It is growing and may grow enormously in future. The capture of the increasing share of this growth will be the test of the British capacity for business as compared with the Americans and the Japanese.

The work of laying the sixty miles of cables required for the TELEPHONE SYSTEM IN THE NEW DELHI will be commenced shortly. The exchange at the new Delhi will be designed for a maximum capacity of 3 000 subscribers on and up to the date of the automatic system being installed. The initial capacity will be for 1 500 subscribers. Later it is intended to provide a similar exchange for Delhi itself.

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Railway Electrification in South America.

(*Continued from page* 533.)

Automatic Switching Arrangements.

In addition to the main switching operations, emergency panels are provided for each machine in the engine room, so that in case of emergency, the engine driver, by pressing a button, automatically opens the main switches of the machine. Exciter field switches are also provided which can be opened and the dampers to the inlet air ducts to the machines can be closed.

In order to avoid any risk of paralleling a generator out of phase through its unit transformer, the switches on the two feeders to each unit distribution board (viz., from the unit transformer and the station distribution boards) are interlocked so that only one can be closed at once. They are also arranged that the change over from one supply to the other can be so quickly effected while the auxiliary plant is running that there is no appreciable drop in the speed of the motors.

The protective gear used on the high pressure apparatus in the power station and on the systems is of the Merz-Price and Merz-Hunter types. Low tension panels with oil switches are equipped with overload trip switches and time-limit fuses.

In the basement of the control switch house, vacuum and compressor apparatus is provided to assist in the cleaning of the high tension switchgear. Pipes are run from the chambers into the switch house and are so arranged that either vacuum or compressed air can be put on to the same pipe.

0·05 sq. in. section. After laying and jointing, the high tension cables were tested by applying for 15 minutes a pressure of 40 000 V between cores and the lead, and between cores.

Direct Current Feeders.

The direct current feeders from the sub-station to the track and the jumpers spanning gaps in the conductor rail are of 1 sq. in. section, paper insulated, vulcanised bitumen sheathed, taped and braided. They are laid solid in Key's fibre conduit filled with bitumen. Where the feeder cables have to be laid on racks such as in the cargo tunnel or low level cutting, the cables used are of the same sectional area, but paper insulated, lead covered, and wire armoured.

The telephone system installed in connection with the electrification works provides communication between the power station and the sub-stations, the car sheds, and the signal cabins in the electrified area. A 50-way exchange of the Sterling type is installed at the power station.

All the cables were supplied and laid by W. T. Henley's Telegraph Works Co.

Traction Sub-Stations.

The line at present electrified is served by four traction sub stations situated at Once, Villa Luro, Castelar and Moreno. The buildings are all of the same general design, being stee

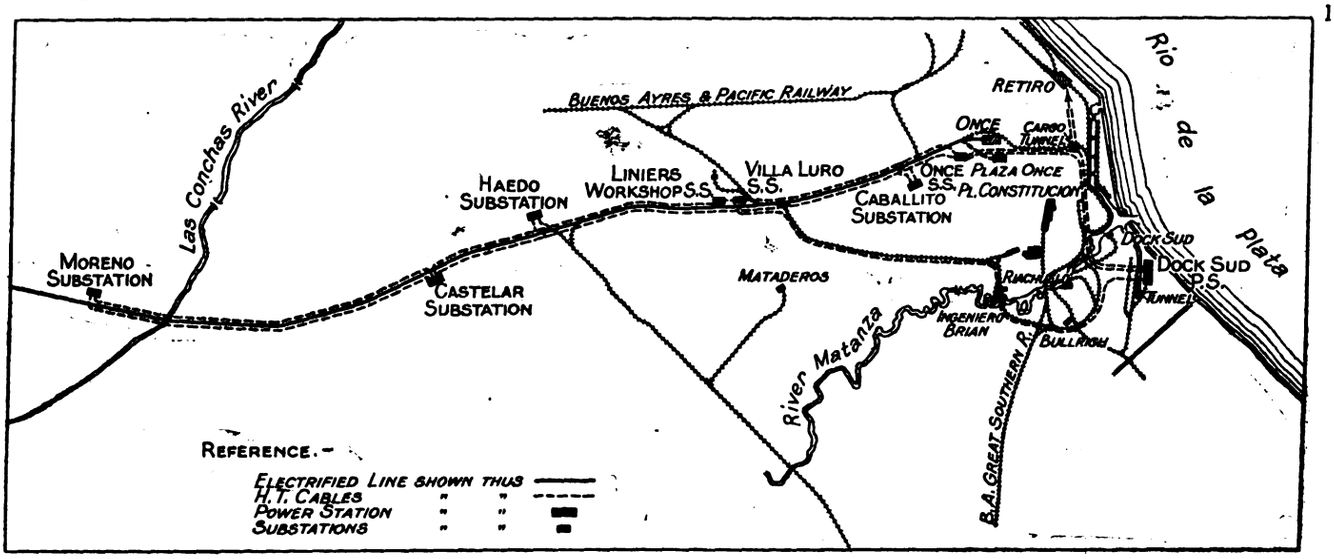

Fig. 4.—Map showing Details of Buenos Ayres Electrified Lines and Cable Runs.

Transmission System.

The high tension transmission system consists of 20 000 V underground feeders of the split conductor type. A complete system of telephone cables is also installed.

The high tension cables are 0·1 sq. in. split conductor, three-core, paper insulated, lead covered, single wire armoured, whilst the eight-pair and sixteen-pair telephone cables are dry core, air spaced, paper insulated, lead covered, single wire armoured and are suitable for the use of superimposed circuits where necessary. Both below and on top of the armour, all cables are served with specially compounded waterproof preservative coverings.

Generally high tension and telephone cables are laid in the same trench, being protected in case of future excavations by lapacho hard wood planks 9 in. by 1 in. thick. Where possible, cables are kept at least 2 m. from the track rails, any part within this distance being protected by being laid in wood troughing and filled with pitch.

Where the cables pass over the transporter bridge a special construction and support has been necessary to allow for both movement of the bridge due to traffic and also for expansion due to large temperature variations. In all cases where the direct rays of the sun can reach the cables sheet iron protection has been provided.

All joints in the high tension cables are made in gun-metal sleeves wiped to the lead of the cable, the sleeves themselves being surrounded by a creosoted wooden box with an iron cover. The sleeves are filled with compound, great care being taken to avoid producing cavities in the filling. Where the armouring is interrupted, the joint is spanned by a copper band of

framed structures walled with brick and covered with cement plaster. The floors and roof are concrete reinforced with Clinton fabric, the roofs being covered with a Paroid waterproof. Provision is made near each sub-station for housing the attendants.

Each building is divided into three main aisles, the centre one containing the rotary converters and the side ones the transformers, and remote from them the high tension and direct-current switchgear. There is a loading bay at one end, into which a siding comes so that railway trucks can be brought under the overhead crane which traverses the whole building.

In the Once and Villa Luro, three rotary converters are installed, and in the Castelar and Moreno sub-stations two. All these rotaries are of the English Electric Co.'s compound wound commutating pole six-phase diametrically connected type. They have a normal rating of 1 000 kW at 800 V, but can supply 1 500 kW for 2 hours, 2 000 kW for 10 minutes, and 3 000 kW momentarily. The transformers are of the British Electric Transformer Co.'s naturally cooled oil immersed type with a capacity of 387 kVA. Station transformers of 25 kVA, and 10 kVA capacity have been supplied by the same firm. Crompton's 5 kW motor generators converting direct current for 440 V to 110 V, a Tudor accumulator of 50 Ah capacity, and air compressors and ventilating fan are also installed. The high tension gear is of the cellular type, the switches being operated by means of metal rods and porcelain insulators by handles which project through cast iron panels and which are operated at machine room floor level. In the case of the machine panels, a knife switch which isolates the circuit breaker from the busbars

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is provided, and this, together with a knife switch connecting the machine to the equalising bars, are mechanically interlocked in such manner that the circuit is always made on the circuit breaker. This being of the free handle type would operate in the case of any fault being on when the switch was closed. These switches also operate the interlocking of the expanded metal doors at the back of the cells.

Differential relays are provided to prevent a circuit breaker being closed when the polarity of its rotary is reversed. These

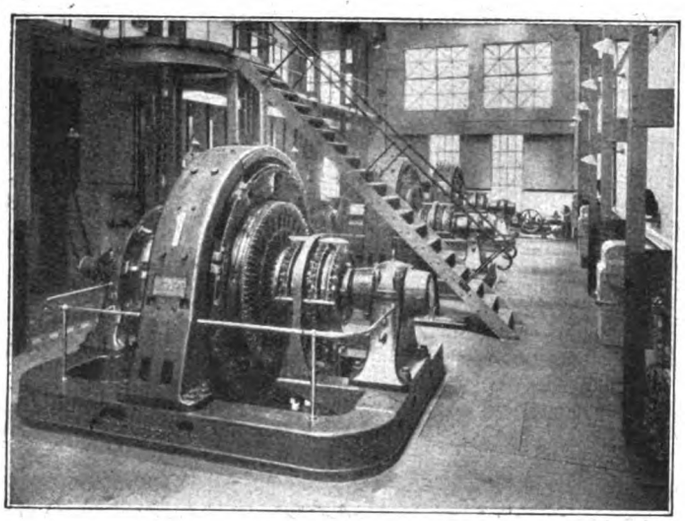

FIG. 5.—VIEW IN A ROTARY CONVERTER SUB-STATION.

operate in conjunction with indicating lamps which light up in such circumstances.

The rotary converters (Fig. 5) are self-synchronising, and are started from tappings on the low tension side of the transformers by an oil-immersed controller. Provision is made for coupling negative boosters to the ends of the shafts when the traffic increases to such an extent that the drop in the track rails becomes higher than desirable.

The auxiliary equipment of each sub-station includes a bank of three single phase transformers which gives a supply to the motor generator, air compressor used for cleaning purposes, ventilating fans and the lighting transformer. The motor-generator gives a direct current supply at 110 V

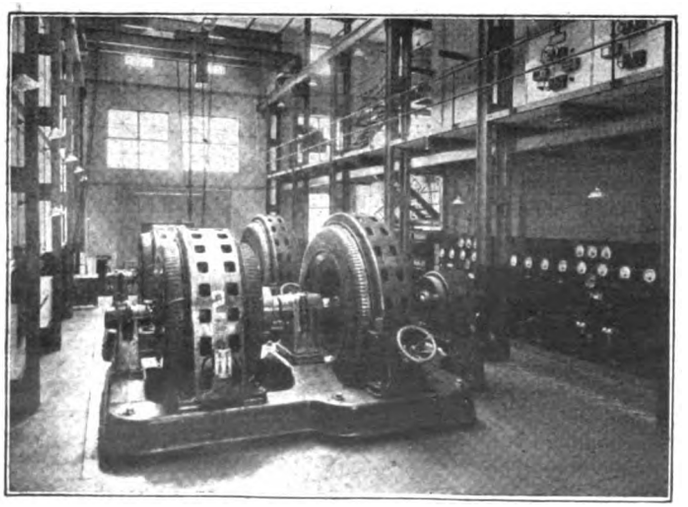

FIG. 6.—THE FREQUENCY CONVERTERS AT VILLA LURO SUB-STATION.

for charging the battery used for the tripping and indicating circuits and the emergency lighting.

In the case of Once and Villa Luro, where 220 V d.c. and 440 V 50 cycle a.c. are available, the auxiliary transformers have not been installed.

Negative Busbar Pilots.

In Villa Luro sub-station a panel is installed carrying centre zero voltmeters connected to pilot wires running to the negative busbars of the four sub-stations. By careful attention to these instruments the sub-station attendant can regulate the voltages of supply at the various sub-stations so that each sub-station takes its due share of the load.

Power and Lighting Equipment.

Two of the traction sub-stations include in their equipment apparatus to give power and lighting supplies for general purposes.

Once sub-station is designed to deal with the power and lighting requirements of the terminal station, train yard, and offices, and to give a supply for pumping in the underground tunnels, and to supply power for the electric track circuiting. At Villa Luro frequency changers (Fig. 6) are installed to supply power and light to the workshops, car sheds, and repair shops at Liniers.

In addition to these, static sub-stations are provided at Caballito, Liniers and Haedo for the supply of power and light to the shops, yards, and locomotive sheds. At Kilo. 5 a supply is given for transmission to the Buenos Ayres Great Southern Railway Co.'s workshops at Talleres.

In the traction sub-stations the high tension switchgear is similar to that supplied for the rotary converter plant. Low tension feeders are run from the sub-station by the underground cables or overhead lines as most suitable. All static sub-stations are small buildings containing two banks of transformers with the necessary high tension and low tension switchgear. All static sub-station high tension and low tension switch gear is of the Reyrolle ironclad type.

(To be continued).

The Carlton Accident.

Inspector's Comments on the Loading of Electric Freight Trains.

The report of Major G. L. Hall to the Ministry of Transport on the accident which occurred at Carlton Station on the North-Eastern Railway on December 29th, 1922, when an electrically operated mineral train which had overrun the home signal for the down main line ran into a steam-worked mineral train which was crossing from the up main to the up mineral line, contains some interesting comments on the loading and operation of electrically operated freight trains.

Details of the Accident.

Carlton Station is situated at the foot of a long bank, with a gradient of 1 in 230. Down this the electrically operated train was allowed to coast as far as some three miles west of Carlton station, when the power was applied as the train was not running to the engine-driver's satisfaction. It came out in evidence that the application of power on this portion of the road is not usually necessary. On this particular occasion the current was cut off about a mile farther on. When the driver observed that the Carlton distant signal was against him when he was some 1 000 yds from it, he applied his hand brake, but did not use his Westinghouse brake until he was actually passing the signal. He observed the home signal at danger when he was at about 500 yds from it, and realised that the Westinghouse brake was not having the desired effect.

He therefore opened his sanders and made an emergency application, the speed at that time being between twelve and thirteen miles an hour. Though this emergency application caused a steady retardation of the train, it did not stop it, and the speed at the moment of the collision was estimated at about three miles an hour.

Need of Definite Information on Train Loads.

It came out in evidence that the driver was wrongly informed as to the weight of the train, and in his comments Major Hall stresses the need for definite and accurate information on this point with heavy mineral trains. On the general question of the method of working and tonnage of trains on this line, it appears that the maximum authorised load for mineral trains hauled by electric engines with four 275 H.P. 750 V motors was recently raised from 1 000 to 1 400 tons, with certain braking modifications.

When this working was first introduced, some apprehension was expressed by the trainmen as to the safety of handling these increased loads. The driver of the train to which the accident occurred, giving evidence on this point, did not suggest that it was not possible to handle these heavy loads with the electric engines, but thought the timing was too short for safety with full load, and that it was not practical working to take such heavy loads down the bank with the brakes pinned down owing to there being short lengths of rising gradients.

Electric Engines Preferred.

Another driver stated that there was little difficulty in handling such loads, and that he preferred the electric to the steam engines. The position therefore seems to be, not that the loads can be handled, but that there is too small a margin for contingencies.

Major Hall therefore suggests that compulsory stops should be introduced for all down trains, that a minimum timing should be established for sections which include the more severe lengths of gradient, and that the block system should be modified.

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Renewing Electric Lamps.

Some Details of the Spirella Process.

By E. GAMBA.

Since the introduction of electric incandescent lamps a large number of researches have been directed to reducing their cost and to increasing their efficiency and life. It is generally believed that modern lamps have already reached a highly satisfactory degree of perfection, and that as far as life and cost are concerned no fundamental progress can be hoped for unless a complete transformation occurs in the constitution of the lamp itself. There is, however, one particular field where no real improvement has been so far obtained.

It is generally admitted that as the cost of the tungsten filament, is only a small portion of the total cost of the lamp, a great step towards cheap lamps would be to find a simple and practical way of changing the burnt out filament in a lamp whose cap, bulb, stem, hooks and leading-in wires were still in perfect condition. But the majority of experts have not been favourable to such an indirect way of prolonging the actual life of electric lamps because they considered this

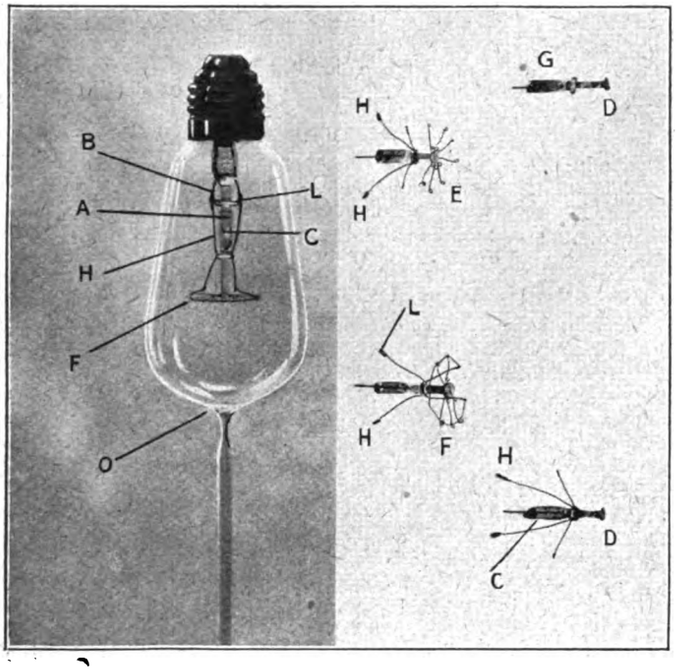

FIG. 1.—SHOWING THE PARTS USED IN SPIRELLA METHOD OF LAMP RENEWAL.

problem quite unfit to be developed on an industrial scale. As a matter of fact several solutions have been proposed and some of them have given satisfactory results in the laboratory.

Methods Employed.

The problem was at last abandoned except in Germany, where the greatest number of patents have been taken out on the subject. All the systems that were proposed or tested were more or less based on the same principle. The lamp had of course to be opened somewhere and this was effected either by cutting round the bulb*, or by making in it one or even two holes†.

In the first case the substitution of the burnt out filament was easy, but the sealing off of the two portions into which the bulb had been divided was quite the reverse. A large number of lamps were broken or wasted during the operation, even if the sealing was executed by extraordinarily skilful workmen. Lamps renewed by such methods always showed more or less defects when compared with newly-made lamps and, moreover, the amount of labour required was too important an item, because even in the cases where the sealing had been successful it was still necessary to open the lamps again in order to insert the exhaust pipe.

In the second case, the introduction of the new filament had to be done through a small hole which caused all sorts of trouble and waste. In both cases, in order to fit the old hooks of the lamp to be renewed, only a certain length and thickness of filament could be used; it was therefore necessary to work at the same time on different types and voltages which rendered impossible a satisfactory distribution of work on mass production lines.

The Use of Auxiliary Supports.

With the idea of facilitating the winding of the filament upon delicate supports, a considerable improvement was introduced by a new method, which consisted of a block carrying auxiliary arms. This was temporarily mounted on the lamp stem and the filament was wound first on this auxiliary block and then slipped on to the hooks. But this improvement, though important, did not overcome many of the difficulties already described.

A Much Simplified Method.

A quite new idea which has been recently introduced is the "Spirella" method.* This has already obtained a remarkable industrial success in Italy. In this method the hole necessary

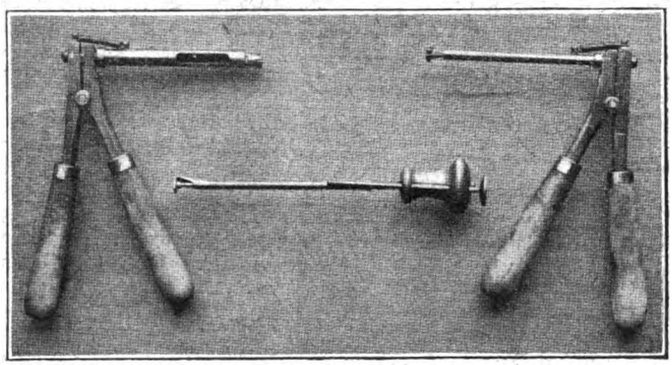

FIG. 2.—SPECIAL TOOLS USED IN SPIRELLA METHOD.

is the smallest possible and the same that would in any case be necessary for exhausting vacuum lamps or for introducing inert gas into gasfilled lamps. In fact, the special feature of this new method is that all the operations necessary for winding the new filament are executed outside the lamp to be renewed.

It will be easily recognised that such an arrangement avoids all the difficulties that are inherent in inside operation and also those due to too large a cutting of the bulb.

As will be seen, the voltage and candle power of the renewed lamps are completely independent of those of the lamps to be renewed.

Details of the Method.

A special mounting of the filament is of course required in "Spirella" method. As shown in Fig. 1, the bulb of the lamp is first opened at the point where the exhaust pipe is usually attached in newly-made lamps. Then by introducing pliers and other convenient "Spirella" tools (Fig. 2) the worn-out filament is withdrawn and the central stem is broken leaving a little stump *A* on the glass foot, through which the two leading-in wires pass. The glass bulb is then carefully washed, cleaned and chemically treated if necessary, so as to be entirely free from any trace of adherent materials.

A supplementary glass stem *C* is prepared (and this is one of the most important details), with a knob *D* supporting the filament *F*, which is generally disposed as a small spiral crown coil† supported by a spider of hook arms *E*.

The arms *E*, which support the tungsten spiral coil *F*, are provided in the usual way with terminal hooks, but they are also fitted with an eyelet with one or more turns in proximity to the central stem *C*. These eyelets give the arms carrying the filament sufficient resiliency to allow the whole to be folded up with an "umbrella-like" movement when the carrying system is introduced into the bulb. Two auxiliary

* English patent. 1707/11 Bloch (also German patent). French patent. 140 413n° 3 vol. 446 (Cervenka) and others.

† United States patent I, 038, 076 (Benneberg), also German. English patent 15424/10–11800/19–15344 (Harrison). Austrian and English patent 27813/12 (Sidon). Nordish patent. 20, 950 (Wolfram Lampen A.G.) German patent 211/112 (Pauli) and other German patents.

* Patent spec. 176 309 acc. September 21st, 1922. M. Calderara, via Merulana 174, Rome.

† Whence the name "Spirella"

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leading wires *H*, each of them ending in a small spiral coil, are fixed to the central auxiliary stem and are connected with the tungsten filament.

Connecting Up Arrangements.

After the introduction of the filament and its supports into the bulb, the spiral coil at the end of the auxiliary leading wires is capped on the two leading-in wires of the old lamp, and contact is easily secured by compressing the spiral cap and forcing it to clamp the leading-in wire on which it remains wound. At the same time, care must be taken that the tubular part of the complementary stem C caps the stump A of the broken original lamp, the "umbrella" opening again elastically upon the completion of the movement. The final steps of the process—i.e., exhausting or introducing gas and sealing the small hole, are accomplished in the same manner as for new lamps.

Flexibility of the Method.

It is evident that by this process it is possible to pass at will from zig-zag wire lamps to the crown spiral type of lamps, and that the voltage and candle power of the renewed lamp can be, within wide limits, chosen freely. If deemed more convenient, lamps may from the beginning be prepared with a central stem in two pieces; a permanent one, and a removable one placed upon the permanent one and carrying the filament.

This small detail is particularly important, for it permits lamp manufacturers to effect renewals quickly, so diminishing the heavy losses due to breakages during manufacture.

It is obvious that a renewed lamp will give just the same result (if properly made, as far as life performance and candle power maintenance, as well as efficiency, are concerned) as any vacuum or gasfilled new lamp. Actually, official tests prove that they are as good as any and better than many new lamps.

With regard to appearance it may be stated that non-expert people can hardly recognise a "Spirella" lamp from a new lamp if they do not examine the trade mark "Spirella" or the scarcely noticeable junction between the leading-in and auxiliary leading wires. It may be interesting to note that in countries where the Government strictly controls the new lamp factories, special marks are provided to prevent retailers from selling renewed lamps for new lamps.

Commercial Possibilities.

Although this method was originated only last year, several factories are at present in full operation, viz., in Milan (via S. Pietro all'Orto 4), in Florence (Piazza Madonna 8), in Naples (Via seguito Bernardo Tannucci), in Buenos Ayres (Compania Argentina Spirella, Corrientes 668). Other factories will probably be started at Reims (France), Martigny-Ville (Switzerland), Ghent (Belgium) and in Germany, Rumania, &c. Existing factories have been started on a small capital, varying from £3 000 to £4 000, which capital is considered sufficient for an output of about 500 lamps per day. A building of 240 to 300 sq. yds. and twenty girls at the benches are considered sufficient.

Cost Figures.

As regards the important question of the actual economy derived from Spirella renewing, it can be stated that the average selling price of a Spirella lamp is generally from 30 to 40 per cent. less than the market price of new lamps. The possibility of this can be easily understood when considering that the labour required for "Spirella" lamps renewing is scarcely more than half of the labour required for new lamp making. Raw material is practically reduced to the mere tungsten filament, for burnt-out lamps are generally obtained from the purchaser as a change.

No big capital, no expensive machinery are necessary, and general expenses can be contained in very reasonable limits.

Londonderry County Council has appointed a sub-committee which, with the solicitor and the County Surveyor, will go fully into the proposals of the BANN ELECTRICITY BILL, which is to be introduced in the Irish National Parliament.

THE NEED FOR FOOL-PROOF DEVICES where electrical equipment is used within the reach of unauthorised persons was demonstrated at the Shire Hall, Nottingham, recently, when William Brown (27), miner, was charged with interfering with an electric switch at Selston on April 8th. Brown switched on an electric coal cutter which was in reverse, with the result that the machine was set in operation, and very serious results might have ensued. Fortunately an automatic switch came into action and prevented any damage. Defendant, who said he wanted to see if the power was on, was fined £3 3s.

An "All-Electric" House at Manchester.

With a view to demonstrating the application of electricity in the home to those who are prospective users and to those in whose homes its use might be extended, an "all-electric" house has been equipped by the Electricity Department of Manchester Corporation. The house selected, which is situated on the Catterick Estate, Didsbury, is of the small semi-detached type of dwellings, the development of which is doing much to meet the present shortage. Viewing is by appointment arranged with the Electricity Department, and the necessary explanations to visitors are given by the person whose word is most likely to carry conviction—the lady of the house.

Hot Water Supply.

We are told the supply of hot water from the small fire-heated range in the living room is inadequate, but the fact causes little inconvenience, for attached to the hot water storage cistern is an electrically heated "Highlow" circulator of 4kW capacity, with a switch giving regulation of full, medium or low heating rate. This is stated to provide an ample supply of hot water for all household needs. In the scullery is installed a washing machine by the Western Electric Co., in which, by convenient gearing, a small motor drives either the automatically reversing drum which carries the clothes to and fro through the hot water or the small wringing machine mounted at one end. The consumption of power for the motor is stated to be about 1 kWh. per weekly wash. Here also is the electric cooker, again of the "Highlow" make, with three-heat control to each of the various parts. Two hot-plates and a griller are provided on top and the oven below is fitted with a Negretti and Zambra thermometer which, though an old-fashioned housewife would think it an innovation, is found entirely reliable to work by. A cake cooks in two hours at 200° C. A two-pint electric kettle completes the cooking equipment.

An Electric Drying Rack.

An interesting novelty is an electrically heated drying rack devised by the householder himself, who is a member of the Department's staff. Between the rails of an ordinary rack suspended from the ceiling are fitted brass tubes which contain resistance heaters. The current consumption is said to be very low, but the device is found an invaluable help on wet days.

In the living room the dining table is fitted on the underside with several sockets for connecting plugs of the various articles which may be required there—an ornamental kettle for afternoon tea, a convenient little toaster, a table lamp and a "Vio-Ray" high frequency tube for treatment of various ailments. Small portable heaters, the "Inventa" of 1½ kW and the "Cosmos" bowl fire of ½ kW are used for occasional heating and a 2 kW Belling fire with a very attractive simulation of a coal fire effect is used to heat the small drawing-room. All plug connections are of the interlocking type.

The bathroom is fitted with an electrically heated towel rack which is much appreciated, as is also the electrically driven of the Singer machine in the sewing-room. The electric vacuum cleaner is, of course, almost indispensable.

The Lighting Installation.

The lighting installation has been made with economy rather than convenience as the prime consideration, but an ingenious portable bracket is shown for attachment to the rail at the head of a bed and pedestal lamps of table and floor type are used to advantage. A pleasant and inexpensive nightlight is found in the Neon glowlamp, the consumption of which is something less than 5 W.

The householder in the area of the Manchester supply who desires to extend his use of electricity for general purposes such as those described is fortunate in being able to have his supply charged on the "Norwich" system, in this case 30 per cent. of the pre-war rateable value of the house plus ½d. per kWh for electricity consumed. The use of charging systems whereby electricity is made available for all its applications at a low flat rate will do more probably than anything else to encourage the all-electric house.

GLASGOW Corporation Electricity Department is showing an "all-electric" house, divided into four "ALL ELECTRIC" FLATS, at Crown Gardens, Dowanhill. "Magicoal" fires are fitted in all the rooms, and amongst other attractions are electric bed warmers, hair-driers and curling tongs, of course in addition to the usual cookers, lamps, etc.

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Exhibits at the Royal Society Conversazione.

Striking novelties were not conspicuous at the first Royal Society Conversazione of this season, which was held on Wednesday, May 16th, but there was a good deal of interest to the electrical engineer, whose services are now generally called in whenever accurate measurements have to be taken. That optical methods have also come to the front again was likewise apparent at Burlington House. The kinematograph displays of Mr. WALTER HEAPE well illustrated what such machines can teach us. The Heape and Gryll rapid kinema machine takes photographs at rates of from 500 to 5 000 per sec. When an Osram vacuum globe was struck by a hammer the effects on the two sides were quite different; on the side struck the glass broke into fairly large pieces, but on the opposite side the air pressure crushed the glass almost into a powder. A solid rubber ball squeezed into a 2 $\frac{1}{4}$ in. gun and shot against a steel target performed the most extraordinary contortions.

High Power Water-Cooled Vacuum Tubes.

Prof. J. T. MACGREGOR-MORRIS and Mr. MALLET exemplified by means of Chladini figures the resonant modes of vibration of telephone receiver diaphragms; sand was sprinkled on the diaphragm, the receiver being excited by alternating currents. The INTERNATIONAL WESTERN CO., of New York and London, showed, in addition to the low-voltage kathode ray oscillograph which we illustrated in our abstract of Sir E. Rutherford's Royal Institution lectures, some high-power water-cooled vacuum tubes—i.e., thermionic valves of 10 kW. The anode is a water-cooled copper tube, soldered merely by heating directly to the glass of the bulb, which contains several tungsten wires, nearly 9 in. long, surrounded by a grid, a close spiral of molybdenum wire. The 100 kW valves used in the recent transatlantic telephone tests are only of double the dimensions mentioned. The third exhibit of the company were some Rochelle salt crystals, used as piezo-electric gramophone transmitters. The varnished crystal, about 1$\frac{1}{2}$ in. high, is mounted between aluminium plates (forming the one terminal) and a copper wire is twisted round the middle of the crystal to act as the other terminal. The mounting further holds a plate against which the oscillating gramophone needle impinges; the plate then twists the crystal, and the differences of potential set up reproduce the sound. Reversing the connections and fitting the crystal casing with a paper cone, makes the crystal act as a loud-speaking receiver.

The Frenophone.

The frenophone of Mr. S. G. BROWN is a somewhat similar but quite original instrument. The diaphragm of a Brown reed-receiver is fitted with a needle which strikes a small steel pad, resting with its cork back on a glass disc, which is slowly being rotated. A cord connects the disc with the large diaphragm of a horn; the needle pressure varies the frictional drag of the rubbing pad, and gives good articulation.

The novelty of the motor control of the Cambridge and Paul Instrument Co., by means of a tuning-fork and a phonic wheel is the circular rheostat. The instrument was designed by Dr. A. B. Wood for the plotting chronograph of Dr. W. W. Rosenhain at the National Physical Laboratory. The motor to be controlled drives, through a reduction gearing, a disc the circumference of which is encircled by a rheostat—a coil of constantan wire. On the rheostat rests a contact brush turning with a second disc on the shaft of the phonic wheel; where the motor is fast or slow the field resistance is altered, and any alteration of this kind becomes visible through a change in the colour of a spectrum painted on the first disc and observed through a window on the second.

The WOOLWICH RESEARCH DEPARTMENT showed several novelties. Mr. G. West detected the presence of X-rays by their ionising action on a puff of fume of ammonium chloride, over which a wire charged at 15 400 V is stretched; when this cloud has settled with a flat top, X-rays cause an outbreak of fumes. The chronograph and photographic recorder of Mr. T. G. Hodgkinson is an ingenious instrument for measuring the time intervals of gunnery calibrations. The instrument comprises a tuning fork, phonic wheel, a vane which interrupts the beams of a lantern every thousandth of a second, an Einthoven multiple string galvanometer, and a photographic recorder, on which 1/10 000 sec. can be determined. The third instrument is Dr. Haughton's modification of the Andrews dilatometer for high temperature work; the indicator is not an ordinary liquid, but mercury, which short-circuits a wire forming one arm of a Wheatstone bridge.

Levitating Magnets.

Mr. HARRISON GLEW's levitating magnets are very curious. A rod of magnetised cobalt steel, about 3 in. long, is placed in a glass cell, which is rested on a strong magnet so that equal poles are near one another; the repulsion keeps the rod horizontally floating about an inch above the magnet; ordinary steel magnets would not answer because their polarity is too easily reversed by a strong magnet. The ANGLO-PERSIAN OIL CO. uses an arrangement reminiscent of the Johnsen-Rahbek relay, for examining lubricating oils under electrostatic stress. A brass disc suspended from one arm of a balance rests on a slab of lithographic stone; the disc is one terminal and a copper foil under the stone the other terminal of a 120 V circuit. When the current is on it takes about a load of 160 gm. more to pull the disc up than with the current off; when a castor oil film is placed on the stone it takes only 10 gm.

Microscopic Interferometer.

The microscopic interferometer made by Messrs. Hilger and Morpeth, Messrs. BARNARD, J. SMILES and F. WELCH, of the National Institute for Medical Research to serve either as a microscope or for objective testing, is fitted with a mercury lamp, the arc of which is struck by a simple device; a branch tube of the mercury bulb is so wound with a resistance that some mercury is evaporated and the column broken. Of physical apparatus shown by the same Institute we can only mention the Rator thermometer of Dr. E. H. J. Schuster, which measures the cooling power of the air. The U-shaped thermometer contains mercury and toluene, and in the bulb a platinum spiral which is electrically heated; the time during which the thermometer cools from 100 deg. F. down to 95 deg. F. is electro-magnetically recorded by the aid of a swinging lever.

We finally notice the stream-line filter of Dr. HELE SHAW. Thousands of sheets of a special made paper, perforated with rows of holes, are so piled upon one another under pressure that the liquid to be filtered—e.g., a very dirty motor oil, which comes out clear and almost colourless— passes in stream boxes, not through the paper, but sideways from one hole to another through the narrow space between sheets in contact

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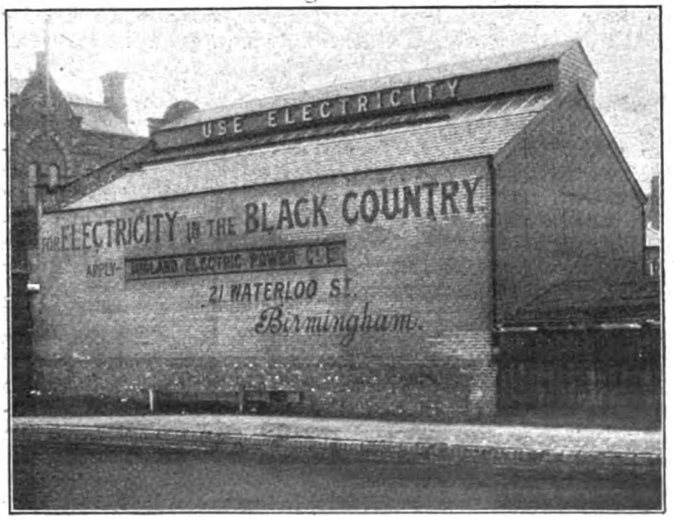
Sub-station Advertising.

An Excellent Example from the Midlands.

Externally, at least, the average sub-station is not a thing of beauty. But even such utilitarian structures can in these days be turned to the subtle uses of advertisement. One example of how this may be done is shown in the accompanying photograph which illustrates the Tipton sub-station of the MIDLAND ELECTRIC



THE WALL OF TIPTON SUB-STATION USED FOR ADVERTISING PURPOSES.

CORPORATION for POWER DISTRIBUTION. The view is taken from the London Midland and Scottish main line, and we are not surprised to hear that it is very effective, the more so as the top line, "Use Electricity," is picked out with electric lamps which are switched on each night.

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Selling Wireless.

Some Practical Hints on a Vital Matter.

By D. M. WILSON.

Quite suddenly the man in the street has realised that wireless is within his reach, and that it has a definite meaning for him. Up to now he has read of it and heard of it as a world-wonder; he has marvelled at the magic of it. All this, however, with a feeling of awe. Wireless has had no more intimate association in his mind than, say, aeroplanes. Then, almost like a flash of lightning, the transformation has come. Wireless is an entirely different thing because it has been brought to everyman's door. The prospect of "listening-in" to London concerts, to ships in the channel, to the Eiffel Tower messages, to New York, is all the more thrilling because it is practicable.

The inventive side of the job having been pretty well dealt with, we thus come up against the selling problem—how to sell this new commodity, what lines of appeal to make use of, what media to resort to, how to secure the widest results, how to probe the attitude of prospective buyers, to determine where to look for these buyers, compiling selling talk, angles of approach, price questions, methods of marketing, special offers. The field of opportunity is tremendous, no more realisable at the moment than was the cinema market twenty or thirty years ago, or the gramophone market.

The Weakest Link in the Chain.

The weakest link in the selling chain is the retailer's shop. Bookstalls are booming wireless periodicals and booklets. The local electrician probably has a two-valve set in his window. The oil store has a notice up about making your own set. The contractor is advertising good poles, the plumber has a few odds and ends on show, likewise the garage, and the shop that wouldn't let for months has been opened as a wireless depot. So far so good. From the seller's point of view we all want to get something out of the "wireless craze" if we can.

Note, however, the effect on this all-important person, the man in the street. He looks in the electrician's window, is duly mystified and passes on. At the bookstall he sees an array of booklets and periodicals pertaining to every side of the wireless question; knowing practically nothing of the subject, again he passes on. Coming home in the evening, he sees in the little wireless shop a notice about a "Crystal Set for £3 10s." That's getting nearer; possibly he thinks about it overnight, or more probably he just lets the subject lie at the back of his mind. There has been nothing to bring him right up to the point.

Don't let me be misunderstood. This is one type of man, and one only; others I will deal with shortly. This type of man is probably most important, however, because—

1. His number is legion. 2. He is fascinated already by the subject. 3. His technical knowledge is very slight if it exists at all. 4. He is asking to be convinced of what he really believes already—i.e., that he simply *must* get a wireless set.

Disillusioning the Customer.

During March Olympia was crammed with enthusiastic home-builders, and an exceptional opportunity was given to popularise wireless. Cheap models as well as hundred-guinea cabinet sets have been shown, practical demonstrations have been given in some cases, and scores of different kinds of instruments have been boomed. The attitude of the particular type of man under consideration is illustrated by a little incident which occurred at one of the stands. A very small crystal receiver was being demonstrated—the detector, that is, mounted on ebonite, with terminals complete and ready for attachment to phones, aerial, etc. The price was low—almost absurdly so. A prospective customer displayed keen interest, handled it, examined it, then asked, "But do you mean to say, then, that if I take this home, I can listen-in?" "Yes, certainly! Naturally you will require an aerial of some kind, and headphones." It was enough: the disillusionment was complete.

Aerials, condensers, amplifiers, inductances, high-frequency are terms which will have to be explained and illustrated over and over again, in many different ways if they are to have anything more than a vague significance for the non-technical man. He doesn't particularly want to understand them; they put him off rather than help to make him to buy.

Some Practical Methods of Getting Business.

I want now to suggest some practical methods of getting this extremely remunerative business. First, and most important have free concerts and demonstrations every night. Not the kind of demonstration which is notified by "Ask to see" such and such a thing; that keeps a host of prospects just outside. I mean the sort of thing which is very obviously open, brings a crowd inside, and makes folks want the music at home. Remember, the proposition is difficult to explain in a simple way; take full advantage of the appeal to the senses. The sure way to sell a wireless set is to let your man listen-in. If you can arrange it, use different kinds of receiving sets every week, or every three days.

Secondly, use your window, keeping in mind all the time the fact that the majority of your prospects don't understand the technical side. Show sets, parts of sets, head-phones, loud-speakers, batteries, accumulators and as much of the paraphernalia as you can, in one part of the window. Let it be one definite part, not an indiscriminate laying-out of different-sized articles with a view to making the window look pretty. Have another part to show that you are catering completely for the man who wants to make his own set. Such things as cardboard cylinders, shellac, etc., etc., you will want, besides terminals and many kinds of wire. Put a showcard in quoting a price for wooden poles of different lengths; it is only a matter of arrangement with a local contractor, after all. Put prices on all the parts you show. Display them attractively; alter the arrangement twice every week.

If you have any room left in your window, show one set each week in a special way. Even if it is just on a stand or a box covered with white paper—boom it. Have showcards giving its price and its special features; say as simply as you can what it will do. State precisely what extras are required to enable a man to sit at home and listen-in with this set. Be clear, non-technical, as simple as you can.

The Use of the Window.

You haven't used the window itself yet. This is the third asset. Even if the window is not very large, you will find this idea worth trying. On one side of the window—or, if more convenient, right across, fairly high up, have a notice consisting of four or five words in bold type, as large as you can accommodate without blocking the view of your goods. Think the wording out very carefully, display it as prominently as you can, and change it frequently. On another part of the window have a few details of some specially interesting line. A typed quarto sheet with an arrow cut out of paper to draw attention to it will serve the purpose splendidly, without expense. One week, for example, you might have notes on a crystal set you are booming; another week a few notes on batteries and accumulators; wire, erection of aerials, cuttings from the Press, humorous items, topical news, special offers, all might be included; the variety will be found to be almost infinite to anyone who is by nature a little resourceful.

Getting People In.

You are now making full use of your shop window and the interior of your shop. The next question is to get more people to come to your shop; in other words, you should advertise. I am not going to advocate spending a lot of money on what are known as "splash" advertisements. Probably you have spent a good deal of money already, most likely you have spent more than you intended to spend. Several methods of advertising are open to you. You may advertise in local papers, on the cinema programme, on hoardings, in trams; you may distribute circulars or handbills.

Methods of Advertising.

In all probability you will be compelled to confine yourself to one of these methods, at any rate, for a time, for financial reasons. Two methods stand out prominently from the rest, and the first is Press advertising. It can be recommended unhesitatingly under certain conditions. The first is that the local paper must be a good one. It must have a fairly local circulation, for one thing. It will be of little advantage to you to have your advertisement read by a man who lives five miles away, unless you are in a small provincial town. He will find a shop nearer home. You should compare the cost per inch with the circulation (if you can ascertain it) and the area it covers, and calculate as far as possible what proportion of the area is of any use to you; your calculation will necessarily be a rough one, and possibly, if your advertising is good

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you will get results from farther afield than you dared to hope for.

Then your printer must have some choice to offer you in both type faces and borders. A crude advertisement seldom pays, neither does one which is similar to its neighbours—a fault very often found in local advertising.

The Importance of News.

You must get news into your announcement. Get a striking headline, but don't try to be facetious; then a short introductory sentence, and a paragraph containing your "news"; follow with prices, if any, and your name and address. Arrange fresh copy for every issue; make each week's news as different as possible from that of the preceding week. Blocks are useful, though probably too expensive for a beginning. Avoid cheap blocks, anyhow.

Sales Letters.

Those are the conditions which should make local Press advertising pay. There is another method, however, which I consider is peculiarly well suited to selling wireless—I mean sales letters. Wireless appeals to intelligent people. It would of course be sheer waste of money to draw up notes about the advantages of wireless and quote prices and send them out in letter form. But if the idea is worked thoroughly, it will pay.

The most important thing is to have the sales letters well written. Get an expert on the job. You should have a series of at least three letters for a beginning—that is to say, a definite series of three. If you can put an enclosure in the envelope with them—a leaflet advertising some line, for example—so much the better. Don't send them out indiscriminately; take one avenue here and another there, middle class and better class property. Try the scheme out in sections; you can get your addresses without difficulty from a local directory. When you get a new customer, and can ascertain his name, register it. Later you will want to send him a special sales letter; wireless enthusiasts progress from one model to another. Your second and third letters are not, of course, intended to cover the ground of the first one; they may or may not refer to it—that must be left to the man who writes them.

Technical and Artistic Books.

Ernest Benn's Latest Enterprises.

The directors of ERNEST BENN, LTD., a branch of the business of Benn Bros., Ltd., which, as we announced recently, has been formed to deal with the Book Department of the latter firm, are placing in the forefront of their programme the production of books on fine and applied art. The keynote of these books will be a combination of literary excellence and fine production.

The series of monographs on Ceramics of which Mr. Hetherington's "Early Ceramic Wares of China," Mr. R. L. Hobson's "Wares of the Ming Dynasty," and Mr. King's "Chelsea Porcelain" were conspicuous successes, will be continued and enlarged.

Oriental art will maintain a prominent part in the general scheme, and among the books which will be published next autumn in this section will be "Japanese Colour Prints," by Mr. Laurence Binyon and Major J. J. O'Brien Sexton.

Modern art, English and European, will have its due share of attention, and as is fitting in the case of a firm which will lay special stress on excellence in typography, books on this subject will not be lacking. In this connection mention may be made of "The Player's Shakespeare," the first two volumes of which have just been published. These were hailed by the critic of the "Morning Post" as "A credit to our generation and an honour to its august subject."

Ernest Benn, Ltd., will not confine their attention merely to the production of art books, but hope to develop their activities in the spheres of science and technology, and shortly to announce the publication of the first volumes of a series of historical books.

A Sulphuric Acid Turbine.

Novel Installation in the United States.

The latest engineering novelty from America is a water-wheel which will be driven by what may be called, if a certain amount of poetic licence is allowed, dilute sulphuric acid.

This water-wheel has been designed by the Pelton Water Wheel Co. for the city of Manizales in Colombia. This city is in the high Andes, more than a hundred miles from a railroad, and the power-house installation had to be so designed that parts could be carried by muleback, wagon and by aerial tramway over the mountain passes.

As the mountain torrent which has to be utilised is largely impregnated with sulphuric acid, the parts of the impulse wheel which come in contact with the water had to be made of bronze, brass and Monell metal, instead of steel.

In other respects the turbine is a standard Pelton wheel of 500 H.P. working on an effective head of 250 ft., and will be direct-connected to a 350 kVA 60-cycle, three-phase generator.

The Drive of Power Station Auxiliaries.

The paper on "The Drive of Power Station Auxiliaries," by Mr. L. Breach and Mr. H. Midgley, which was abstracted in our issue of May 4th, was discussed at a recent meeting of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers. We deal with the remarks of the various speakers below.

Disadvantages of A.C. Drive.

Mr. P. J. ROBINSON said that some of the lay-outs given in the Paper were not applicable to both riverside and cooling tower schemes. It was a question whether a d.c. generator, satisfactory for the size and speed, placed on the generator shaft, was practical. The use of a secondary generator on the shaft was economical in steam consumption, but he saw no advantage in making this of the a.c. type. The use of two circulating, two air and two extraction pumps was not essential. He would prefer two steam driven turbo-pumps to one steam and one electrical. In changing over it was doubtful if a time lag of 30 sec. would serve any useful purpose. It was not desirable that the general drive of auxiliaries should be effected entirely by a.c. as any pressure dimunition, with corresponding drop in speed, set up a vicious circle through the slowing down of auxiliaries. A ring-connected switchboard on the h.t. side of the auxiliary supply was an unnecessary complication. An alternative method of dealing with auxiliaries was to provide a battery to run one unit complete for an hour and the station lighting half on a.c. and half on d.c.

A Word for Batteries.

Mr. J. HAMILTON remarked that a stand-by battery capable of supplying auxiliaries for one hour was the nearest approach to absolute reliability. For boiler feed pumps the turbine drive had valuable qualities and he wondered why the author regarded this reliable apparatus as a stand-by. Steam operated air ejectors should be included under direct steam drive. A special house set required additional attendants. It would be of interest to have the authors' views on the most reliable source of supply to such a set.

Mr. A. E. MALPAS said that in the case of circulating pumps, air pumps and lift pumps, it was not usually necessary to duplicate separate items for small units. But with units of say 10 000 kW even the separate units might with advantage be duplicated.

Employing Pass-Out Steam.

Mr. T. F. HOUGHTON recalled that in discussing the disposal of exhaust steam from the house turbine the authors concluded that feed heating should be done by bleeding the main turbine. The installation of a pass-out turbine for house service work, the pass-out steam being utilised in a feed water evaporator, also deserved consideration. With a four-effect evaporator a turbine capable of passing out 25 per cent. of steam would be needed. The steam consumption of such a machine would be 13 to 14 per cent. greater than that of a condensing turbine, and feed water would be obtained at the cost of the increase in coal consumption of the auxiliary turbine.

Mr. J. H. COLLIE thought that for some auxiliaries, especially boiler feed and circulating pumps, it was desirable to use a steam drive, with a stand-by of either steam or electrically driven pumps. The two main auxiliaries were thus independent of the station supply. Direct current motors, in view of their flexibility, were preferable to a.c. motors. A stand-by battery both for auxiliaries and lighting, was most desirable. High speed d.c. generators on the main shafting were usually satisfactory if the radial high speed commutator was kept in good condition; but they were apt to flash over with heavy shorts and he doubted if manufacturers would recommend them for such important duty. It was better to drive such generators by gearing.

Mr. A. STUBBS said the chief drawback of the steam drive was the low efficiency of the small unit.

Mr. H. DICKINSON remarked that the scheme of running two turbines with two circulating pumps was not satisfactory; it would be better to have three pumps so that if one failed there would still be a pump to meet the requirements of each turbine. Direct current motors required more attention than a.c. motors, but the extra cost was not a serious factor if one considered the use of a battery as a stand-by.

The D.P. BATTERY CO. have just installed one of their latest type storage batteries at Stowe House, near Buckingham, which has recently been converted from a country mansion to a public school. The D.P. Battery was supplied through Girdlestone and Co., who were responsible for the electrical work.

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Advertising in the Engineering Press.

The Copy—Faults and Fallacies.

By HUGH M. GOODY.

It is, I believe, a fact that the word "copy" inspires a feeling of displeasure, conscious or unconscious, in the breast of many engineers. To them it is a piece of advertising jargon which is in some unexplained manner incompatible with the dignity of their profession. If, however, the word has, or at all events *had*, unpleasant associations, the idea which it connotes is just printed salesmanship, a thing which even the most dignified of us can ill afford to do without. Some such prejudice, however, is probably responsible for the "copy-less" advertisement which is by no means an infrequent phenomenon in the engineering Press—a phenomenon which renders it necessary to devote a portion of this article to a plea for the very existence of what is possibly the most important element in the vast majority of advertisements.

The Essence of an Advertisement.

The essence of an advertisement is obviously to persuade the reader to buy. To effect such persuasion it is necessary that you should give him *reasons* for buying. It will, I know, be remarked that much successful advertising has consisted in the constant reiteration of a name. It must be remembered, however, that the majority of such advertising has been in the form of posters. In this case nothing more is possible during the short time for which the reader's attention is caught, and reliance is placed upon other forms of advertising to complete the selling process. Where this type of publicity has been successful in ordinary Press advertisements it has usually been in the sphere of domestic commodities. Here it is sometimes the case that of several commodities of almost equal merit the housewife will unconsciously ask for that with which constant reiteration has made her most familiar. Advertisements in the engineering Press are, however, concerned with a class of buyer who is accustomed to use his powers of reasoning and with a class of commodity which is usually the object of serious deliberation before purchase.

"Copy" Essential.

It may, then, be taken as axiomatic that engineering advertisements should include "copy" in one form or another. Selling arguments can, of course, be conveyed in a variety of ways—as, for example, by letterpress, by pictures and by general atmosphere. Pictures will often "speak for themselves," and will sometimes tell their story more effectively and pleasantly than mere words. It must, however, be remembered that the reader cannot always be relied upon to spend the time which is necessary to a proper appreciation of the message conveyed by your illustration, whereas plain letterpress would, probably, have given him the key to your argument. "Atmosphere," too, is a subtle thing, the effects of which are to some extent dependent upon the reader's psychology. It is, in fact, safe to say that of the several ways in which selling points can be conveyed the most flexible and most universally applicable is the printed word, and it is with this aspect of the technical advertisement that the present article proposes to deal.

Let us assume, first of all—since that presents the greatest difficulties—that we are dealing with a highly technical piece of apparatus. We will assume, too, that the writer of the copy is an engineer, closely acquainted with the apparatus and, very possibly, concerned in its design and that he is working in conjunction with an advertising agency.

Obstacles to Good Copy-Writing.

What are the landmarks he should observe and the pitfalls he must avoid? One of the most important obstacles to good copy-writing is likely to consist in the view point of the writer. If he is intimately acquainted with the manufacturing and technical aspects of the product he will probably consider the merits of the apparatus from that standpoint. However difficult it may be for him to do so, that attitude of mind must be discarded at the outset. The only viewpoint that should be evidenced by a salesman (whether he exercise his function by word of mouth or through the Press) is the customers!

Choosing a Selling Point.

We will suppose that small brass and ferrous castings have entered largely into the manufacture of the apparatus in which you are interested. As a result of overhauling the design it is found possible to effect considerable economies in manufacture by, for example, the introduction of drawn metal and stampings. Now, when your mind is thoroughly accustomed to the idea, it is quite likely that you will be tempted to consider that the use of stampings is intrinsically meritorious and to put it forward to your customers as a talking point. Actually, of course, a manufacturing detail of this kind is of no interest to a prospective purchaser except as a means to an end, e.g., making the apparatus cheaper or more convenient. It is essential, therefore, to choose the real "selling point." In claiming that your product is cheaper or more convenient than heretofore it may be helpful to explain how you have achieved those objects, but it is fatal to lose sight of the end in the means.

Getting the Customer's Viewpoint.

If the copy-writer can get the customer's viewpoint in the manner suggested, half the battle is won and he can now safely put pen to paper. First of all he should make brief notes of the principal talking points and then proceed to write round these notes a description in simple English of the apparatus. This description should be gone through again and again to see how far the same things can be said in a smaller number of words. It will be found that up to a certain point, as the description gets terser and terser, the meaning is conveyed not less clearly but more clearly. The process is, in fact, a refining one. Having got the matter to its smallest dimensions it will possibly still be too lengthy for a single advertisement. In this connection 100 words may be regarded as a safe maximum for a majority of advertisements. In that case it will be necessary to sectionalise your manuscript and deal with it in, say, four or six announcements. Each section should be taken and turned to a self-contained advertisement which, at the same time, will follow on naturally from the last advertisement of the series and lead up to the next.

As to style, simplicity has already been urged. Involved sentences and parenthetical clauses should be avoided. Nothing should require to be read twice to convey its meaning. As a matter of experience (and without entering into any argument on the merits of the case) it will be found that Anglo-Saxon words convey their meaning more economically and more clearly than Latin derivatives. Equally, however, it is desirable to avoid the opposite extreme where terseness resolves itself into a series of pistol shots which are the reverse of pleasant. It is necessary, too, to adopt a positive rather than a negative style, since it conveys a stronger impression to state that your product is actually good, rather than that it is merely not bad. (Stated thus baldly, such an injunction may seem hardly necessary, but it is surprising how much "negative" copy finds its way into print.)

Decrying Competitors.

Another danger which should be avoided is the temptation to decry competing designs of apparatus. The principal reason for this is that some of your readers are, probably, purchasers of the competing line and in criticising it you are at the same time, reflecting upon their discernment in purchasing it.

Originality and freshness of outlook are as important in technical advertising as in any other branch. At the same time due allowance must be made for precedent and tradition and anything in the nature of "stunt" advertising should be left severely alone. It is unwise to generalise in these matters, but it is probably true to say that the general tendency of the engineering mind is a conservative one. Anything savouring of "cheapness" or Americanism (though the two are not necessarily synonymous) is resented and must be avoided.

In conclusion, it may be permissible to remind the engineer and copy-writer of the value of co-operation on the part of his advertising agent in the preparation of copy. Copy-writing is an art of which the agent is a past master but which will probably elude the engineer for many a long day. Technically, the engineer must reign supreme, but he may often find that the agent can translate his technical notes into "copy" more effectively than he. At all events the agent will be invaluable in so far as he provides that freshness of outlook already referred to, which is so essential to successful copy-writing.

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Three Electricity Schemes Considered.

North-East Midlands Electricity District.

Exclusion of Power Companies not Approved.

As a result of the inquiry held at Sheffield in October and December last, the Electricity Commissioners have come to certain conclusions and decisions regarding the schemes put forward for the North-East Midlands Electricity District.

Subject to certain exclusions, the most important of which is that Buxton and the surrounding parishes have been transferred to the South-East Lancashire Electricity District, the area provisionally determined is confirmed.

Lindsey not to be Excluded.

Evidence was given at the inquiry to show that the proposed scheme of development offered no immediate advantage to those parts of Lindsey which were included in the provisionally determined district, but it was not established that it would be disadvantageous to those parts to be included. Taking into account the trend of colliery and other industrial development eastwards from Doncaster, the possible need of a capital station on the River Trent within the next few years, the potential developments which might result from the establishment of such a station, and the existence of supplies of waste heat at Frodingham and Scunthorpe, the Commissioners have therefore come to the conclusion that these parts of Lindsey should be associated at the outset with the development of the other portions of the district.

Position of Yorkshire and Nottinghamshire Companies.

It was suggested at the inquiry that portions of the areas of supply of the Yorkshire Electric Power Co. and the Derbyshire and Nottinghamshire Electric Power Co. situated within the district should be excluded under Section 17 of the Electricity (Supply) Act, 1922.

After consideration of the operations of the Yorkshire Electric Power Co. in the district, of the possible assistance to be derived from the capital station of the company at Ferrybridge, and of the distribution developments under the South-East Yorkshire Special Order, the Commissioners are of the opinion that the Power Co. should continue to operate within the district.

The Derbyshire and Nottinghamshire Electric Power Co. is not at present giving any supplies in the district, but proposals were submitted by them for the development of the southern portion of their area from the generating station at Spondon, and of the northern portion of their area by means of bulk supplies from the Yorkshire Electric Power Co. The Commissioners are therefore satisfied that a case has not been made out for their exclusion, and that the company should be afforded the opportunity of developing their area.

The Technical Scheme.

The technical scheme submitted by Sheffield provided for the inter-connection of the municipal generating stations in the district and for the installation of additional generating plant up to 20 000 kW, for the subsequent extension of the municipal stations at Sheffield and Rotherham, and for the establishment when required of two further generating stations at Mexborough and Sprotborough, respectively, together with the construction of inter-connecting transmission lines.

The Commissioners consider it premature to come to a conclusion as to the position of the new capital stations in the district, as subsequent developments may modify the position. The Commissioners think advantages would accrue if arrangements were made with the Yorkshire Electric Power Co. for the erection of some of the proposed transmission lines by that company, and with the various colliery owners for the connection of their electrical systems to the main transmission system of the district. They are also of opinion that a further improvement could be effected in the distribution of electricity in the area to the south of Sheffield, and that this matter could be satisfactorily settled by arrangement between Sheffield and the Derbyshire and Nottinghamshire Electric Power Co.

A Joint Authority Necessary.

The Commissioners have come to the conclusion that a case has been made out for the establishment of a joint authority on the lines proposed at the inquiry, but their approval to this establishment is conditional upon the transfer or lease to that authority of the stations within the district belonging to the principal authorised undertakers, or upon the agreement of those undertakers to an effective and unified control of the stations in question.

It is proposed to establish a joint authority of twenty-six members, eight representing Sheffield, four Rotherham, two Chesterfield, two Doncaster, one Mexborough and one Worksop. Local authorities not supplying electricity would have two representatives jointly, the Yorkshire Electric Power Co. and the Derbyshire and Nottinghamshire Electric Power Co. one each, the Sheffield and Rotherham manufacturers one jointly, the South Yorkshire Coal Trades Association, the Derbyshire and Nottinghamshire Coal Owners and Ironmasters' Committee, the Doncaster Collieries' Association and the Lincolnshire Ironmasters' Association one jointly, and the London, Midland and Scottish Railway Co. and the London and North-Eastern Railway Co. one each.

Mid-Lancashire Electricity District.

The Electricity Commissioners have considered the evidence given at the inquiry held at Preston in February into the schemes submitted for the Mid-Lancashire District. The conclusions and decisions of the Commissioners are as follows :—(1) The area of the district as provisionally determined is confirmed. (2) Under the agreed technical scheme it is proposed to deal with the district in two portions.

The Central and Eastern Area.

The new stations at Blackburn and Preston are to be utilised, in central and eastern area, with the existing stations at Accrington, Burnley, Colne, Darwen, Nelson and Rawtenstall, which are not to be further extended except in the cases of Nelson and Rawtenstall, and, unless otherwise determined, in the case of the stations at Colne and Darwen. Provision is also made for shutting down the two existing stations at Preston and the Jubilee Street station at Blackburn. During the first stage of development transmission lines will be established between Preston, Blackburn, Accrington, Burnley, Brierfield and Nelson, to supplement the existing lines. A new generating station is to be erected at Padiham, when required, either by the Corporation of Burnley or by the Lancashire Electric Power Company.

The Western Area.

In the western area the stations at Blackpool and Fleetwood will be extended and utilised with the station at Lytham St. Annes, which is not to be further extended unless otherwise determined. Provision is made for a supply to be given from the Blackpool station to Bispham and Lytham St. Annes.

The Commissioners approve generally the proposals in the amended Technical Scheme.

Scheme of Administration.

The agreed scheme of administration provided for the establishment of an advisory board, an engineering committee for the whole district, and three sub-committees for the central, eastern, and western areas respectively. It appears to the Commissioners that there would be some advantage in making provision for the direct representation of local authorities other than authorised undertakers on the Advisory Board, instead of for the County Council, and for the representation of other authorised undertakers established hereafter in the district.

Administrative Sub-Committees.

With regard to the proposed appointment of three separate administrative sub-committees, the Commissioners are of the opinion that this is a matter which should be left for the present.

Subject to the foregoing observations, the Commissioners approve generally the agreed proposals.

The main outlines of the approved technical scheme will be embodied in the draft order which will be forwarded to interested parties for their observations prior to the holding of a further local inquiry.

Mersey and West Lancashire Electricity District.

The Second Inquiry.

The Electricity Commissioners held their second inquiry at Liverpool on Thursday and Friday last into the proposed Mersey and West Lancashire district.

Mr. E. WOOLL, K.C., for the Provisional Committee of Local Authorities, said support for the scheme had been greatly strengthened since the appointment of the provisional committee. Six-sevenths of the area of the Wirral Peninsula had now joined the committee. The local railways would probably be electrified, and a large generating station would probably be erected at Liverpool, from which the Wirral district could be adequately served. The time had now arrived when it would be of advantage to merge the Wirral Joint Board in the larger area. The line of independence now being taken by Liverpool was to be deplored, for there was really no difference of opinion between the Liverpool Corporation and the provisional committee.

Mr. MILLER, for Birkenhead Corporation, said that municipality would have preferred to extend its own municipal undertaking, but as it was not likely the Commissioners would consent to that, the council supported the proposed Wirral Joint Board. The inquiry was being held to complete details for the draft scheme only.

Mr. W. J. JEEVES, K.C., for the Wallasey Corporation, said to eliminate the Wirral Joint Board and absorb the Wirral area in the Mersey and West Lancashire district would make it a new scheme, which would be *ultra vires*.

Mr. A. W. WILLMER, a member of the Mersey Dock and Harbour Board and the Provisional Committee, said that the Dock Board were unanimously of opinion that a single authority for both sides of the river would be a great advantage.

Mr. T. M. NEWELL, engineer to the Mersey Dock and Harbour Board, said the area of the proposed scheme was small enough, and he would have preferred to see a scheme for the whole of Lancashire.

Mr. ROWLAND HARKER, for Liverpool Corporation, asked the Commissioners to adjourn the inquiry to give the Corporation an opportunity of considering the present scheme in detail.

The inquiry was adjourned until after the July meeting of the Liverpool City Council.

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Merchandise to Sell and Profit By.

In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

An Original Design in Fittings by Strode.

Contractors and retailers, who seek fittings of distinction in both design and quality of workmanship, should see to it that they make a close study of the range manufactured by STRODE AND CO.; if it is not possible to make the choice from a display of the actual fittings, reference should be made to the tasteful catalogue published by the firm. No matter what the method of selection, all contractors or retailers who pride themselves that they take first place in the local showrooms, should have a choice range of these fittings on show. We illustrate an original design of fitting, viz., a wall bracket with a suspended alabaster bowl. The catalogue which we have referred to contains details of a number of these fittings.

A TASTEFUL LIGHTING FITTING FOR THE HOME.

The Econometer CO_2 Tester.

We illustrate an instrument which will be of particular interest to engineers. Fig. 1 demonstrates its essential features, and Fig. 2 proves how portable the device is. The manufacturers are KELVIN, BOTTOMLEY AND BAIRD (a name standing high in the list of instrument makers), and they will be pleased to post a copy of a descriptive list with full technical data to all engineers who are interested.

FIG. 1. FIG. 2.

TWO VIEWS OF THE ECONOMETER CO_2 TESTER.

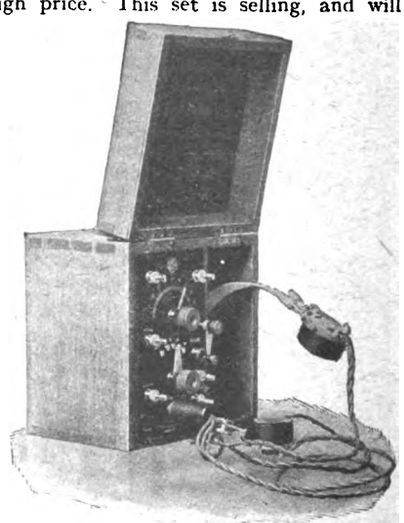
Advice to Buyers of Dry Batteries.

We shall make no apology for reiterating the importance of care and discrimination when buying dry batteries. This item of electrical merchandise is usually regarded as very small fry, but it will prove a pig in a poke if the first fundamental is neglected. That fundamental can be very briefly stated, but it does not lose its cogency by being brief. Batteries can only be bought on one basis —who is the manufacturer and have the batteries a quality policy behind them? FULLER'S UNITED ELECTRIC WORKS are one of the select list of makers whose product can be bought and sold with confidence. Our illustration is of the No. 2 round battery, and while from outward appearance there is no difference from the multitude of other round pattern "bread and cheese" batteries on the market, it bears the name of "Fuller." Further, the battery is made up on the Chkliar patent process. By the use of this process Fuller's claim that the local action of self discharge is reduced to an absolute minimum, and the shelf life is increased accordingly. Vigilant inspection throughout the various processes of manufacture results in batteries of constant regularity in service and maximum efficiency. The range of batteries manufactured by Fuller's under the Chkliar process is a considerable one. No less than seven sizes with varying capacities are made in rectangular shapes and four sizes in the round shape.

A USEFUL DRY BATTERY.

The "Elwell" Crystal Set.

We illustrate the Aristophone crystal receiver No. 11a, manufactured by C. F. ELWELL. The set is listed at £8 7s. 6d., complete with aerial equipment and one set of Brown's headphones. It should not be judged hastily as a slow seller because of the comparatively high price. This set is selling, and will continue to sell because of the undeniable demand there is for "something better," even in crystal sets. Next September will see a boom in "wireless" such as will dwarf the present boom, but the public will be more discriminating in their purchases. Hence it is necessary for retailers to build up their business and reputation on quality.



AN EFFICIENT CRYSTAL SET.

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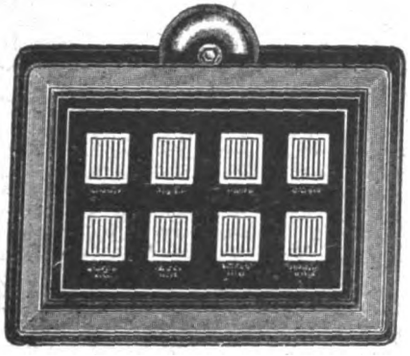
A Reliable Bell Indicator by Gent.

In pre-war days it was the practice of contractors to buy bell indicators at 1s. per way. Many still long to buy at the same price, ignoring the fact that it is impossible to produce and sell a sound indicator at such a price. It will not profit contractors to purchase "cheap" indicators, because the profit on the job will be dissipated in service charges or what could well be called "pacification" charges. We illustrate an indicator which is but one of a



AN INDICATOR THAT WILL GIVE NO TROUBLE.

large range manufactured by GENT AND CO. A study of the indicator and the specification to which it is made, reveals the fact that in this particular quality Gent and Co. have a line with which to fill the legitimate call of contractors for an indicator at a moderate, and withal, competitive price. It is known as the Fig. 13, and is made in sizes from two-way and upwards to a maximum of thirty-way.

The Public Needs in Accumulators.

We dare hazard that none will gainsay the argument that we have many times voiced in these columns, and which if need be we shall reiterate again and again, that there is only one basis on which to buy accumulators, viz.: quality. In addition, it must be remembered that accumulators to the wireless amateur are

A BATTERY FOR WIRELESS AMATEURS.

part and parcel of a set, and therefore must be compact and portable. They are bought as parts of the set and must be as readily handled as gramophone records. We illustrate a "Fuller" 6 V accumulator which is manufactured by FULLER'S UNITED ELECTRIC WORKS. It is of compact design with ebonite case, and is fitted with a strap handle. The accumulator is of the well-known "Block" type for which Fuller's are renowned.

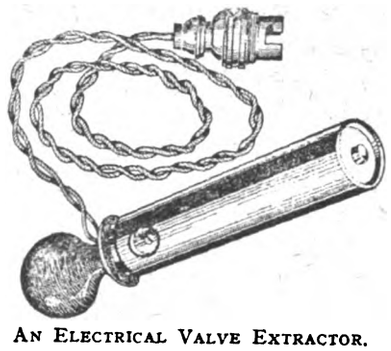
"Spring Cleaning" Trade.

According to the calendar the date for summer to commence is June 21st, and although electrical traders do not pay slavish attention to such milestones, "spring cleaning time" for all good housewives will soon be over. We can, however, accept it that this "spring madness" (as a mere man would call it) will have possessed a vast number of women during the month of May. And there is still a period in which sales of electrical labour-saving and comfort-creating devices can be boosted.

We have previously referred to the devices offered by the NORTHERN STEEL AND HARDWARE CO., and there is no purpose in our describing again their many electrical and mechanical details. One point we would emphasise. Besides electrical and mechanical details which none will deny every electrical device must have, domestic apparatus must have some "housewifely" features and these have not been neglected in the Northern apparatus. The Northern Co. have not left it to the retailer entirely to provide the selling force. The folder entitled "Get the dust *out* of your home" is a piece of publicity which will compel the attention of every housewife whose hands it gets into. It is for the retailer to see to the latter detail.

A Device to Save Time and Patience.

We illustrate an electric valve extractor which will appeal to many contractors and retailers who do business in automobile apparatus and spares. A vast amount of time and temper is wasted in getting valves out after the cotters are withdrawn. This little labour-saving device consists of a special form of electro-magnet so constructed as to be equally efficient for either convex, flat or concave valveheads. It is very simply operated off the car lighting circuit. When the cotters have been withdrawn the "Extractor" is plugged into a lamp connection or other convenient point of the car's lighting system. It is then inserted through the valve cap hole and withdrawn with the valve hanging on the bottom.



AN ELECTRICAL VALVE EXTRACTOR.

The extractor is also handy for recovering steel parts from awkward positions, e.g., the under-shield.

The device is listed at 17s. 9d., and it is manufactured by ROUSE AND GRASEBY.

A Two-valve Set of Proved Worth.

Judging from the large number of testimonials received by the GENERAL ELECTRIC CO., we need have no hesitation in stating that the catalogue No. BC2001 two-valve set manufactured by them is of proved worth. We should render a service to retailers if we

ANOTHER SNIP FOR THE BROADCASTER.

could quote some extracts from these testimonials, but unfortunately our limited space will not permit this. We must, however, impress upon retailers the wisdom of thoroughly investigating the selling possibilities of this set in their various districts.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

"M. and C. Machine Mining" for May has just been published by MAVOR AND COULSON, LTD.

FERRANTI, LTD., have sent us a copy of their list No. FA75, describing non-magnetic cast iron.

"Ornamental Loud Speakers" is the title of a descriptive list just published by WESTERN ELECTRIC CO.

The VAUGHAN CRANE CO. have kindly sent us a copy of a mailing card briefly describing an electric hoisting block.

"Uniflow"-Steam Engines" is the title of a descriptive list recently published by HICK, HARGREAVES AND CO.

GARGUARM SPECIALITIES have kindly sent us a copy of a folder describing "The Merican Atmospherics Absorber."

In a publication No. P.177 "Prescot" jointing compounds are described and prices quoted for various grades. As is well known the manufacturers are BRITISH INSULATED AND HELSBY CABLES, LTD.

"The final solution of the problem of bare wire insulation." This is the claim made by LIONEL ROBINSON AND CO. for Ballsok beads (which they distribute) on a postcard recently received. The postcard also quotes a schedule of prices.

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Parliamentary Intelligence.

Private Bills.

Synchronisation of Purchase Rights.

The POTTERIES and NORTH STAFFORDSHIRE TRAMWAY and LIGHT RAILWAYS BILL was considered by the Unopposed Committee of the House of Commons, presided over by Mr. J. FitzAlan Hope (Chairman of Ways and Means), on Wednesday, May 9th.

Mr. BROWN (Messrs. Dyson, Bell and Co., Parliamentary agents) said that the Bill was promoted by the Potteries Electric Traction Co. and the North Staffordshire Tramways Co., between which companies the working arrangements were close, so that for all practical purposes the two undertakings formed one system. The undertakings were situated in the districts of several local authorities, and by reason of the fact that the tramways and light railways of the companies had been authorised at different dates, the dates on which the local authorities could purchase the portions of the undertakings which were in their districts did not synchronise. If the local authorities decided to purchase, therefore, there would be a great deal of inconvenience to both the tramway undertakings and themselves. The main object of the Bill was to synchronise the dates of purchase. The date for purchase was fixed at 1925, and the local authorities had agreed that unless they purchased at that date the companies should be left alone until 1950, after which the intervals should be 30 years.

The other principal provision of the Bill was one which enabled the Minister of Transport, on the representation of the Companies, to make an Order authorising the Companies to abandon any particular line or portion of it. The form of the clause had been questioned, however, by the Minister of Transport.

After some discussion, the Committee announced that the preamble of the Bill was proved, subject to the final settlement of the form of the clause.

Tramway Proposals in Belfast Bill.

The Select Committee appointed by the North of Ireland Parliament to consider the BELFAST CORPORATION BILL, dealt with the tramway proposals on the 11th inst.

Mr. J. S. D. MOFFET, manager of the tramways, gave the usual statistics of the undertaking, and expressed the opinion that the proposed extensions would improve the finances of the undertaking in time.

Mr. E. S. MURPHY, K.C., representing the railway interests, said, in regard to the proposed Dundonald extension, there was no justifiable reason for extension to the cross-roads. The Belfast and County Down Railway Co. suggested that the object was to tap the traffic that at present came to Dundonald station, and the receipts on the tramway, as estimated by the promoters, would show a large deficiency, which Mr. Moffet estimated would continue at least five years. The extension on the Holywood Road was not a necessity at the present moment. He submitted that it was beyond dispute that the railway provided adequately for the traffic.

Several witnesses expressed the opinion that there was no need for the Holywood extension.

The CHAIRMAN (Senator T. M. Greer) announced, after the Committee had considered the evidence, that the Committee proposed to allow the following extensions: (1) Donegal Square North to Victoria Street; (1a) junction tramway, Donegal Place and Donegal Square North; (1b) junction tramway, Chichester Street and Victoria Street; (2) Dufferin Road; (3) Malone terminus to near entrance to Malone House; (4) Dundonald terminus to Dundonald Cemetery gate furthest from Belfast; (5) Short Strand; (6) Belmont terminus to Killeen Road; (7) Ballygomartin Road to Glencairn Road junction; (8) Thompson Wharf (Queen's Road); (9) Holywood Road (one mile and three furlongs); (10) Queen's Road to Newtownards Road, via Hamilton Road and Severn Street.

Wimbledon and Sutton Railway Bill.

This Bill, to extend the time for the compulsory purchase of lands and for the construction and completion of the railway authorised by the WIMBLEDON and SUTTON RAILWAY ACT of 1910, and to raise additional capital, has been ordered to be reported for third reading in the House of Commons.

Mr. R. B. BAXTER (Parliamentary Agent) explained to the Committee on Unopposed Bills that the railway authorised in 1910 was that between Wimbledon and Sutton, about 5½ miles long. (This was dealt with in the proceedings on the City and South London Railway Bill, reported in our issue for May 4th.) The Act of 1910, incorporating the Wimbledon and Sutton Railway Co., was promoted by certain landowners, but they were unable to raise the capital authorised, and in 1912 or 1913 they had asked for the assistance of the Underground group of companies. In 1913 a further Act was passed, which extended the time allowed for construction and authorised further capital. Further extensions were subsequently granted. The present time limit is July 26th, 1924, the present Bill extends the time to July 26th, 1928. The new railway would be connected with the Southern Railway Company's line at Wimbledon, and with the new extension of the City and South London Railway at Morden, so that Sutton would have two train services.

The total capital authorised at present is £550 000, and there is power to borrow up to one-third of the paid-up capital. The capital issued is £5 350 in £10 shares. It is estimated that, owing to increased costs of materials, labour, etc., the cost of the railway, rolling stock, etc., will now amount to about £1 300 000, and powers are asked for in the Bill to raise a further £600 000 additional capital, and to borrow up to half the amount of the paid-up capital.

Maidstone Corporation Bill.

This Bill, which was recently considered by a Committee of the House of Lords, and has now been reported for third reading, contains provisions with regard to trolley vehicles, omnibuses and light railways, and to the electricity undertaking of the Corporation. Power is given to run trolley vehicles over specified routes, and there are a number of usual provisions with regard to electrical works and equipment, public safety, etc. No trolley vehicle route is to be opened for traffic until it has been inspected and certified to be fit for traffic by the Minister of Transport. Certain provisions of the Tramways Act of 1870 are applied. The trolley vehicles and omnibus undertakings are to form part of the light railway undertaking of the Corporation. The borrowing powers are £5 400 for trolley vehicles, £5 300 for posts and other apparatus for the purpose of the trolley vehicles, £4 800 for omnibuses, and £3 500 for lands and the erection of buildings for the purposes of the light railways, trolley vehicles and omnibuses.

Bradford Corporation (Trolley Vehicles) Provisional Order.

This Provisional Order, which was passed by the Unopposed Committee of the House of Commons on May 16th, confirms an Order made by the Minister of Transport authorising new routes for trolley vehicles in Bradford, other than those specified in the Corporation's Act of 1910.

Rating of Machinery Bill.

A hardy annual, in the shape of a proposal to exempt machinery from assessment, was discussed and carried by a substantial majority, and the Bill was read a second time.

Questions of Electrical Interest.

Wireless Experimental Licences.

Sir JAMES CORY asked the Postmaster-General whether any experimental licences had been granted since the reference of the applications to the officers of his Department.

The POSTMASTER-GENERAL replied that the examination and classification of the suspended applications was approaching completion. He hoped to issue licences in a considerable number of cases shortly.

The Broadcasting Committee.

Mr. T. P. O'CONNOR having asked that the composition of the Committee of Inquiry into Broadcasting should be revised so that musical and theatrical interests should be represented,

The POSTMASTER-GENERAL said, in reply, that the entertainment industry was not the only interest which desired to be represented. In view of the many applications received it would be impracticable to comply with the request.

Automatic Train Control.

Col. WILFRID ASHLEY (Secretary, Ministry of Transport) has stated in reply to a question, that the recommendations made by his inspecting officers regarding train control on railways, are in every case brought to the notice of the railway companies concerned, and in addition the companies have been asked to consider the conclusions arrived at by the Departmental Committee on Automatic Train Control, whose report was published last year. The companies have appointed a committee of experts on the matter.

Overcrowded Tube Trains.

In reply to a question by Mr. ALFRED SHORT, on May 14th, regarding overcrowding on the "Bakerloo" Tube between 8.30 and 9.30 a.m., Major H. BARNSTON (Comptroller of the Household) said the company informed him that trains were run every two minutes during the rush period. It was impossible to avoid overcrowding when passengers from other lines happened to concentrate on the same train.

Speed of Telephone Installation.

On the 15th inst. the POSTMASTER-GENERAL said, in reply to a question, the average time for the provision of a telephone exchange line was at present three weeks. Numerous schemes for additional plant were in hand throughout the country to meet the increased development which might be expected as a result of the reduced charges and to shorten generally the waiting period.

Broadcasting in Northern Ireland.

In the House of Commons of the Parliament of Northern Ireland last week Mr. M'GUFFIN asked the Minister of Commerce whether in view of the increasing desire for the establishment of a broadcasting station in the Six Counties area he was now in a position to make a statement with respect to the matter.

Mr. ARCHDALE replied that the establishment of such a station was a matter which, under the agreement entered into by H.M. Postmaster-General, could only be undertaken by the British Broadcasting Co. If and when a formal application was made by the company the Northern Government would raise no objection provided certain essential conditions were complied with. If they did apply all interested in wireless would be consulted.

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Legal Intelligence.

Claim for Damages to a Stator.

Shipowners Repudiate Liability.

In the Commercial Court, on May 9th, Mr. Justice Bailhache heard an action brought by the Madras Electric Supply Co. against the P. and O. Steam Navigation Co., Ltd.

Plaintiffs claimed damages in respect of a stator carried on one of the defendants' vessels to Madras and which was dropped into the harbour while being taken off the ship.

Mr. Wright, K.C., for plaintiffs, said that the machine was shipped by his clients in April, 1922, at Tilbury. The stator weighed 25 tons 9 cwt. In the act of discharging the machine at Madras the package fell overboard to the bottom of the harbour. It was recovered by a diver, but not before it had been very seriously damaged. It was rendered useless, and had to be re-conditioned completely owing to the salt water setting up rusting In respect of the damage plaintiffs claimed about £5 756.

The points of the defence put in referred to the terms of the contract based on the terms of the bill of lading. According to the pleadings, the damage was caused by the breaking of the derrick guy rope which caused the derrick to take charge. Defendants contended that a latent defect in the tackle, which came within the exceptions of the bill of lading, had caused the damage.

The hearing was adjourned until July 5th, to give plaintiffs an opportunity of calling evidence from India.

Infringement of B.T.-H. Patents.

In the Chancery Division on May 11 Mr. Justice Sargant heard an action by the British Thomson-Houston Co. against the Yorkshire and District Electric Lamp Repairing Co. for infringement of plaintiff's patent for gasfilled lamps. The defendant company was not represented.

Sir ARTHUR COLEFAX, K.C., for plaintiffs, said the validity of plaintiffs' patent was not in question, and the only issue was as to infringement. The action was brought to restrain infringement of plaintiffs' letters patent 10918 of 1913 for improvements in incandescent electric lamps, the patent being that for gasfilled lamps. What defendants had done and claimed to continue to do was to take a gasfilled lamp, the filament of which had broken, to open it, put in a new filament, fill it again with gas, and then say that it was merely a repair.

His LORDSHIP asked if the lamps were originally made under plaintiffs' patent.

Sir ARTHUR COLEFAX said this was not so in all cases.

Dr. OBERLANDER, consulting chemist, said it was impossible to repair a broken filament, and in order to make a gasfilled lamp within plaintiffs' specification, they would have to construct a new lamp.

His LORDSHIP granted the injunction asked for, with an inquiry as to damages, costs, and an order for the delivery up of the infringing articles.

Electrical Imports and Exports.

Increased Imports and Decreased Exports.

IMPORTS.—The following are official values of electrical machinery, apparatus and material imported into this country (*a*) during April, 1923, and (*b*) the aggregate figures from January 1st to April 30th, with increase or decrease compared with corresponding periods of 1922 :—

Electrical machinery, (*a*) £107 792 (increase £38 825), (*b*) £384 891 (decrease £65 621); telegraph and telephone cables, submarine, nil; other than submarine, (*a*) £10 582 (increase £9 341), (*b*) £30 143 (increase £17 987); telegraph and telephone apparatus, (*a*) £67 815 (increase £55 492), (*b*) £154 623 (increase £103 013); other electrical wires and cables, rubber insulated, (*a*) £9 842 (decrease £8 181), (*b*) £47 337 (increase £8 953); with other insulations, (*a*) £12 351 (increase £9 906) (*b*) £36 566 (increase £17 612); carbons, (*a*) £5 753 (increase £4 144), (*b*) £16 899 (increase £5 000); glow lamps, (*a*) £9 239 (decrease £1 196), (*b*) £72 831 (increase £9 686); arc lamps and electric searchlights, (*a*) £62 (increase (£47), (*b*) £828 (increase £367); parts of arc lamps and searchlights (other than carbons), (*a*) £367 (decrease £1 016), (*b*) £4 741 (increase £1 189); batteries, (*a*) £10 905 (increase £4 672), (*b*) £44 076 (increase £22 158); electrical instruments (commercial and scientific), and electricity meters, (*a*) £8 085 (increase £3 402), (*b*) £36 375 (increase £17 375); switchboards, (*a*) £1 807 (increase £1 667), (*b*) £1 927 (increase £408); other electrical goods and apparatus, (*a*) £86 755 (increase £44 755), (*b*) £255 427 (increase £79 437). Total of electrical machinery, apparatus and material (other than uninsulated wire), (*a*) £331 355 (increase £161 858), (*b*) £1 086 664 (increase £218 960).

EXPORTS.—The exports of electrical machinery, apparatus and material, produced or manufactured in the United Kingdom, (*a*) during April, 1923, and (*b*) from January 1st to April 30th, with increase or decrease compared with corresponding periods of 1922, were as follows :—

Electrical machinery, (*a*) £311 699 (decrease £138 790), (*b*) £1 327 415 (decrease £359 468); including railway and tramway motors, (*a*) £19 006 (increase £13 908), (*b*) £85 660 (increase £26 952); other generators and motors, (*a*) £171 000 (decrease £31 263), (*b*) £697 949 (decrease £303 504); and other electrical machinery, (*a*) £121 693 (decrease £121 435), (*b*) £543 806 (decrease £282 916); telegraph and telephone cables, submarine, (*a*) £37 128 (increase £14 108), (*b*) £186 804 (increase £81 533); other than submarine, (*a*) £100 606 (increase £38 793), (*b*) £320 991 (increase £113 442); telegraph and telephone apparatus, (*a*) £175 178 (increase £8 269), (*b*) £637 391 (decrease £70 587); other electrical wires and cables, rubber insulated, (*a*) £78 935 (increase £29 004), (*b*) £375 461 (increase £179 957); with other insulations, (*a*) £81 557 (decrease £2 010), (*b*) £350 955 (decrease £70 071); carbons, (*a*) £1 151 (decrease £1 699), (*b*) £18 493 (increase £3 035); glow lamps, (*a*) £29 735 (decrease £9 443), (*b*) £105 768 (decrease £30 352); arc lamps and searchlights, (*a*) £576 (increase £167), (*b*) £2 265 (decrease £989); parts of arc lamps and searchlights (other than carbons), (*a*) £49 (decrease £497), (*b*) £295 (decrease £1 643); batteries, (*a*) £37 670 (decrease £4 320), (*b*) £181 127 (increase £33 224); electrical instruments (commercial and scientific) and electricity meters, (*a*) £29 585 (increase £1 038), (*b*) £107 902 (decrease £26 586); switchboards, (*a*) £18 504 (increase £5 319), (*b*) £45 484 (decrease £93 566); other electrical goods and apparatus, (*a*) £120 406 (increase £38 260), (*b*) £444 457 (increase £25 462). Total of electrical machinery, material and apparatus, other than uninsulated wire, (*a*) £1 022 779 (decrease £21 801), (*b*) £4 104 808 (decrease £416 609).

The Press and Industry.

"The Greatest Force on the Side of Fair Play."

The public has been subjected to so many inconveniences, direct and indirect, as the result of industrial disputes, and has seen so many efforts to secure harmony between Capital and Labour come to grief, that it is somewhat difficult for those who are doing genuine good work in this field to get a hearing. Nevertheless these problems must be faced.

Mr. Geo. J. Wardle and other representatives of the INDUSTRIAL LEAGUE AND COUNCIL, who addressed a recent meeting of the Circle of Scientific Technical and Trade Journalists, presented the subject in a somewhat new light, and there was an interesting discussion. Apart from the description of the persevering and useful work that the League is doing, the consideration of the part to be played by the press raises interesting problems. Mr. Wardle, as one time Parliamentary Secretary to the Ministry of Labour and for many years editor of the "Railway Review," is equally conversant with politics and journalism. On the whole he thought there was little to choose between Capitalist and Labour organs; there was vision in both just as there was narrowness and bigotry. The Industrial League and Council, he said, was not a capitalist or a labour dodge but a genuine attempt of both sections of industry to get questions solved by mutual agreement and discussion. The press could play an important part by holding the scales equal and acting as the greatest force in industry on the side of fair play and a square deal. On many labour disputes a journal could and ought to take an impartial view. But there were occasions when a journal, voicing the views of its supporters, had to "take a side."

This was fully recognised in the discussion. But it was pointed out that even in this case the editor who has a case and states it fairly and without acrimony may do a public service and use his influence in the interests of peace.

Rating of Machinery.

At the annual meeting of the Machinery Users' Association last week the president, Sir EDWIN STOCKTON said the Bill for the Exemption of Machinery from Rating was necessary because if it were not passed it would be merely a matter of time for manufacturers to have their machinery included in the assessments to local rates, at 5, 7½, or 10 per cent. upon its capital value. To impose restrictions upon the development of trade was a suicidal policy that should be resisted by all constitutional means. The one source from which practical aid to British industries might come was the removal of taxation from machinery and factories. The foreign and export trade of the country would immediately be increased by that means.

Books Received.

"Telephony." By T. E. Herbert, M.I.E.E. (London: Sir Isaac Pitman and Sons, Ltd.) Pp. 868. 18s. net.

"Traction Motor Control." By A. T. Dover. (London: Sir Isaac Pitman and Sons, Ltd.) Pp. 114. 2s. 6d. net.

"Experimental Electrical Engineering." By Vladimir Karapetoff. Vol. I. (London: Chapman and Hall, Ltd.) Pp. xxxii+794. 30s. net.

"Electric Motors—Polyphase." By H. M. Hobart, M.I.E.E. Vol. II. (London: Sir Isaac Pitman and Sons, Ltd.) Pp. 384. 15s. net.

Report of the British Antarctic (Terra Nova) Expedition, 1910–1913. (The Physiography of the McMurdo Sound and Granite Harbour Region.) By Griffith Taylor, B.Sc. (London: Harrison and Sons, Ltd.). Pp. 246.

We are asked to state that "THE COST ACCOUNTANT" (38, Grosvenor Gardens, London, S.W.1) starts its 3rd volume in the June number. Annual subscription, to non-members of the Institute of Costs and Works Accountants, 18s.

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Imperial Notes.

AUSTRALIA.

Electricity Supply in Brisbane District.

Negotiations are proceeding for the supply of electricity by Brisbane Tramway Trust for electric lighting throughout the towns of ITHACA and TOOWONG. The Metropolitan Electricity Board have suggested that the Tramway Trust might also supply current for lighting SANDGATE, TOOMBUL, KEDRON and ENOGGERA, and the Trust have asked for information as to the demand.

[Proposed Royalty of 1d. per kWh.

ANGASTON (S. Australia) Council propose to enter into an agreement with the Barossa Electric Supply Co. for the supply of electricity. The company offer to supply up to 50 000 kWh per annum for lighting, on which the Council would receive 1d. per kWh. The company would supply current in Angaston and Nuriootpa for ten years, and would erect its own distributing system.

Broken Hill Requires More Electricity.

The South Mining Co. have made an offer to supply electrical energy to BROKEN HILL (N.S.W.) Council for distribution in the town. There is at present a power station owned by the Council. The Council have resolved that the electricity works manager be requested to furnish a report as to the cost of installing a semi-Diesel oil engine and a 120 kW generator, and the cost of installing a 120 kW motor generator and erecting poles and mains to convey current from the South mine to such motor-generator.

N.S.W. Contracts Board.

A new board has been formed to control NEW SOUTH WALES GOVERNMENT CONTRACTS and the buying of stores amounting to over £2 000 000 a year, the object being to avoid duplication and unnecessary expenditure and to get better prices by purchasing materials in larger quantities. The members of the Board are—The manager of the State Stores Department (Mr. A. Berckelman); the Controller of Stores for the Water Board (Mr. Bagnall); the Controller of Stores for the Harbour Trust (Mr. Wood); the commercial officer of the Irrigation Commissioners (Mr. Lewis); the Superintendent of Stores, Public Works Department (Mr. Paterson); and the Acting-Controller of Stores, Postal Department (Mr. Barrow). Mr. Barrow represents the Commonwealth, which is also interested in the matter.

The Treasurer (Mr. Cocks), says there had been no drastic change except that the old stores committee had been reconstituted and given additional powers.

CANADA.

United Kingdom Goods for Canada.

H.M. Trade Commissioner in Western Canada calls attention to the fact that a series of AGRICULTURAL EXHIBITIONS AND FAIRS is held during the summer months in Western Canada. These exhibitions afford an excellent opportunity of familiarising Canadian traders with United Kingdom productions. Fairs will open at Brandon on July 2nd; Edmonton, July 16th; Regina, July 30th, and Vancouver, about the middle of August. At each of these H.M. Trade Commissioners will maintain a bureau of information and display copies of British trade journals. H.M. Commissioners will also be pleased to receive (up to 50 copies) journals dealing with agricultural implements and machinery (including engines, small electric lighting plants) mining engineering, etc. Apply to H.M. Trade Commissioner, 703, Union Bank Building, Winnipeg.

EAST AFRICA.

The Uganda Government propose to spend £6 000 on an exhibit at the BRITISH EMPIRE EXHIBITION.

A new 1 000 kW electric-power station is being erected at Mombasa at a cost of £50 000, and electricity works estimated to cost £100 000 will be erected near Thika.

The "British and South African Export Gazette" states that the town and country districts in KENYA COLONY continue to demand small self-contained electric-lighting sets.

INDIA.

Trunk Telephone Scheme.

The Government of Baroda State have decided to establish a TELEPHONE SERVICE BETWEEN BARODA AND BOMBAY, and preliminaries have been settled with the Bombay Telephone Co.

Electricity Supply at Karachi.

It is stated that the new capital of 17 lakhs of rupees issued by the Karachi Electric Supply Corporation, so that the capacity of the generating plant might be doubled for the third time, has been fully subscribed. A new high-pressure supply is expected to be available within six months.

Indian Hydro-Electric Progress.

In his presidential address to the PUNJAB ELECTRICAL CONGRESS, Mr. W. P. Sangster said the Sutlej hydro-electric project which had been decided upon was designed to give 80 000 kW by directing the minimum flow of the river through a tunnel, and the power would be transmitted by overhead cables as far as Lyallpur to the west and Delhi on the south-east. As this undertaking might take some time to materialise, a smaller scheme to supply the Kalka-Simla railway, the Nalagarh quarries and Simla might be proceeded with in the meantime. Licences for public electricity supply had been granted for Rawal Pindi, Jullundur and Lyallpur, and applications and inquiries had been made in respect of a number of other places in the Punjab, indicating that public interest in the advantages of electricity supply is being sustained.

Foreign Notes.

EUROPE.

Three of the largest electrical concerns in Sweden, the Swedish General Electric Co. (Allmanna Svenska Elektriska Aktiebolaget), Luth and Rosen, and the Eck Electric Co., says the "Financier," have joined in acquiring a controlling interest in the ELEKTRO-MEKANISKA Co. It is believed this step is associated with a desire to obtain contracts in connection with the electrification of the State Railways, which will probably be commenced soon.

NETHERLAND INDIES.

Hydro-electric Power Developments.

The subject of the development of hydro-electric power in the Netherlands East Indies is dealt with in the "Netherlands Indies Review." The headquarters of the hydro-electric service are at Bandoeng (Java). Conditions for the employment of water power for generating electricity are favourable in the principal islands. The average rainfall in Java is from 118 to 156 in. per annum, and in the mountainous districts sometimes reaches 312 in. It is calculated that Java, Sumatra, North Borneo and Celebes can supply water power equal to 5 500 000 H.P.

In WEST JAVA there is a hydro-electric station supplying energy for the Tandjing-Priok-Batavia-Buizenzorg Railway, and there are similar works supplying current for various purposes at Bandoeng, Batavia and Buitenzorg. Tji Anten station, with a capacity of 28 000 H.P., and Tji Jatik station, with 7 500 H.P., supply current to Batavia and Buitenzorg, and stations at Tji Kapoengdoeng (3 000 H.P.) and Tji Saroewa (4 500 H.P.) supply Bandoeng. Another power station of (1 000 H.P.) is being built at Dajenh Kolot, near Bandoeng.

In the PREANGER REGENCIES, Java, there are some 240 hydro-electric undertakings run by private enterprise. These have a total capacity of about 9 000 H.P. There are private installations totalling about 12 000 H.P. in the whole island.

In CENTRAL JAVA the General Netherlands Indian Electric Co. has a hydro-electric station of 2 200 kW, and supplies electricity in Semarang and Salatiga.

In the valley of the Tjatoer, in EAST JAVA, there is a Government station supplying energy to the State railway workshops near Madioen. This plant is driven by two 1 000 H.P. turbines, and energy is transmitted by an overhead line at 55 000 V. It is proposed to electrify the railways in and around Sourabaya, and to establish a 10 000 H.P. Government plant to supply the necessary energy.

In SOUTH SUMATRA the State has a fairly large plant at Tambang Sawah, Bankoelen, the Simau mines have a 1 300 H.P. plant, and certain other mining companies have also fairly large plants.

In CENTRAL SUMATRA the Government has one 16 000 H.P., two 10 000 H.P., and one 4 000 H.P. stations, the Netherlands India Portland Cement Factory has one of 1 500 H.P. There are numerous others of 1 000 H.P. or less.

CELEBES has four hydro-electric stations with plant aggregating 150 000 H.P.

Exhibitions Booming.

Whatever may be said of some branches of industry, it is evident that the exhibition business has not only recovered its pre-war standard but has reached a stage of activity that surpasses all previous records. Europe, which, if we may believe the newspapers, is in a condition of industrial stagnation, is at all events doing enough business to justify a number of fairs and exhibitions which go beyond anything ever attempted in the days before the war. From a list which is published in the current issue of "The European Commercial," it appears that twenty fairs are at present in progress at places as far apart as Antwerp and Königsberg. Between now and the end of the year no less than seventy-six fairs are to be held, including the International Mining Exhibition during June in London and an exhibition of electro-mechanical appliances in Ghent, which will be open from June 1st to October 31st. We hope in addition to see a revival of the local electrical exhibitions which were so successful last winter.

Business Items.

Mr. W. M. SELVEY, consulting engineer, 66, Victoria Street, Westminster, S.W.1, informs us that his telephone numbers are now "Victoria 1796 and 1797."

The address of SMITH AND ANSELL, LTD., makers of electric light fittings, etc., is now Stockfield Works, Stockfield Road, Acocks Green, Birmingham (Acocks Green 269; Essalite, Birmingham).

The ENGLISH ELECTRIC COMPANY'S Offices at 2, Taviton Street, Gordon Square, London, W.C., are now permanently closed. Communications for the Publicity Department should be addressed to the Head Office, Queen's House, Kingsway, W.C.2.

Mr. DAVID BROWNLIE, 46, Grange Road, Ealing, London, W.5 (Ealing 2344), has, by amicable arrangement, severed his connection with Brownlie and Green, and is now engaged in private practice as an advisory specialist in matters relating to fuel economy, particularly in regard to coal saving by improved methods of steam generation and the scientific control of boiler plant.

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Electricity Supply.

Extensions and Developments.

MARYLEBONE (London) Borough Council have received sanction from the Electricity Commissioners to borrow £170 000, on account, for plant, and £25 500 for a cooling tower.

Electricity for driving the pumping plant at the Armthorpe borehole of the Markham Main Colliery is to be supplied under a twenty years agreement, by DONCASTER Corporation.

Notice has been given to the Yorkshire Electric Power Co. of the intention of SHEFFIELD Corporation to require the company to transfer to the Corporation the part of their undertaking within the portion of the added part of Ecclesfield which is not within the limits of Rotherham Corporation.

A Ministry of Health inquiry was held on May 9th into the application of the DOVER Corporation for sanction to appropriate land for the construction of a cooling pond for the new electrical plant. The Town Clerk said if the pond was not constructed two important demands for electricity would have to be refused, or a cooling tower would have to be erected. There was no opposition.

At a meeting of Greenock Corporation last week a report was submitted on the request received last month by the Corporation to submit an offer for the supply of electricity in bulk to PAISLEY. The convener of the Electricity Committee said it had been thought better that a joint offer should be made by the Greenock and Kilmarnock Corporations. Later it was agreed to appoint Sir Alexander Kennedy to inquire into the subject and report. The sub-committee was given power to deal with the report when received and make an offer, in conjunction with Kilmarnock.

In the course of a LECTURE, Mr. E. MOXON, borough electrical engineer of Southport, stated that with the old reciprocating engines which were used in the Southport electricity works in 1921, the pounds of coal used per kWh generated were 6·58; in 1922, with turbines, the coal figure was reduced to 4·03 lb., and for the year ended 1923 to 2·93 lb., the coal consumed being 8 659 tons and the kilowatt hours generated 6 567 318. The 1922 figures show a reduction in fuel consumption of nearly 55 per cent., and figures obtained at the present time show over 62 per cent. Fewer men were employed, and there were many other direct and indirect advantages and economies. It was better for a public utility service to sell a very large quantity at a low price than a small quantity at a high price.

Tapping New Areas.

The North Metropolitan Electric Power Supply Co. have entered into an agreement to supply electricity in HARPENDEN Urban District.

A scheme is under consideration for the supply of electricity by NORWICH Corporation to Sheringham, Coltishall, North Walsham, Overstrand, Cromer, East and West Runton, and perhaps Wroxham. As regards Cromer, negotiations will be necessary with Edmundson's Electricity Corporation.

Miscellaneous Supply Items.

TIVERTON Corporation have adopted an electric lighting scheme prepared by Mr. Christy, the estimated cost of which is £17 800.

DOUGLAS (Isle of Man) municipal electricity supply was commenced on the 18th inst. The capital expended on the undertaking is £60 000.

PENZANCE Town Council have decided that the present time is inopportune for going further into the question of the adoption of electric lighting.

The undertaking of the Chichester Electric Light and Power Co. was formally handed over on the 17th inst. to CHICHESTER Corporation, who have purchased it for £16 500.

It is expected that WICKLOW Urban Council's electricity supply undertaking will be in operation in July next. The contract for equipping the works is being carried out by Mr. J. Kane.

BLAIRGOWRIE Town Council have obtained a report on the best method of providing a supply of electricity for the town, and have been recommended to put in oil-driven plant, at an estimated cost of £8 864.

It is being urged in NEWTOWNSTEWART (Co. Tyrone) that an electric lighting scheme would benefit the town and locality. There is said to be ample power in the River Mourne for operating a hydro-electric plant.

The Minister of Transport proposes to confirm a Special Order authorising LLANDRINDOD WELLS Urban Council to supply electricity in the urban district. Objections to the Secretary, Ministry of Transport, Whitehall, London, by June 2nd.

The authorities of Marlborough College have agreed to find room in their generating station for the MARLBOROUGH Corporation to erect an engine and plant to supply electricity in the borough. The whole of the plant will be kept in repair by the college.

On the 17th inst. public and private electric lighting was inaugurated at CORWEN (Merionethshire). Electricity for this supply is generated by the water power of the falls of Cwnyd, on the Rug Estate. The new undertaking is due to the enterprise of Col. Wynn, of Rug.

Numerous petitions are being lodged against the Bill which is being promoted in the Northern Parliament of Ireland to authorise the BANN ELECTRIC SCHEME. These have been deposited by farmers, the Navigation Authority, the Harbour Commissioners, and others.

An old water mill called the Cwm Mill, at FERRYSIDE, Carmarthenshire, has been converted into a generating station by the Ferryside Electric Supply Co., and will shortly be opened. Mr. A. H. Stoodley is the engineer, and the plant will be capable of meeting the demands of 150 householders.

COLLINGHAM and WETHERBY Councils have declined the offer of the Yorkshire Electric Power Co. to supply electricity at 10d. per kWh. The former Council are inquiring into the practicability of installing a water-driven electrical set, and the latter are applying for authority to erect a plant of their own.

Mr. W. G. PICKVANCE, borough electrical engineer of Wrexham, in a recent lecture to North Wales colliery owners, managers and engineers, advocated the setting up of a central electric power station to supply current for DRIVING WINDING AND OTHER MACHINERY IN COLLIERIES. By this means he estimated that they would save 75 per cent. of the fuel now used for such purposes and £72 000 a year.

The Gas Company has reduced the price of gas at SUNDERLAND by 3d. per 1 000 ft., making the price 2s. 3d. per 1 000, which is said to be the lowest in the country. A member of Sunderland Corporation recently asked whether he would be in order in moving a vote of thanks to the chairman of the Electricity Committee for the energy of his department in extending its scope and efficiency, which had been the direct cause of the reduction of the price of gas.

At a meeting of ACCRINGTON Corporation, Alderman Higham said it was recommended that there should be contributions in aid of the rates of £2 000 from the tramways, and £1 000 from the electricity department. Coal consumption at the electricity works was now about 2 lb. per kWh. So long as they kept to that figure they might be certain they were on safe and economical lines. The surplus on the year's working of the electricity department was about £23 000.

The income of STAFFORD electricity department for the year ended March 31st was £26 251, plus £284 for fittings, a total increase of £7 228. The gross profit was £14 344, an increase of £8 416. Including dividends, rents, etc., the available balance was £15 834, and after providing for capital charges and allocating £5 893 to the renewals fund, there was a net deficit of £1 238, compared with £6 227 last year. The kilowatt hours generated were 3 671 603, compared with 2 014 860, and sold 3 077 853, against 1 587 870.

The Prince of Wales and Electricity Supply.

The Prince of Wales has consented to open the ROTHERHAM Corporation's Rawmarsh Road power station on May 28th. The aggregate capacity of the plant is 75 500 kW. He will also formally open the Nechells station of the BIRMINGHAM Corporation on June 12th.

Personal Items.

Mr. G. H. FLEMING, B.Sc., has been appointed as an assistant in the Department of Engineering at Edinburgh University.

Prof. FRANK S. CAREY will retire from the professorship of mathematics at Liverpool University at the end of the present term.

Mr. G. H. FROEBEL has been appointed manager of the marine sales department at the East Pittsburg (Pa.) works of the Westinghouse Electric and Manufacturing Co.

Gillingham (Kent) Corporation have appointed Mr. HAROLD HALL, chief assistant at the generating station, Tidworth, Hants, as borough electrical engineer. Mr. Hall has been chief assistant at Tidworth since 1915.

We understand that Mr. F. JENKINS, who has been employed in various capacities in the Wimbledon Electricity Department for nearly twenty-three years has received a week's notice of dismissal. Mr. Jenkins gave evidence for Mr. Lee in a recent action for slander.

Will.

Sir JAMES DEWAR, who died on March 27th, left estate in his own disposition of the gross value of £129 555; net personalty, £128 828. He desired that no bursary, fellowship, scholarship or annual lecture be founded or connected with his name by public subscription, and that no biography of his life should be published as a separate book. A sum not exceeding £500 is left to be distributed as gifts amongst those who assisted him at the Royal Institution, and provision is made for the publication of his scientific manuscripts, etc.

Obituary.

Ernest Wilfred Smith.

The death of Mr. ERNEST WILFRED SMITH, works superintendent at Dover Corporation electricity works, occurred on May 10th. Mr. Smith, who was 42 years of age, had been employed in the Dover electricity department about 27 years.

Arthur Gordon Webster.

We regret to learn of the tragic death of Prof. ARTHUR GORDON WEBSTER, aged 60, a well-known physicist of Harvard University, who committed suicide in consequence of his belief that some of his research work had been a failure. In 1895 he was awarded the Thompson prize of 5 000 francs in Paris for research on the period of electrical oscillations.

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Tenders Invited and Accepted.

UNITED KINGDOM.

FALKIRK CORPORATION.—2 000 kW turbo-alternator, with condensing plant and accessories. Specification from the Chief Engineer, Electricity Works, Falkirk.

FULHAM (LONDON) BOROUGH COUNCIL, May 26th.—Six 200 kW single phase air cooled transformers. Specification from the Borough Electrical Engineer, Townmead Road, Fulham, S.W.6.

MANCHESTER CORPORATION, May 29th.—Four-ton overhead runway for Barton power station. Specification from Mr. F. E. Hughes, Town Hall, Manchester.

BLACKPOOL CORPORATION ELECTRICITY COMMITTEE, May 30.—Supply and erection at West Caroline Street generating station of a water-tube boiler, with stoker and auxiliaries; steam duty 40/50 000 lb. evaporation per hour, working pressure 255 lb. Specification, etc., from the Borough Electrical Engineer and Tramways General Manager.

NEWMILL URBAN DISTRICT COUNCIL, May 31st.—(1) Three-phase 400 V switchboard, (2) 230 creosoted wood poles, (3) 1 500 insulators, (4) iron and wood arms, (5) about 26 miles bare copper conductor, (6) labour of erection and completion. Particulars from the Engineer, Council Offices, Honley, near Huddersfield.

WORTHING CORPORATION, June 13th.—Cables. Specification from the Engineer, Electricity Works, Worthing.

WORTHING CORPORATION, June 13th.—Diesel oil engine and c.c. dynamo, and hand-operated overhead crane. Specifications from the Borough Electrical Engineer.

LEICESTER CORPORATION. June 23rd.—(1) Three-phase turbo-alternator, with condensing plant, of 12 500 kW maximum rating, 3 000 revs. per min; and (2) house service turbo-alternator of 500 kW rating. Specification from Mr. T. Robert Smith, City Electrical Engineer.

SOUTHAMPTON CORPORATION, June 26th.—One 5 000 kW (or alternatively 6 000 kW) turbo-alternator, with condensing plant and accessories. Specification from the Borough Electrical Engineer.

GREAT INDIAN PENINSULA RAILWAY CO., June 28th.—Motor bogie trucks and bonds. Specifications from the Secretary, 48, Copthall Avenue, London, E.C.2.

SOUTH AFRICA.

JOHANNESBURG MUNICIPAL COUNCIL, June 4th.*—Transformers and electric cable and wire.

IRRIGATION DEPARTMENT, PRETORIA, June 27th.*—50 B.H.P. hydro-electric plant for Hartebeestpoort Irrigation Works.

RIVERSDALE MUNICIPALITY (Cape Province), July 31st.*—Generating plant, l.t. distribution material, meters, etc.

BARNES URBAN COUNCIL have accepted the tender of the Enfield Ediswan Cable Works for one mile of cable, at £516.

MANCHESTER CORPORATION have accepted the tenders of W. T. Glover and Co. and British Insulated and Helsby Cables for supplies of cable.

The Electricity Committee recommend EASTBOURNE CORPORATION to accept the tender of Reavell and Co. for an electrically driven compressor plant, at £2 504.

The Westinghouse Brake and Saxby Signal Co. have received orders for Westinghouse brake equipments for 150 new coaches for the LONDON ELECTRIC RAILWAYS.

For two electrically driven centrifugal sewage pumps, each with capacity of 1 300 gallons per min., the RIVER IRWELL CONSERVANCY COMMITTEE have been recommended to accept the tender of Mather and Platt, £607.

The tender of Callender's Cable and Construction Co. has been accepted by AYR CORPORATION, for cable for the supply of electricity to Milne's Ice Factory and other consumers in Tam's Brig area, at £2 364.

SALFORD CORPORATION have accepted the tender of Mather and Platt for two electrically driven centrifugal pumps, at £607; and that of Tangyes, Ltd., for two electrically driven reciprocating sludge pumps, at £1 473.

For supply of high and low pressure paper-insulated lead-covered cables for one year, CARLISLE CORPORATION have accepted the tender of British Insulated and Helsby Cables, Ltd., at a schedule of prices based upon metal prices.

The tender of Benjamin Electric, Ltd. (lowest tender received), for 3 602 illuminated number indicators has been accepted by LONDON COUNTY COUNCIL, at £2 746 10s. 6d. Thirteen tenders were received, the highest being £10 806.

ABERYSTWYTH CORPORATION have accepted the following tenders in connection with new sewage works:—Boving Engineering Works, electrically driven pumping plant, £905; S. S. Stott and Co., electrically driven sewage screen, etc., £838.

Vickers-Petter, Ltd., have recently secured a contract for two 2-stroke 450 500 B.H.P. Diesel engines for the EGYPTIAN PORTS AND LIGHTS ADMINISTRATION. These engines are required for tugs constructed by J. S. White and Co., and will be used in Suez Harbour.

* Particulars from the Department of Overseas Trade.

MARYLEBONE (LONDON) BOROUGH COUNCIL have accepted the tender of the General Electric Co. for supply of an air cooler for the 12 500 kW turbo-alternator at £1 275. The tender of Babcock and Wilcox for a 60-ton electric travelling jib crane and gantry at £5 520 is recommended for acceptance.

EDINBURGH CORPORATION have accepted the tenders of the Swedish General Electric Co. for a 250 kVA three-phase transformer, £226, and Ferguson, Pailin, Ltd., for 6 600 V switchgear, £241. The tender of the English Electric Co. for two 800 H.P. induction motors, £3 110, is recommended for acceptance.

LONDON COUNTY COUNCIL have renewed the contract with Siemens and English Electric Lamp Co. for the supply of the whole of the Council's requirements of incandescent lamps, including gasfilled, vacuum and carbon filament, for a further twelve months. The company have also received a contract from the PORT OF LONDON AUTHORITY for Siemens gasfilled type lamps.

The following tenders have been accepted by WALLASEY COUNCIL: Tudor Accumulator Co., battery of 25 cells, £176 5s.; Metropolitan-Vickers Electrical Co., main station switchgear, £12 618; Brush Electrical Engineering Co., centrifugal pumping units, etc., £1 672 17s. 6d.; Babcock and Wilcox, coal-handling plant, £10 058, boilers, stokers, economisers, etc., £21 310; E. Bennis and Co., ash-handling plant, £2 838.

The Leeds Tramway Disaster.

Ministry of Transport Inquiry.

Lt.-Col. MOUNT opened on the 15th inst. an inquiry into the cause of the accident which occurred on May 12th, at Churwell Hill, Leeds, when, as announced last week, a tramcar (No. 191) got out of control, with the unfortunate result that seven persons lost their lives, and about 35 were more or less injured.

Mr. T. A. BUTTERY, chairman of Morley Highways Committee said there had been complaints that the four-mile speed limit on Churwell Hill and other hills on the Leeds system, was not being adhered to. The speed attained was often eight miles. His committee suggested that (1) conductors should have a knowledge of the working of the brakes; (2) conductors should not leave the platform on specified hills; (3) speed indicators should be provided; (4) cars should be provided with jacks.

Mr. J. B. HAMILTON, general manager of the Leeds Tramways said if these observations were accompanied by proof of the cases they would be noticed. He believed the men kept to the speed limit.

Col. MOUNT said he would consider the suggestion that conductors should not leave the platform.

Mr. HAMILTON said jacks were provided at convenient points. Those used in the present case were within 150 yards.

Thos. SYKES, tramway inspector, said he had never seen a driver exceed the speed limit in descending Churwell Hill or other hills where the four-mile limit applied. George Knight, the driver of the car concerned in this case, was a spare driver, but had driven on this route on several occasions. He was a careful driver.

Evidence was given that new brake blocks to the car were fitted nineteen days before the accident and they were very little worn. The average life of the blocks was about six weeks.

Driver HAIGH, who drove the car following No. 191, said he never exceeded six miles an hour down Churwell Hill.

Driver DICKENSON, who had driven car No. 191 on the day before the accident said the brakes were then in good condition. Some years ago his car got out of control on Churwell Hill through failure of the power brake. He stopped it in a dozen car lengths by reversing the motor and using sand.

G. H. BABB, chief motor inspector, said Knight had not a regular car or route. He acted as relief man, chiefly on the Morley route.

On the second day of the inquiry, the attention of a depot foreman was drawn to four drivers' reports in eight days that the hand-brakes of the car were working hard, or very hard. He said that was a normal occurrence, and did not indicate unsatisfactory adjustment. Brakes were always needing adjustment.

ALBERT HARROP, a conductor, who was on car No. 191 as a passenger, said when it passed the School Street loop it was going at from 20 to 30 miles an hour. Witness tried to apply the brakes, but without success.

Mr. A. ALLAN, works manager, reported that he had found nothing wrong with the brake rods or chain of the car.

The inquiry was adjourned until Tuesday next, May 29th.

Local Authorities' Contracts.

Preference to be Given to British Firms.

In a circular to the local authorities of England and Wales the Minister of Health states that the Government have decided that, as regards all contracts for works in respect of which grants are given expressly because of unemployment, or in respect of which guarantees are given under the Trade Facilities Act, are to be placed in this country.

The Government also urge that the same principle should be adopted, in the absence of special circumstances, in the case of all contracts in respect of works carried out by local authorities.

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Electric Traction.

Tramway Extensions and Developments.

The promoters of a widely-signed petition for the extension of the tube railway northwards from Finsbury Park (London) to Barnet, Waltham Cross and Enfield recently waited on the Ministry of Transport. Facilities were sought for the petition to be presented personally by a deputation comprising the chairmen of the District Councils and the members of Parliament for the area affected. The Ministry replied that the petition appeared to ask only that the consent of the London and North-Eastern Railway should be obtained to the proposed extension, and that the Ministries of Transport and Labour should intervene with a view to the desired extension being put in hand by the companies concerned without delay. Neither Ministry had any compulsory powers in the matter, and no effective steps could be taken until a definite scheme was prepared for submission to Parliament.

New Tramways.

Mr. Mark Nokes, chairman of the DEARNE VALLEY LIGHT RAILWAY Committee, formally broke the ground in connection with the construction of the railway—a joint enterprise undertaken by the Urban Councils of Wombwell, Wath-on-Dearne, Bolton-on-Dearne, and Thurnscoe. The line will link up most of the towns and villages in the Dearne Valley with Barnsley. Mr. A. R. Hoare, of Stephen Sellon and Partners, engineers for the scheme, presided at a dinner which followed the ceremony.

Miscellaneous Tramway Notes.

The tramways manager, Mr. Walter T. Young, submitted at a meeting of DUNDEE Corporation Tramways Committee answers to seventeen questions in regard to OVERHEAD TRAMWAY EQUIPMENT which had been put to him by a newspaper representative The following information was conveyed by the answers. Testing the overhead equipment was a daily duty of the staff. Breaks of wires occurred on four occasions on the tramway route between High Street and Belsize Road from January to April this year. The system in Dundee was the one generally adopted. The breaking of wires did not occur in Dundee with greater proportionate frequency than in other places. He did not know of any fatal accident anywhere from a broken trolley wire. Generally a car had just passed when a wire broke, and that caused people to be out of the danger zone. He exhibited a new trolley head, which he said was less likely to be jerked from the trolley pole than the type now used.

Keighley Tramways to be Scrapped.

KEIGHLEY Corporation discussed at their last meeting a proposal to substitute a railless system for their present tramways. The Tramways Committee reported that to repair and maintain the present system it would be necessary to spend £6 150 per annum on the track, and they recommended that application be made to the Ministry of Transport for an Order authorising the substitution of trolley omnibuses. The Council adopted the Committee's recommendation unanimously. Mr. C. Jackson, general manager, informed the Council that there has been no previous instance of the total scrapping of a municipal tramway system in this country.

Railway Notes.

Lt.-Col. A. H. L. Mount says, in his report to the Minister of Transport on the COLLISION which occurred AT RIVERSIDE STATION, CARDIFF, on February 23rd, "at a junction of this nature, where movements are particularly frequent at the peak periods of local traffic, the immunity from error of this kind (the use of the wrong clock instrument) is remarkable, in that there exists at Riverside Station no supplementary means—for example, track circuiting with the usual locking—of reminding the signalman in the West-box of trains standing within his control." Col. Mount adds that he thinks this safeguard would be of assistance, and he understands the company have this feature under consideration.

Institution Notes.

On Friday evening, June 15th, Sir Ernest Rutherford will give his postponed discourse on "Life History of an Alpha Particle of Radium," and on Saturday (afternoon), June 16th, his concluding lecture on "Atomic Projectiles."

The annual general meeting of the RÖNTGEN SOCIETY will take place on Tuesday, June 5th, at 8.15 p.m., at the Institution of Electrical Engineers, Victoria Embankment, London, W.C.2. Sir Oliver Lodge has been nominated for election as president. Papers will be read by Prof. Sidney Russ on "The Effects of X-rays of Different Wave-lengths on Animal Tissue," and by Mr. T. Thorne Baker on "The Establishment of a Definite Relationship between Exposure and Density in an X-ray Plate."

The annual general meeting of the INSTITUTION OF ELECTRICAL ENGINEERS will be held on Thursday, May 31st, at 6 p.m., at the Institution Building, Victoria Embankment, W.C.2. At the beginning of the meeting there will be presented to the Institution:—An oil painting of the late Dr. Silvanus Thompson, F.R.S. (presented by Mrs. Thompson); Dr. Thompson's Library (presented by a number of members of the Institution and others); and a bronze bust of Dr. Thompson, by Mr. Gilbert Bayes, A.R.A. (presented by the Finsbury Technical College Old Students' Association). The Annual Conversazione will be held on Thursday, June 28th, 8.30 to 11 p.m., at the Natural History Museum, South Kensington, S.W.

Wireless News.

The Entertainment Industry and Broadcasting.

Mr. M. C. Rypinski, vice-president and director of Canadian Brandes, Ltd., of London, Toronto and New York, and chairman of the Radio Section, Associated Manufacturers of Electrical Supplies, addressed a meeting in London last week on the development of broadcasting in America. He said there were about 700 licensed broadcasting stations in America and about three million receiving stations. The British system was on a much better plan than they had in America. He approved of the formation of a single broadcasting authority Originally some of the American theatre managers had assumed that broadcasting would hurt their business, but now it was recognised as an excellent advertising medium. He thought broadcasting would not prejudice the entertainment industry, but would popularise it still further. American music publishers had decided to permit the free broadcasting of copyright music for the present.

The Broadcasting Co. and Musical Copyright.

In a statement on the subject of Broadcasting and musical copyright the Broadcasting Co. point out that musical publishers pay no entertainment tax, while, seeing that half the licence fees go to the Government, the Broadcasting Co. may be said to pay very heavily in this respect. The Broadcasting Co. are willing and anxious to come to an arrangement on the subject of copyright, and are not without hope that an amicable settlement will be arrived at.

Italian Telephone and Telegraph Rights.

Italian Royal Decrees have been issued empowering the Government to TRANSFER the TELEPHONES and TELEGRAPHS to PRIVATE ENTERPRISE. The Decrees dealing with the telephones and telegraphs respectively are identical, except for the necessary verbal differences. Amongst the provisions are the following:—

The right to lay and work telephone lines for private and public use is reserved to the State. The right, however, of anyone to establish telephone communication on their own land for their own use will be permitted.

The Government are empowered to grant to bodies, companies or private persons all or part of their prerogative in regard to the working of State telephone plant or the construction and working of new telephone plant, on certain conditions, which include the following:—

The decree granting a concession will indicate new constructions in detail, and concessionaires must give preference in the purchase of material to that which has been manufactured in Italy.

The Government have the right to require the extension of an urban telephone system to the neighbouring communes, provided the inhabited centres are within 10 km. from the central telephone station.

The minimum period of a concession will be 25 years, except when new works complete those done under previous concessions which lapse earlier. The State may redeem concessions upon one years' notice.

Concessionaires will pay to the State an annuity not less than 5 per cent. of the gross takings, plus one third of the net profit in excess of 7 per cent., or half the excess over 8 per cent., or three-fifths over 9 per cent. If the net profits or dividends exceed 10 per cent. the tariff must be reduced.

Tariffs will be approved by the Minister of Posts and Telegraphs

Mr. C. H. Merz on Electricity Supply.

Probable Future Developments.

Mr. C. H. MERZ, who is visiting the United States, was entertained to dinner in Chicago by two hundred engineers on May 2nd, under the presidency of Mr. Samuel Insull. Contrasting British and American power-station practice, Mr. MERZ said there was no counterpart in Great Britain to the large boilers employed in the States. He believed that future progress would be along the lines of greater interconnection, more centralisation, increase in the size of generating stations, and higher steam pressures. With large steam turbines of 50 000 H.P. and upwards economies comparable with those of the internal combustion engine were obtainable. While the greatest economy in electric power production must be sought, security and reliability must not be neglected.

E.D.A. and the New Postal Rates.

REDUCTIONS OF POSTAL RATES having come into operation, the British Electrical Development Association suggest that electricity suppliers and contractors should bear in mind that whereas formerly not more than one ounce of printed matter could be dispatched for a halfpenny, two ounces can now be transmitted for the same amount; and an additional ounce is also allowed for the 1½d. letter rate. It is argued that *it is as wasteful to send out half-empty envelopes as to send out half-filled lorries. Make every postage stamp carry its full load.* E.D.A. has a very large number of envelope fillers which will enable electrical undertakings and firms to make every stamp carry its full load. The E.D.A.'s experience proves that postal publicity brings more trade from old customers and fresh trade from new.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

HUTCHINSON AND CO., 101, Dartmouth Road, Forest Hill, electrical contractors. £29 14s. 6d. April 6th.

J. L. ELECTRIC CO., Church Street, Birmingham, electricians. £15 14s. 8d. April 10th.

RISELEY AND POW, 132, Queen Street, Cardiff, electrical engineers. £28 9s. 1d. April 7th.

TAYLOR, Mr. W., 10, Rangoon Street, Crutched Friars, E.C., electric lamp and accessories dealer. £51 13s. 11d. April 5th.

WRIGHT BROS. AND CO., 251, Fulham Road, S.W., electrical engineers. £12 19s. 2d. April 6th.

Receiverships.

ARMATURE REPAIRING AND SUPPLY CO., LTD. A. O. John, of Fisher Street, Swansea, was appointed receiver on May 8th, 1923, under powers contained in debentures dated November 1st, 1921.

WESTON (G.) AND SONS, LTD. F. S. Wilks, of 31, Lombard Street, E.C., was appointed receiver on May 7th, 1923, under powers contained in debenture dated June 11th, 1920.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

CUTTING BROS., LTD., Stamford, electrical engineers.—Registered May 5th, £8 000 debentures, balance of £20 000; general charge. *£27 000. December 7th, 1922.

R. J. CORPORATION, LTD., London, N.W., electrical engineers —Registered May 10th (by order on terms), £1 000 (not ex.) charge, dated March 9th, 1923 (by receiver), to Cox and Co., bankers; general charge (except uncalled capital). *£13 000. December 31st, 1922.

ST. HELENS MOTOR AND ELECTRICAL ENGINEERING CO., LTD.—Registered May 3rd, £50 debenture, to H. Devany, 75, College Street, St. Helens, corn miller; general charge.

SCARBOROUGH ELECTRIC SUPPLY CO., LTD.—Registered May 1st, trust deed date April 25th, 1922, securing £80,000 1st debenture stock; charged on land and generating station at Seamer Road, Scarborough, also general charge. *£28 905 17s. 11d. June 6th, 1922.

VEREY (A.) AND CO., LTD., London, S.W., electrical engineers. —Registered May 7th, £750 debentures, to G. H. Verey, 19, Ailsa Road, St. Margarets-on-Thames, electrical engineer; general charge. *——. February 26th, 1923.

Satisfactions.

BROOK HIRST AND CO., LTD., Chester, electrical engineers.—Satisfaction registered April 25th, £7 000, registered November 26th, 1907.

ENTERPRISE MANUFACTURING CO., LTD., London, W.C., electrical merchants.—Satisfaction registered May 9th, £500, registered August 4th, 1917.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Companies Winding-Up Voluntarily.

CHICHESTER ELECTRIC LIGHT AND POWER CO., LTD.—V. W. Grosvenor, Incorporated Accountant, of 70A, Basinghall Street, London, E.C., appointed liquidator.

W. BLACKBURN (KEW), LTD.—William Blackburn, 47, Grove Park Road, Chiswick, W., appointed liquidator.

Bankruptcy Information.

DUFFIN, Albert Harold, and KERSHAW, George, carrying on business at Provincial Buildings, Conway Road, Colwyn Bay, under the style of A. H. DUFFIN AND CO., electrical engineers and contractors. Receiving order, May 12th. Debtors' petition.

RUDD, Richmond, Long Ashton, Somerset, electrical engineer. Receiving order, May 15th. Debtor's petition.

Notices of Intended Dividends.

COATON, Thomas Green, carrying on business under the style of T. G. COATON AND CO., 16, Humberstone Road, Leicester, electrical engineer. Last day for receiving proofs, June 2nd. Trustee, E. H. Hawkins, 4, Charterhouse Square, London, E.C.1.

PERRIN, Francis Leopold, 57, Wellingborough Road, Northampton, also 5, College Street, Northampton, electrical engineer. Last day for receiving proofs, June 1st. Trustee, H. C. Palmer, Kingham Chambers, Abington Street, Northampton.

WATKINS, Fred Arthur, 57, High Street, Hythe, Kent, electrical engineer. Last day for receiving proofs, June 4th. Trustee, E. H. Hawkins, 4, Charterhouse Square, London, E.C.1.

Partnerships Dissolved.

ELLIS AND MORT (William Joseph ELLIS and Albert MORT), electrical engineers and electrical equipment factors, 50, Topping Street, Blackpool, by mutual consent as from March 29th, 1923. Debts received and paid by A. Mort.

ROCK ELECTRICAL CO. (Stanley Ernest Ilford PORTER and Lionel LEAVERS), electrical contractors and engineers, 12A, Rock Place, St. James Street, Brighton, by mutual consent as from March 31st, 1923. Debts received and paid by S. E. I. Porter, who will continue the business.

SEGERS AND BRADSHAW (Sidney Miles SEGERS and Charles Weston BRADSHAW), wireless engineers and agents, Sudbury, by mutual consent as from May 4th, 1923. Debts received and paid by S. M. Segers, who will continue the business in his own name.

JAMES TATE (Charles Edward JONES and William Henry WILKINSON), manufacturing electrical engineers, Victory Works, East Parade, Bradford, by mutual consent as from May 11th, 1923. Debts received and paid by C. E. Jones, who will carry on the business.

WIRELESS SUPPLY DEPOT (Lionel Henry MANSELL and Clare Annandale MORTIMER), Edith Walk, Great Malvern, by mutual consent as from April 30th, 1923. Debts received and paid by L. H. Mansell, who will continue the business.

Edinburgh Gazette.

AYRSHIRE ELECTRICAL CO., New House, Kilbirnie (Daniel W. CLOSE, trading as). In this sequestration Mr. Maurice Crichton, chartered accountant, Glasgow, has been elected trustee, and P. J. Nicholls (General Electric Co., Ltd., Glasgow), H. G. Barrett (Simplex Conduits, Ltd., Glasgow), and Alexander E. Ross (Falk, Stadelmann and Co., Ltd., Glasgow) have been elected commissioners. The examination of the bankrupts will take place at the Sheriff Court House, Kilmarnock, on Wednesday, May 23rd, at 10.30 a.m. Creditors will meet in the offices of Wilson, Stirling and Co., C.A., 93, West George Street, Glasgow, on Thursday, May 31st, at 12 noon.

Bankruptcy Proceedings.

BARLOW, ALFRED JAMES, trading as BARLOW BROS., 9, Brunswick Place, City Road, E.C., electrical engineer. The statutory first meeting of creditors under a receiving order recently made in this case was held last week at Bankruptcy Buildings, Carey Street, W.C. It appeared that the debtor began the business as above in 1911, and it had always been successful, except for bad debts, to which he entirely attributed his present position. During the last eighteen months he had been compelled to sue a large number of his book debtors, and on April 16th last a private meeting of his creditors was held (see ELECTRICIAN, 20/4/23, p. 439), when it was resolved that he should execute a deed of assignment of his property in favour of a trustee on behalf of his creditors in general. That deed was never registered, and the debtor eventually filed his petition because a creditor for £166 had threatened him with proceedings for recovery of that amount. The debtor had added that he had been handicapped by the trade depression, but that he could have overcome had his accounts been paid promptly. He roughly estimated his liabilities at £1 600, and valued his assets at £820. The meeting appointed Mr. A. Willmott, C.A., 14, Old Jewry Chambers, E.C., as trustee to administer the estate in bankruptcy.

SAGAR, LEWIS, 143 and 143A, East Street, Walworth, S.E. This debtor, who formerly carried on business in partnership with another person under the style of the VENUS ELECTRIC CO., attended at the London Bankruptcy Court last week for his public examination on a statement of affairs showing liabilities £623 and assets nil. Examined by the Official Receiver, the debtor said that he first came to this country in February, 1914. In January of last year he entered into partnership with another person, and they began to deal in electric globes at 86, York Road, Lambeth. It was agreed that they should divide profits equally between them, and he paid at the outset £250 to his partner in order to import the globes from Austria. Later he gave him further sums amounting to £400, which included his partner's share of profit. They obtained many thousands of globes at about 2s. each, but they ascertained that the globes were patented in this country, with the result that they were unable to effect sales. They eventually

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disposed of the globes to travellers and hawkers at about 9d. each. The examination was concluded.

WATSON, Stanley (trading with Herbert ROTHWELL and Frank Cecil JINKS as the VULCO MAGNETO CO.), late of 11, Long Acre, W.C. An adjourned sitting for the public examination of this debtor was appointed at the London Bankruptcy Court last week. The failure occurred in June, 1921, the provable debts amounting to £2 832. The estate has realised £21. The other partners' examinations have been concluded and one of them has applied for and been granted his order of discharge, but the examination of the debtor Watson had stood adjourned on the application of the Official Receiver who required further information and accounts. The Official Receiver, attended and examined the debtor regarding his banking accounts and more particularly regarding the disappearance of a sum of £1 000, but he was unable to obtain any satisfactory explanation from the debtor and eventually applied for an adjournment of his examination *sine die* on the ground that he had failed fully to disclose his affairs to the Court. The debtor, however, protested against this application, his solicitor remarking that he had afforded all explanation and information in his possession. The Official Receiver said that as a matter of fact throughout the bankruptcy proceedings he had received very little help from this debtor and that day he had for the first time disclosed the existence of a banking account in Manchester. His Honour said that although he considered this debtor's examination most unsatisfactory he should order the examination to be concluded. The Court would, however, show its sense of his examination when he came to apply for his order of discharge.

Companies' Reports, Dividends, etc.

ADELAIDE ELECTRIC SUPPLY CO., LTD.—An interim dividend a t the rate of 12 per cent. per annum, tax free, has been declared on the ordinary shares.

CAWNPORE ELECTRIC SUPPLY CORPORATION.—A final dividend of 7 per cent. is recommended, making 10 per cent. for the year, and £667 is being carried forward.

The profit of COLOMBO ELECTRIC TRAMWAYS AND LIGHTING CO. for 1922 was £54 915. The directors propose a dividend of 15 per cent., tax free, carrying forward £18 789.

The BRITISH ELECTRIC TRACTION CO. is paying a final dividend of 3 per cent. on the ordinary stock for the year ended March 31st, making 5 per cent. for the year, compared with 4½ per cent. last year.

The report of the GENERAL ELECTRIC COMPANY (New York) for 1922 shows net profits $26 231 019 (after charges, depreciation and Federal taxes), equal to $14·86 per share on common stock, compared with $12·50 a share in 1921. Net sales were $200 194 294, against $221 007 992.

The CHLORIDE ELECTRICAL STORAGE CO. have declared a dividend of 5 per cent. and bonus of 5 per cent., tax free, on the ordinary shares for the half-year, making 15 per cent. for the year; £40 000 has been placed to reserve, making £100 000; £6 000 to employees' benefit fund; and £33 017 carried forward.

At a meeting of the URBAN ELECTRIC SUPPLY CO., the report abstracted in our issue of May 11th was adopted. The chairman, Mr. P. D. Tuckett, said they had felt the benefit of the fall in costs combined with higher prices. All their undertakings had done substantially better, with the exception of Cornwall.

EVER-READY COMPANY (GREAT BRITAIN), LTD.—A final dividend of 6½ per cent. on ordinary shares is recommended, making 10 per cent. During the year the company purchased for cash the whole share capital of a competing concern, and half interest in a company carrying on an allied business. These two undertakings have made satisfactory initial progress.

At the meeting of the LANCASHIRE ELECTRIC LIGHT AND POWER COMPANY last week, the report abstracted in our issue of May 11th was adopted. The chairman stated that the output from the generating station in the past year was 87 644 000 kWh, an increase of 28 754 000 over the year 1921. Sales were 76 155 000 kWh, against 49 978 000. Every confidence in the continued success of the company seemed to be justified.

POTTERIES ELECTRIC TRACTION CO., LTD.—The directors' report for the year ended December 31st, 1922, states that the revenue was £256 196 18s. 1d., compared with £300 831 16s. 9d. The directors recommend a dividend on the preference shares at the rate of 5 per cent. per annum, which will require £12 250, and that £5 376 os. 11d. be carried forward. The reserve stands at £113 138 10s. 3d., and the renewals fund at £49 081 2s. 11d.

CALLENDER'S CABLE AND CONSTRUCTION COMPANY held their annual meeting on the 17th inst. The report abstracted in our last issue was adopted, and the chairman, Sir F. Flannery, stated that the volume of orders secured during the year was fairly maintained, and profits were about £34 000 more than those for 1921. There were indications that interlinking of power systems was likely to be largely adopted, and this would create a greater demand for super-tension cables.

The directors of the SHANGHAI ELECTRIC CONSTRUCTION CO. recommend a final dividend of 8 per cent., less tax, making 20 per cent. for the past year, carrying forward £17 029. A concession from Shanghai Municipal Council for the extension of the company's system under railless traction has been drafted, and it is anticipated that negotiations in regard to it will soon be completed. Arrangements for the reorganisation of the undertaking of the Singapore Electric Tramways are in progress.

VERA CRUZ ELECTRIC LIGHT, POWER AND TRACTION CO., LTD.—At the ordinary general meeting, the Chairman, Mr. Vincent W. Yorke, said he was sorry to say there had been a distinct setback in their affairs since the last meeting, owing to the falling off of the number of ships visiting the port of Vera Cruz and the tonnage of goods they carried. However, the gross receipts of the light and power business were 10 per cent. up. It was proposed to pay a dividend of 7½ per cent. and place £5 000 to reserve. The report was adopted and the dividend approved.

RANGOON ELECTRIC TRAMWAY AND SUPPLY CO.—It is recommended that a dividend of Rs.1 per share, free of tax, to shareholders domiciled in India or Burma, on ordinary shares, making Rs.1½ for year; that £32 500 be placed to reserve for renewals; £1 322 allocated for depreciation on sundry assets; £5 165 for Indian income tax; £4 000 for corporation tax; £3 765 for employees' provident fund and bonus; £22 589 for repairs, etc.; £3 061 for stamp duty on increased capital; £10 000 to dividend equalisation fund; and £18 228 carried forward.

JOHNSON AND PHILLIPS' directors' report, summarised in our last issue, was adopted at the meeting last week. The chairman, Mr. Claude Johnson, said there had been for the last two years strong evidence of the growing demand in the Eastern and Far Eastern markets for the manufactures of this country, and only the political and financial position had kept back the huge orders which must ultimately come to this country and in which that company was bound to participate. Home demands and requirements were almost in the same position and only awaited more settled conditions to fructify into orders.

VICKERS, LTD.—The report of the directors for the year ended December 31st, 1922, states that the industrial conditions of the past year showed little variation from those of 1921. Some slight improvement in the trade outlook became apparent towards the end of the year, and there are grounds for hoping that it may be continued. Profit was £683 204 15s. 11d., out of which preference dividends have been paid amounting to £398 465 7s. The balance, £284 739 8s. 11d:, has been added to the "carry forward" from December 31st, 1921, of £872 993 10s. 3d., making a disposable balance of £1 157 732 19s. 2d. The directors recommend a dividend on the ordinary shares at the rate of 5 per cent. per annum, less tax, which will require £453 825 11s., leaving a balance to carry forward of £703 907 8s. 2d.

At the general meeting of SIEMENS BROS. AND CO., on Tuesday, the report dealt with in our last issue was adopted. The Chairman, Mr. G. Mure Ritchie, said, notwithstanding the poor results of 1922, the company remained in a sound position. During 1922 those plants in which most of their capital was sunk were shortest of orders—for example, the submarine cable and telephone works. The net result was not less disappointing to the directors than to the shareholders. Although the orders received in 1922 were greater in value and still more in volume than in 1921, much less work was brought over from 1921 than from 1920. Business, generally, showed signs of improvement, orders received this year exceeding those for the corresponding period of 1922. He thought it reasonable to hope that the British Government would entrust them with a good proportion of the automatic telephone exchange work which was projected.

Prices of Metals, Chemicals, etc.

TUESDAY, May 22.

		Price.	Inc.	Dec.
Copper—				
Best Selected ..	per ton	£71 0 0	£1	—
Electro Wirebars ..	,,	£78 0 0	£1	—
H.C. Wire, basis ..	per lb.	10½d.	½d.	—
Sheet	,,	11 1/16d.	—	1/16d.
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2½d.	½d.	—
Brass 60/40—				
Rod, basis	,,	7½d.	—	—
Sheet, basis ..	,,	10½d.	—	½d.
Wire, basis	,,	10½d.	—	½d.
Pig Iron—				
Cleveland Warrants	per ton	£6 7 6	—	2s 6d.
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 10 0	—	—
Lead Pig—				
English	,,	£27 5 0	£1	—
Foreign or Colonial	,,	£26 7 6	£1 5s.	—
Tin—				
Ingot	,,	£202 15 0	£3 5s.	—
Wire, basis	per lb.	2s. 8d.	½d.	—
Aluminium Ingots ..	per ton	£115 0 0	—	—
Spelter	,,	£31 17 6	£2 2 6	—
Mercury	per bottle	£10 12 6	2s. 6d.	—

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2½d.
,, (Roll-Brimstone)—,, £8 5s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate .. ,, £26 10s. per ton, £7 10s.
Boric Acid (Crystals). ,, £50 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 2½d.; plantation 1st latex, 1s. 2½d. to 1s. 2⅞d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

192 970 H. GOLDSCHMIDT and A. STOCK. Electrolytic manufacture of compact metallic beryllium. (19/4/22.)
184 142 A. LUZY. Electro-mechanical lamp for mines. (4/4/21.)
192 986 E. E. MATHERS. Trolley heads. (4/7/22.)
192 990 J. and A. PERSOONS. Electrically driven centrifugal cream-separator. (18/2/22.)
193 073 R. C. M. HASTINGS. Party-line telephone systems. (17/8/21.)
193 074 R. C. M. HASTINGS. Telephone systems. (17/8/21.)
169 148 K. NISHIKAWA. Manufacturing carbon filament for incandescent lamps. (12/9/20.)
170 015 AMERICAN RADIO AND RESEARCH CORPORATION. Electric discharge devices for rectification of alternating currents. (8/10/20.)
193 085 T. ATKINSON. Bends, half normal bends, and sets for tubing used for electric wires. (11/10/21.)
193 087 K. KAWAKAMI. Accumulators. (13/10/21.)
183 092 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC Co.). Means for producing oscillations. (14/10/21.)
173 737 C. LEAN, GLIMMLAMPEN GES., FRANKLIN-INDUSTRIE-GES., and J. M. SCHMIERER. Cathode glow discharge lamps. (14/11/21.) (Convention date not granted.)
193 128 AUTOMATIC TELEPHONE MANUFACTURING CO. and C. REMINGTON. Mine-signalling systems in which signals consist of a single series of impulses. (15/11/21.)
193 133 H. T. POINTER. Electric water-heaters. (15/11/21.)
193 136 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC Co.). Electric switches. (16/11/21.)
193 145 RELAY AUTOMATIC TELEPHONE CO. (GENERALE DE TELEGRAPHIE ET DE TELEPHONIE SANS FILS). Telephone systems. (17/11/21.)
193 150 W. W. BURNHAM. Variable inductance devices. (18/11/21.)
193 152 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC Co.). Electrical measuring instruments. (18/11/21.)
193 158 E. C. R. MARKS (Soc. S.A.A.E. Soc. ANON.). Protecting a.c. electric installations against disturbances produced in feeding circuit. (19/11/21.)
193 159 C. G. LAWSON. Electric bells and gongs. (19/11/21.)
193 163 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC Co.). Electrical measuring-instruments. (22/11/21.)
193 164 R. P. MYERS. Automatic electric switches. (22/11/21.)
193 178 W. G. MOORE. Apparatus for therapeutic treatment of the body with rays from electric arcs. (30/11/21.)
193 201 G. WILKINSON. Automatic circuit breakers. (19/12/21.)
193 203 P. C. RUSHEN (BING WERKE VORM. GEB. BING AKT.-GES.). Toy wireless telegraph and telephone apparatus. (19/12/21.)
173 233 WESTERN ELECTRIC CO. Cores for electromagnets. (21/12/20.)
193 208 METROPOLITAN-VICKERS ELECTRICAL CO., A. B. FIELD and L. MILLER. Indicating-devices for use with a.c. generators driving induction motors. (22/12/21.)
193 210 H. CLARK. Sand gear operator for electric and other vehicles. (23/12/21.)
193 226 CALLENDER'S CABLE AND CONSTRUCTION CO. and G. S. BOOTHROYD. Electrically bonding metallic sheathed cables and wires in junction boxes, etc. (9/1/22.)
193 231 METROPOLITAN-VICKERS ELECTRICAL CO. and N. E. NORTH. Switches. (11/1/22.)
193 241 M. PAYNE and W. S. JEAL. Accumulators and secondary batteries. (20/1/22.)
193 243 CHAMBERLAIN AND HOOKHAM and S. JAMES. Power factor measuring or indicating instruments for use with alternating currents. (21/1/22.)
193 249 W. GEE. Wall-plug. (26/1/22.)
174 641 SIEMENS AND HALSKE AKT.-GES. Telephone systems. (31/1/21.)
193 252 CABLE ACCESSORIES CO., F. H. REEVES and P. W. DAVIES. Switches. (1/2/22.)
193 254 B. CHERNIKEEFF. Electric submerged logs. (1/2/22.)
193 267 G. NATOLI. Magneto-electric machine. (10/2/22.)
193 296 CABLE ACCESSORIES CO., F. H. REEVES and P. W. DAVIES. Wall-plugs. (13/3/22.)
177 171 A. BADERNA. Cut-outs. (17/3/21.)
193 300 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC Co.). A.c. machines. (18/3/22.)
193 307 COVENTRY AUTOMATIC TELEPHONES, LTD. (R. C. ARTER). Machine switching telephone systems. (28/3/22.)
180 643 ETABLISSEMENTS GAIFFE-GALLOT AND PILON. X-ray tubes. (24/5/21.)
193 319 H. BARON (R. FRISTER-AKT.-GES.). Electric flat-iron. (19/4/22.)
180 990 SOC. DES ETABLISSEMENTS GAUMONT. Electro-mechanical control systems. (28/5/21.)
193 325 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC Co.). Electric lamps. (3/5/22.)
193 329 PHILIPS' GLUHLAMPENFABRIEKEN, G. HOLST and D. LELY, JUN. Leading-in conductors for vitreous material. (9/5/22.)

APPLICATIONS FOR PATENTS.

May 7th.

12 174 B. N. D'ARCY. Switch.
12 182 A. M. TAYLOR. Electric transmission systems.
12 185 A. E. MARDEN. Cap for wireless valves, etc.
12 217 H. CLIFTON and H. T. HALL. Multiple wireless receiver.
12 243 S. KATATANI. Resistance materials. (8/5/22, Japan.)
12 261 H. WADE (GOULD STORAGE BATTERY CO.). Storage battery separators.
12 262 H. WADE (UNIVERSAL WINDING CO.). Electric coils and winding machines therefor.
12 268 A. K. E. STRATHDEE. Series parallel switches.
12 269 A. W. G. SCAIFE. Means for registering telephone calls.

May 8th.

12 284 E. FIGUEIREDO. Combined handle and coupler for tumbler switches.
12 286 G. AND J. SWINGLER and E. SWINGLER. Chains.
12 288 P. E. LUDLOW. Electric flash-lamp.
12 290 C. E. H. BONN. Thermo-electric generator.
12 304 F. HANMER. Electric lamps for motor cycles.
12 305 J. S. AND W. E. HIGHFIELD. Trolley road vehicles.
12 313 J. S. CATTELL and S. A. FLETCHER. Ear pieces of telephones, etc.
12 316 COVENTRY AUTOMATIC TELEPHONES, LTD., and J. E. COLLYER. Automatic telephone switching.
12 319 EDISON SWAN ELECTRIC CO. and W. J. DAVIS. Rheostats.
12 324 H. E. STEDMAN. Electrically heated steampipe oven.
12 328 C. J. COLEMAN. Rectifier crystals for wireless telephony.
12 331 W. A. E. BUSBY and F. C. R. HOLLAND. Thermionic valves.
12 343 W. T. HENLEY'S CO. and P. DUNSHEATH. Maintaining insulation resistance of cables.
12 356 GES. FUR DRAHTLOSE TELEGRAPHIE. Telephone transmitters and receivers. (30/8/22, Germany.)
12 359 CREED AND CO. and F. G. CREED. Telegraph signalling apparatus.
12 360 R. AMBERTON. Electric controllers.
12 368 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC Co.). Switches for suspending electric appliances.
12 377 AJAX, LTD., D. F. SELL and C. A. COOPER. Electro-therapeutic apparatus.
12 383 SOC. ANON. LE CARBONE. Liquid-tight coating on porous electrodes. (1/6/22, France.)

May 9th.

12 399 T. J. SLATER. Electric locomotive.
12 408 G. ROGERS and A. T. THURMAN. Operating voltage regulator of mercury arc rectifiers.
12 410 L. JOHNSON. Thermionic valve devices.
12 413 A. K. BINDLASS. Crystal-holders for wireless receivers.
12 427 T. HARVEY. Wireless receivers.
12 438 ENGLISH ELECTRIC CO. Hydraulic turbines.
12 452 W. G. WOODING. Frame aerials.
12 458 E. A. GRAHAM and W. J. RICKETS. Thermionic valve apparatus.
12 461 N. TOGAMI. Automatic electric distributing apparatus.
12 467 E. C. F. OAKLEY. Wireless receiver.
12 484 H. F. HOLWORTHY. Portable aerials for wireless signalling.
12 489 SOC. L'ELECTROTECHNIQUE. Dynamos (13/5/22, France.)
12 490 T. TORDA. Synchronous induction machines.
12 499 and 12 500 H. WADE (PHILIPS GLOEILAMPENFABRIEKEN). Separation of zirconium and hafnium.

May 10th.

12 528 F. W. V. FITZGERALD. Reception and reproduction of telephone signals.
12 530 C. E. WHITEHEAD. Trolley pulleys.
12 542 F. W. V. FITZGERALD. Telephone transmission, reception and reproduction of drawings.
12 543 L. B. WATTS. Valve-holder and filament rheostat.
12 554 MIDLAND ELECTRIC MANUFACTURING CO. and W. L. BARBER. Boxes of ironclad switches, etc.
12 559 A. J. GREGORY and J. NICOL. Electric indicator.
12 573 J. R. C. AUGUST and E. K. HUNTER. H.t. distribution systems.
12 579 J. W. CLOUD. Switches.
12 597 H. MACLEAN. Installations for electric bells and telephones.
12 602 ENGLISH ELECTRIC CO. and C. E. FAIRBURN. Vehicles for rail traction systems.
12 603 ENGLISH ELECTRIC CO. and F. MORRIS. Electric control of mechanical movements.
12 607 C. A. KEEGAN. Wireless telegraphy, etc.
12 615 G. B. CANALE. Trolley arms.
12 618 H. L. VACARESSE. Electrical apparatus for projection of advertisements. (10/5/22, France.)
12 623 TELEPHONE MANUFACTURING CO. and R. L. MURRAY. Switch devices.
12 632 A., H. AND J. DANIELS. Fittings for electrical apparatus.

May 11th.

12 633 A. T. ENTWISTLE. Connector box for electric wires.
12 637 A. H. GLEDHILL. Programme-controlling device for electric current.
12 644 F. J. PHELPS. Telephone infection preventor.
12 655 J. M. L. GYSBRECHTS. Frame for wireless battery.
12 659 H. T. TILLQUIST, E. O. JOHANSSON and E. R. I. NORDSTRÖM. Mounting electric heating elements.
12 667 E. G. HUGHES. Mounting of inductance coils.
12 670 WESTERN ELECTRIC CO. Submarine telegraph signalling (12/5/22, U.S.)
12 671 WESTERN ELECTRIC CO. Electric discharge devices. (12/5/22, U.S.)
12 675 C. H. JOHNSON. Telephone receivers.
12 680 H. M. ROBINSON. Masts for aerials, etc.
12 696 WESTERN ELECTRIC CO. Selecting switches.
12 702 IGRANIC ELECTRIC CO. (CUTLER-HAMMER MANUFACTURING Co.). Rheostats.
12 705 FULLER'S UNITED ELECTRIC WORKS, LTD., and L. FULLER. Accumulators.
12 689 J. J. MORCH. Diaphragm for telephone receivers.
12 715 SOC. ANON. LE CARBONE. Liquid-tight coating on porous electrodes. (3/11/22, France.)
12 716 SIEMENS-SCHUCKERTWERKE GES. Stranded conductors or cables. (13/5/22, Germany.)
12 723 METROPOLITAN-VICKERS ELECTRIC CO. and J. A. KUYSER. Electric generators.
12 730 T. LENAGHAN. Automatic telephone systems.
12 732 BRITISH THOMSON-HOUSTON CO. and A. S. FITZGERALD. Control of electric switches.
12 733 W. B. SAYERS and P. BAXTER. Contacting devices for electric machinery.
12 734 L. S. VELLO. Incandescent lamps. (12/5/22, France.)

May 12th.

12 739 W. ALDRED and T. MILNES. Commutator for direct currents of generators and motors.
12 763 J. L. SCHLESS. Electric welding flux.
12 766 WESTERN ELECTRIC CO. Telephone receivers. (17/11/22, U.S.)
12 770 J. A. WARD. Variometers for radio-telegraphy.
12 771 E. O. BURN and W. PHILLIPS. Shunt regulators for generators.
12 777 BRITISH THOMSON-HOUSTON CO., A. R. YOUNG, J. H. BUTCHER and F. A. FOSSEY. Telephone receivers, etc.
12 778 BRITISH THOMSON-HOUSTON CO., H. W. H. WARREN and R. NEWBOUND. Insulating materials.
12 779 BRITISH THOMSON-HOUSTON CO. Protection of electric machines. (14/6/22, U.S.)
12 780 SIEMENS BROS. AND CO. and F. H. W. DUMJOHN. Automatic telephone systems.
12 785 ELECTRICAL APPARATUS CO. and R. H. BARBOUR. Wireless receivers.
12 790 GENERAL ELECTRIC CO., LTD. Manufacture of tungsten wire, etc. (7/8/22, Germany.)
12 803 B. PEEBLES AND CO. and G. HENDERSON. Apparatus for short circuiting rotor windings.

Arrangements for the Week.

FRIDAY, MAY 25th (To-day.)

PHYSICAL SOCIETY OF LONDON.

5 *p.m.* At the Imperial College of Science, South Kensington, S.W. (1) Paper by Prof. C. H. Lees and Mr. J. E. Calthrop on "The Effect of Torsion on the Thermal and Electrical Conductivities of Metals." (2) Paper by Mr. A. Rosen on "The Use of the Wien Bridge for the Measurement of Dielectric Losses." (3) Demonstration by Mr. C. R. Darling on "The Production of an Intermittent Pressure by Boiling Water." (4) Demonstration by Dr. N. W. Maclachlan on "A Novel Instrument for Recording Wireless Signals."

INSTITUTION OF ELECTRICAL ENGINEERS.

7 *p.m.* At the Institution Building, Savoy Place, Victoria Embankment, London, W.C.2. Paper by Mr. V. S. Manyam on "The Supply and Distribution of Electricity," preceded by Annual General Meeting.

THURSDAY, MAY 31st.

INSTITUTION OF ELECTRICAL ENGINEERS.

6 *p.m.* At the Institution Building. Annual General Meeting.

FRIDAY, JUNE 1st.

INSTITUTION OF ELECTRICAL ENGINEERS (WESTERN CENTRE).

Summer Meeting at Plymouth (June 1st–June 4th).

ROYAL INSTITUTION OF GREAT BRITAIN.

9 *p.m.* At the Institution, 21, Albemarle Street, Piccadilly, W.1. Lecture on "The Radiation of Light" by Prof. H. A. Lorentz.

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CONTENTS.

Notes of the Week	587	Stimulating Electrical Interest in China	603
Institution Business	589	Pulverised Fuel in U.S.A.	603
Electricity Supply at Rotherham. Illustrated	590	Incorporated Municipal Electrical Association	603
A Steam Engineer on Electric Traction	593	Electrical Exhibition at Ilford	603
An Investigation of the Financial Prospects of Railway Electrification	594	The "Open" Clause in Contracts	603
The Henley Pillar Unit and Micanite Insulation. By Ernest J. Judge. Illustrated	596	Vickers and the Spearing Boiler Co.	603
An Advocate for the Contractor. By "A Spectator"	597	Imperial Notes	604
Reviews	598	Foreign Notes	604
Correspondence	599	Electricity Supply	605
Fans to Merchandise and Profit By. Illustrated	600	Personal Items	605
Modern Storage Equipment	602	Tenders Invited and Accepted	606
Two Notable Books	602	Forty Years Ago	606
Books Received	602	Business Items	606
Lead-Boring Beetles	602	Electric Traction	607
The Patent Office in 1922	602	Wireless News	607
Parliamentary Intelligence	602	Companies' Reports, Dividends, etc.	608
Electrolytic Disinfecting Fluid	602	New Companies	608
Scottish Tramways Association	603	Commercial Intelligence	609
		Prices of Metals, Chemicals, etc.	609
		Patent Record	610
		Arrangements for the Week	610

Notes of the Week.

Electrical History at Rotherham.

THE Rotherham Corporation Electricity Undertaking is busy making electrical history. It has had the same chairman, Ald. WINTER, and the same chief engineer, Mr. EDWARD CROSS, during the twenty-two years of its existence. In nine years it has spectacularly developed from a very ordinary municipal undertaking with a generating capacity of 4 500 kW, to a super-undertaking with a capacity of 70 000 kW, and an ultimate capacity of 125 000 kW—ultimate that is without building another station. It has just purchased and set to work a 40 000 kW turbo-alternator, which is the largest generating set now operating in this country. This set was formally started by the PRINCE OF WALES on Monday last, thus bringing to a fitting culmination an extraordinary record. Incidentally, it is pleasant to find our Royal Family taking such a keen interest in the development of electricity supply. Last year the DUKE OF YORK opened a new station at Sheffield, and in addition to Rotherham, the PRINCE OF WALES is formally to inaugurate the Nechells station of the Birmingham Corporation on June 12th. His Royal Highness, as we well know, makes a point of keeping closely in touch with all developments which are likely to be for the good of the country. In the attention he is now paying to electricity supply we may therefore read a favourable augury for the future. Rotherham is to be congratulated on its progressiveness. For in such a district as the PRINCE himself said, "The demand for electrical power is naturally enormous. . . . This new station is a very important addition to the electrical resources of Yorkshire and I am glad to hear that it is proving of material assistance to the industrial progress of such a wide area."

Turbo-Alternators—A Size Problem.

THOUGH we are not among those who invariably pay homage to mere size we have thought it well to give on another page of this issue a detailed description of the new Rotherham turbo-alternator. To instal a set of this capacity requires a certain amount of courage which we hope will be justified by the results obtained. Its design and construction are, we gather, sound enough, and no anxiety need, therefore, be felt on that score. And we presume that in concentrating so much power in one unit Mr. CROSS has had in mind not only the present but the future requirements of the undertaking. That undertaking consists largely of power and traction loads and for that reason there is more than the usual justification for a more than usually large generating set. At the same time there is the risk that in the case of breakdown it may be difficult to give a supply at all, and unless the connections develop quickly and the load is of such a character as to keep this gargantuan machine fully loaded the best in the way of economical operation may not be reached. These are, of course, generalisations which may not be applicable to this particular case. We merely point them out to show that what is good for Rotherham may not be good for other places and that at the present time there is a good deal to be said for not unduly increasing the size of generating sets.

Two Views on Electric Traction.

Two papers which have recently been read before two different societies illustrate in an interesting way two opposing attitudes on the subject of electric traction. In the first of these, which was read before the Institute of Transport, Sir PHILIP DAWSON summarised the results of a series of financial investigations which were undertaken when the question of converting the main lines between London, Brighton, Eastbourne and Worthing came up for consideration. In the second, which was read before the North East Coast Institution of Engineers and Shipbuilders,

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Mr. T. GRIME gave the views of a steam engineer on electric traction. It is not surprising to find that in these two papers different conclusions are reached. Sir PHILIP DAWSON'S figures show that from 1909 to 1920 there was a steady rise in the number of passengers carried electrically (a result which it is quite usual to find follows electrification), and that the number carried by the steam services during the same period decreased. It naturally follows that in the one case the gross and net receipts are increasing and in the other decreasing, though it is interesting to find that on the expenditure side the movement is reversed. These results, which are surprisingly good, have been obtained in spite of the fact that the best areas are not yet electrified. For these reasons Sir PHILIP recommends a further extension of the electrified system, being sure that by so doing the carrying capacity and the gross receipts of the railway would be increased.

Advantages Grossly Exaggerated.

ON the other hand, Mr. GRIME protests that the advantages claimed for electrification are grossly exaggerated. On the grounds of thermal efficiency nothing much is to be gained by conversion; weight for weight the steam locomotive is a more powerful machine than its electrical competitor, and the amount of smoke made by a steam locomotive is small compared with that made by factories and other fuel consumers. Finally, he comes to the conclusion, with which no one will disagree, that the whole problem is one of finance. But that being so, we rather wonder why he should drag in a large number of other factors, which, though interesting enough, have little bearing upon the problem. It seems obvious that this question must be tackled from the traffic point of view. There are certain sections of railway which it would, on SIR PHILIP DAWSON'S showing, not pay to convert immediately. There are others by whose conversion everybody, not the least the railway companies themselves, would benefit. The choice having been made, electrical engineers can provide suitable equipment, and the results are likely to be equally as good as those obtained on the Brighton Railway. It is to be hoped that now the troubles due to grouping have been overcome, some advances in this direction will be made.

The Institution and Scientific Development.

IN a letter which appears in our Correspondence columns this week Mr. J. SAYERS regrets that no lecture on the atomic structure of matter has been delivered before the Institution of Electrical Engineers during the session that has just closed, and remarks that it is most desirable that the imaginations of the members should be excited each year by a knowledge of the latest discoveries and theories in this field. This argument opens up an interesting topic for speculation. We agree with Mr. SAYERS that, if only as an intellectual exercise, it would be well that all electrical engineers should keep themselves in touch with what is going on in this important branch of scientific investigation. Unfortunately electrical engineers are busy men and might not look upon the study of this subject as much of a recreation from other anxieties. But supposing that they did, this desire for an annual lecture would land the Institution itself in a difficulty. The number of men who can give in the space of an hour an interesting and informative discourse on such a subject is small. To be asked to deliver the Kelvin lecture is an honour, and an honour that should not be confined too closely to one class of members or of subject matter. If the subject that Mr. SAYERS desires information about is to be dealt with other than in the Kelvin lecture, something else, perhaps of more practical importance, will have to be omitted from the Institution's programme. Each year the scope of the Institution widens, and for that reason concentration must be avoided. Again, a year is a short period to cover in a review of this kind and vain repetition for repetition's sake might have the contrary effect to that which Mr. SAYERS desires. It seems to us that the remedy for this state of things, and we agree that it requires a remedy, lies in members' own hands. A good deal on this subject is published in the scientific and technical journals in the course of the year, and thus a good deal not only of descriptive matter but of comment sees the light of day. A study of these articles would go a long way to bring about what Mr. SAYERS wishes, a closer knowledge of fundamentals by electrical engineers engaged in practical work.

A Month of Conferences.

IN the electrical world June, 1923, is to be a month of conferences. On Monday next the Summer Meeting of the Institution of Electrical Engineers opens at Manchester, and with progresses to Liverpool and Llandudno, continues until the end of the week. On June 18th the Annual Convention of the Incorporated Municipal Electrical Association opens at Scarborough, and, fortunately, having opened, stays there to discuss a variety of interesting subjects and to do a variety of interesting things, as the programme we publish elsewhere in this issue shows, while towards the end of the month the Tramways and Light Railways Association will open at Swansea. These three meetings will give an ample opportunity to those attending to obtain both a general knowledge of recent electrical development and special information from colleagues on their own particular subject. They will also give plenty of opportunity for social intercourse and for recreation. All the same, we wish matters had been arranged rather differently. Three conferences means a certain diffusion of effort. Few people will be able to attend all of them, and because of that inability their efficiency will be reduced. Though, looking at the programme of each meeting separately, a certain concentration is visible, in the aggregate there is a good deal of diffusion and a certain overloading is obvious in the laudable attempts of those responsible for the Institution Summer Meeting to provide something each day which will tickle the palate of everybody attending. Better than three conventions so close together would, therefore, be one large "All-Electric" Convention, which would give an opportunity for electrical people of every sort to meet and for matters of the widest interest to be discussed. The suggestion has been made more than once in these columns that this should be done. We hope that next year, when the British Empire Exhibition at Wembley will be held, it will be done.

Is Gas Deteriorating?

COMPARATIVE statistics, though proverbially misleading are nevertheless interesting. This is especially the case when the relative merits of electricity and gas are considered and those relative merits are dealt with by members of the gas industry. In a recent statement, attempting to controvert some of Mr. L. L. ROBINSON'S statements about the advantages of electricity for domestic purposes, Mr. F. W. GOODENOUGH states that "twenty units of electricity do the same practical work as one therm." Electrical engineers may or may not believe this, but they will be interested to gather from such a source either that the thermal value of electricity is increasing or that that of gas is decreasing. This decrease is progressive. A year or two ago electricity for lighting, according to the same authority, was thirty times the cost of gas, then it fell to fifteen or ten times, then to three times, and now it is equal. Evidently the same movement is taking place when gas is used for heating. A little while ago one therm was equal to 29 units, now it is equal to 20. We hope the fall will continue, even as low as the German mark. But at this point Mr. GOODENOUGH will no doubt agree with us about one thing: that all the hard words that have been said about statistics are justified.

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Electric Hot Water.

A DISCUSSION on thermal values naturally leads us on to a discussion of the provision of hot water by electrical means, a subject in which we, and we hope a number of our readers, are interested at the present time. Gas engineers would no doubt be able to prove by means of the statistics that they have at their fingers' ends that for practically every reason gas would be better than electricity for this purpose. Yet gas as a means of providing hot water in the home cannot be called an unqualified success. The apparatus is costly and cumbersome, the ventilation must be properly looked after, if disaster is to be avoided, and the vents may be a constant source of draughts. Gas is burning at the by-pass when it is not being usefully employed, and even when the geyser is at work a large number of therms go in heating up metal, which heat is not communicated to the water. Matches are required, and the whole procedure which has to be gone through is not to be recommended either to the nervous or the careless. Surely we can do better than that; or, if we cannot, it is time we set about it and did. The problem is not an easy one, but electrical engineers have solved even more difficult matters, and we hope soon after June 29th to publish some further steps towards its solution.

Institution Business.

The Annual General Meeting of the Institution of Electrical Engineers is not a function which has much attraction for the general body of members. We do not suppose that the meeting which was held yesterday, too late for the proceedings to be reported in this issue, was any exception to the rule, especially as the one excitement of past years, the announcement of the results of the elections to the Council, was lacking. It will be remembered that under the new By-Laws, which came into force as the result of the granting of the Royal Charter, a change was made in the procedure for these elections. Instead of the Council nominating more candidates than there were vacancies they will now nominate the exact number, the Council's list will be issued not later than May 31st in each year instead of not later than March 31st, as heretofore, and it will be left open for any ten members to nominate further candidates not later than June 21st.

Why the Procedure was Changed.

The reason for this change, as explained at the Special General Meeting for the confirmation of the By-Laws last year, is that it was difficult for the Council to get men to stand when full support could not be given to all of them. It is, of course, still open to the general body of members to nominate other candidates, and we hope of this course full advantage will be taken. Otherwise there will be no election, and in the limit one Council will simply become the nominees of the Council preceding it. It has been argued that the Council knows best which members are most suitable for the Council, and there is some force in this, but it is rather counteracted by the regulation that three of the nominees must not have served on the Council before. In these democratic days, moreover, we should be glad to see the general body of members taking a real interest in this important question.

Membership Still Increasing.

Turning to the Annual Report which was submitted at yesterday's meeting, it is gratifying to find that the membership of the Institution is still increasing, and now stands at 10 911. The net increase during the past year was 636, which, though less than the year before, and considerably less than the record years of 1920 and 1921, is an indication not only of the development of the electrical profession and industry, but that the Institution is recognised as the representative body of that profession and industry. A further indication of this is to be found in the announcement that employers in increasing numbers are stipulating the Associate Membership as a qualification for employment, and we hope that this tendency will continue. The increase was by far the greatest in the student class, which in itself is a good augury for the future. This class now numbers 26 per cent. of the total membership.

The Meetings and Attendance.

An Appendix to the report gives an impressive list of the meetings held during the past session. These total 369, of which 125 were committees of various kinds, 76 students' meetings, and 86 local centre meetings. Now this means a vast amount of voluntary effort, even when it is spread over the large membership of the Institution, and it is not surprising, therefore, to find the comment made that the arrangement of reading the same Paper at a number of centres reacts unfavourably on the attendance at a particular meeting, a result which in the case of highly technical Papers may need consideration in the future.

Some Improvement Required.

Some change certainly seems to be indicated. At present a few of the Papers presented obtain a Benjamin's share of the publicity, the others obtain little or none. A way out of the difficulty seems to be to seek for short Papers on subjects that can be easily discussed and to arrange for these to be discussed at one centre only. This would mean a concentration of those interested in that particular question at the meeting, for as a glance through the proceedings will show, members have no aversion to travel; and it is not unknown for one member to discuss the same Paper at more than one centre. Constant attendance at the meetings throughout the session has convinced us that the proceedings are not becoming more interesting to the general body of members, and in spite of a greater spontaneity in the discussions, to which the Council rightly draw attention, much more must be done in this direction. One of the great objects of the meetings is their educativeness, and that object must never be lost sight of. It can only be achieved by attracting members who are not experts in the particular subject under discussion, and that can only be done by increasing the interest and to some extent the informality of the proceedings.

The Cost of the "Journal."

With one exception the other matters dealt with in the report require no comment. That is not because of their lack of intrinsic interest but because, owing to the publication of matters as they occur they have already been before our readers. The exception, it is hardly necessary to say, is the problem of finance. During the past few years much controversy has raged round the cost of the "Journal." We are glad to see that in spite of the increase in the number of copies printed and of the amount of matter published the cost has fallen from £4 936 to £4 604. The Council, however, feel that this decrease is not enough, and have therefore recently adopted a course with which we cannot be expected to agree, whether it be successful or the reverse. A much wiser and a more economic policy would have been to limit the length of the contributions to the "Journal." Often these would increase rather than decrease in interest by a little judicious pruning.

In this connection we are glad to see that arrangements are being made to lighten the burden of the cost of "Science Abstracts," which falls on the Institution. This is a useful and valuable publication, but it should be paid for by those who find it useful and valuable, and not by subsidy.

Financial Position Sound.

Financially the Institution is in a sound condition. The margin to the good on the revenue account is just over £862, as compared with £639 in the previous year. The mortgages have been reduced by nearly £4 000, and now stand at £20 338. The assets are now valued at £120 430, and the liabilities at £6 030, giving a surplus of £114 399 as compared with £108 939 last year. Thus both financially no less than technically, the Institution may be said to be sound, and it is to be hoped that its worth to members and their worth to it will continue to increase.

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Electricity Supply at Rotherham.

The Largest British Turbo-Alternator—Prince of Wales Formally Opens New Station.

The history of electricity supply in Rotherham is almost a romance. Supply was commenced from a municipally-owned station in May, 1901, and since that time the undertaking has had the same chairman, Ald. Winter, and the same chief engineer, Mr. Edward Cross. This partnership must almost constitute a record. For the first thirteen years of its existence the progress of the undertaking was sure but slow, and in August, 1914, the generating capacity was 4 500 kW. But in May, 1923, it was 70 000 kW, something of a difference in nine years. The new plant is installed in a separate power station which, though it has been running for some time only received the honour of a formal opening by the Prince of Wales on Monday last. On that occasion His Royal Highness started a 30 000 kW turbo-alternator which has been manufactured by the British Thomson-Houston Co. and which is said to be the largest generating unit in this country. A view of the ceremony with the Prince actually starting the machine is given in Fig. 4.

Steam is admitted at a gauge pressure of 200 lb. per sq. in. at 200 deg. F. superheat, the average vacuum being 28½ in. The full load steam consumption under these conditions is 342 000 lb. per hour, and at the most economical load of 25 000 kW the steam consumption is 277 500 lb. per hour.

The Steam Turbine Constructional Details.

The high pressure end of the turbine casing is made of cast steel and the low pressure end of high grade cast iron. The casing is divided along the horizontal centre line, and the adjoining faces of the two parts are scraped to a true surface, consequently no jointing material is required. The diaphragms are made of cast iron, and round the periphery of each one are cast thin steel plates shaped to form the nozzles, through which the steam is directed on to the blades of the revolving wheels. These diaphragms are made in halves, the top halves being fixed to the top casing so that when this is lifted the wheels and shaft can be readily inspected.

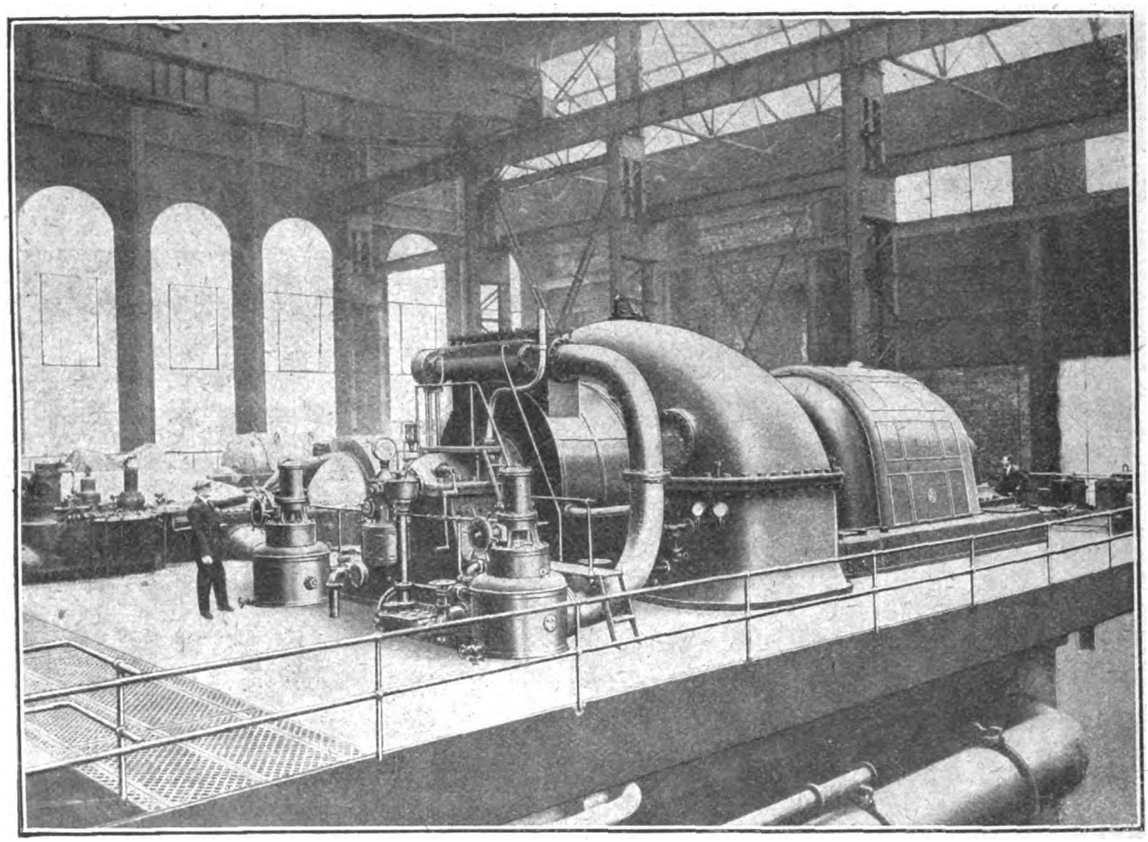

FIG. 1.—THE NEW 30 000 KW TURBO-GENERATOR IN ROTHERHAM POWER STATION.

The original equipment of the new station at Rotherham consisted of two 12 500 kW Parsons turbo-alternators with the usual steam raising plant, accessories and switchgear. The station as it then stood was fully described in THE ELECTRICIAN for June 27th, 1919, and further particulars need not therefore be given. It may be mentioned, however, that the ultimate capacity of the station will be 125 000 kW controlled from four sections of switchgear with busbar reactances and that an interconnector between the new station and the old allows the transfer of 5 000 kW.

Turbine Design and Construction.

The most interesting feature of the plant at the present time is, of course, the new turbo-alternator which has a continuous output corresponding to 40 000 H.P., the alternator delivering 30 000 kW three-phase current at 6 600 V 50 cycles, the speed being 1 500 revs. per min. This set is illustrated in Fig. 1.

The turbine is of the Curtis type, with 14 stages, the first stage wheel having two rows of blades and the remaining 13 wheels one row of blades each. The largest wheel is 12 ft. in diameter.

The total weight of the turbo-generator is about 300 tons, and the space occupied is approximately 47 ft. by 20 ft. 6 in. floor area by 12 ft. above floor level.

The first stage nozzles are in four segments, two segments being bolted to the top half of the casing and two to the bottom half, as steam is admitted at the bottom as well as the top of the casing. The wheels are of high grade steel turned all over and each bore is fitted with two bronze rings. This construction enables a good forced fit to be made when pressing the wheels on to the shaft without in any way damaging them or the shaft in the process. The blades are made of bronze with the exception of those on the last two wheels, which are of carbon steel, sherardised to prevent corrosion.

The turbine and alternator bearings are both spherically seated and self-aligning, the shells being made of cast iron lined with babbit metal. A thrust bearing of the multi-collar type is attached to the steam end bearing and is so arranged that by means of a worm, the spindle of which extends to the outside of the bearing housing, the axial clearance of the rotor may be adjusted while the turbine is running.

Coupling Arrangements.

The turbine rotor is connected to the electrical rotor by means of a flexible coupling of the "claw" type, the claws being lubricated from the adjacent bearings. The governor is of the centrifugal type and is driven by worm and wheel from the

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turbine shaft, the governor lever being connected through a floating lever to two pilot valves; one pilot valve admits oil under pressure to either side of a piston for actuating the throttle valve which governs the steam admission, at the bottom of the turbine, up to approximately half load; the other pilot valve admits oil under pressure to either side of the vane of the servo-motor. Assembled on the servo-motor shaft are a number of crank discs which open or close a series of valves as the shaft rotates in either direction, thereby admitting or shutting off steam to the top of the turbine. At the end of the servo-motor shaft is a small pinion, geared to a rack and connected by a rod to the floating lever. As the servo-motor shaft is moved the floating lever brings the pilot valve to mid position, covering both port holes, thus locking the servo-motor.

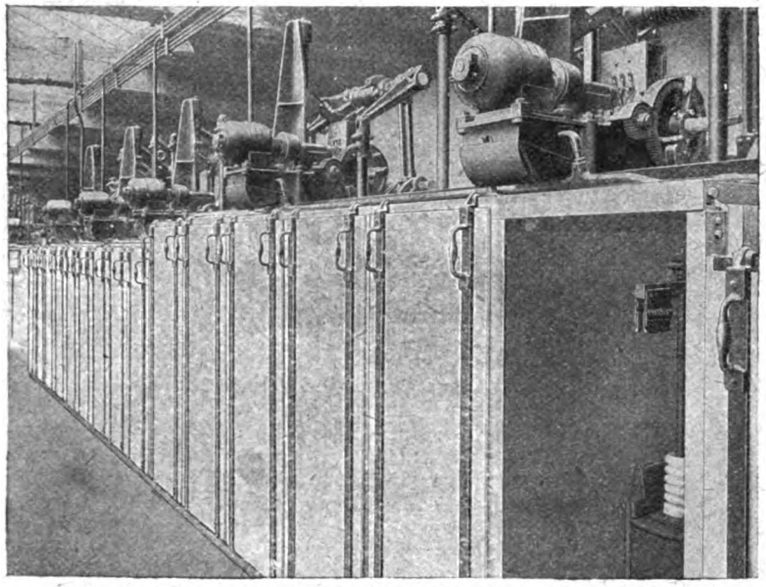

FIG. 2.—ONE BANK OF THE MOTOR-OPERATED OIL SWITCHES.

Governing Equipment.

The governor maintains the speed of the turbine constant within 3 per cent. from no load to 30 000 kW, and is provided with both hand and electrical adjustment, by means of which the speed of the turbine can be varied 5 per cent. above or below the normal speed of 1 500 revs. per min.

The two main stop valves are also arranged to act as emergency valves and to shut off the steam if the speed of the turbine exceeds 10 per cent. above normal. This operation is performed automatically by means of an unbalanced steel ring, which at normal speeds is held concentrically with the shaft by means of a spring, but which, at the higher speed, flies eccentrically due to the increased centrifugal force and comes into contact with a trigger, which trips the mechanism of the valves and closes them instantaneously. Means are also provided for hand and electrical tripping at any time, the electrical tripping being performed by means of a solenoid operated from the switchboard.

The oil for operating the servo-motor and for the general lubrication of the bearing is supplied under pressure by an oil pump driven from an extension of the turbine shaft through a worm and wheel. An auxiliary steam turbine driven oil pump is also provided and is arranged to come into operation automatically, if, due to failure of the attached oil pump or any other cause, the oil pressure drops below a pre-arranged figure. The auxiliary oil pump is also used, when starting and stopping the turbine, to maintain a liberal supply of oil to the bearings.

The Electrical End.

The alternator is designed for a maximum continuous output of 40 000 kVA, three-phase at 1 500 revs. per min., 6 600 V, 50 cycles at a power factor of 75 per cent., i.e., 30 000 kW. It is of the totally enclosed, air-cooled type, direct coupled to the turbine and is provided with a direct coupled exciter.

The stator frame is of cast iron, divided into halves vertically. The section is of the box type, strongly ribbed, the space between the outer and inner shells serving as a passage by which the air, after ventilating the machine, is conducted to the exit duct. The frame is provided with detachable planished steel over the outside openings to facilitate inspection. The frame is machined on its inner surface to support the laminated iron core, which is assembled on steel dovetail section keys which are fixed to the frame ribs.

The stator core laminations are constructed of high resistance, high permeability steel, both sides of which are coated with an insulating enamel so as to reduce eddy current losses to the lowest possible value. The laminations are in the form of segments, and are provided on their outer circumference with dovetail slots for the keys, and on the inner circumference with slots for the reception of the windings. The segments are assembled in the frame so as to break joint in successive layers. The complete core is firmly clamped in position between massive cast iron end flanges secured to the frame by means of amply proportioned screws, the use of bolts passing through the punchings being avoided. At frequent intervals in the length of the core, radial ventilating ducts are provided, and the teeth of the punchings are well supported at the ends by steel fingers attached to the end flanges.

The Stator Winding.

The stator winding is of the bar type, arranged in two layers, in open type slots. The slots have openings shaped to accommodate dovetail section keys of impregnated hard wood, which hold the windings securely in position. The end portions of the windings are supported by deep section bronze rings well insulated, and mounted on brackets on the end flanges.

The winding consists of an upper and bottom layer of conductors, there being one conductor per layer per slot.

FIG. 3.—CONTROL ROOM FOR THE H.T. SWITCHGEAR.

The conductor consists of a large number of separate laminations and is insulated with successive wrappings of varnished mica tape hot pressed to dimensions and continued throughout the entire length of the coil. The copper laminations comprising one conductor are also individually insulated, this

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insulation being continued without a break through the entire length of the winding from the high voltage terminal to the neutral terminal. In this way extra losses due to eddy currents are reduced to a very low value. The stator windings were subjected to a high potential test of 14 200 V for one minute, both to earth and between phases before the machine was put into service.

The rotor is of the cylindrical non-salient pole type with distributed windings and is designed with its critical speed below the normal running speed, i.e., approximately 1 000 revs. per min. In order to allow of running through this speed with safety and freedom from excessive vibration, the shaft journal at the exciter end is carried in a special " slip " bearing. This is arranged to permit of a small radial play between friction collars, and the radial movement thus allowed when running through the critical speed with the resulting work which is done on the friction collars completely destroys any tendency of the shaft to " whip."

The exciting windings are of solid copper strip, edgewise wound, insulated with mica from one another and from the core. The slot keys are of hard copper and are connected at each end of the rotor to massive bronze end plates, so as to constitute a squirrel cage winding on the rotor. The complete rotor was subjected to a high potential test of 1 500 V for one minute when running at 15 per cent. above its normal speed.

This type of rotor, employing distributed exciting windings, and a practically uniform squirrel cage winding, results, the makers claim, in the generation of a smooth potential wave closely approaching a sine wave at all loads, and the squirrel cage winding permits of a certain amount of unbalanced single phase load without undesirable heating effects in the various parts of the machine.

Ventilation.

The alternator is designed to be self-ventilating in accordance with B.T.-H. standard practice, thus dispensing with the use of external fans. The stator is provided with double end shields and shrouded fans are attached to each end of the rotor for creating the necessary draught. The ventilating air is drawn into the machine by the rotor fans through suitable ducts in the foundations at both ends of the machine. On entering the machine between the double end shields, part of the air is drawn into the rotor, cooling on its way the end windings, the remainder passing through the fans into the space enclosed by the inner end shields, in which are situated the stator end windings. The air which enters the rotor is distributed along the entire length and is expelled through the various radial air ducts into the air gap. The air from the stator end shields, after cooling the end windings, also passes through the radial ducts in the stator core into the outer frame of the machine. From this point the air is carried, through a suitable flume, outside the building or into the boiler room.

This system of radial air ducts in the magnetic structure of both rotor and stator makes possible a very efficient use of the ventilating air, and ensures uniform cooling. The intake air is drawn through an air washing plant, which removes dust particles which would otherwise, in course of time, accumulate in the air passages of the machine and reduce the efficiency of the cooling.

The exciter, which is mounted on an extension of the main bedplate is a four-pole, shunt-wound, self exciting machine with commutating poles, and is connected direct to the alternator rotor windings, without a series rheostat, the control being effected by a rheostat in the shunt field circuit. The armature is direct coupled to the alternator shaft through a flexible coupling and equipped with an outboard pedestal bearing. The armature is of the slotted drum type, the winding consisting of copper bars insulated with mica.

The bearings of the alternator and exciter are lubricated under pressure from the main turbine oil supply system, and efficient means are provided for preventing oil escaping along the shafts from the bearings and finding its way into the machines. Every care is taken in the design of the alternator, to avoid shaft currents through the bearings, but as an additional precaution the outer bearing pedestal of the alternator and the exciter pedestal, together with the oil piping to them, are insulated free from the bedplate in accordance with B.T.-H. standard practice.

Reactance and Short-Circuit Characteristics.

The alternator is designed with high internal reactance, so that in the case of accidental short circuit occurring at the terminals of the machine, the maximum momentary current is limited to a safe value, thus protecting the set against injury. On this account external protecting reactors in the generator circuit are unnecessary. The inherent voltage regulation is coarse, but by the use of an automatic voltage regulator of the Tirrill type the actual variation is reduced to a value not exceeding approximately 2 per cent. above or below the normal voltage at any load. As the generator is designed to operate normally in conjunction with the Tirrill regulator, coarse regulation is in no way detrimental and is of secondary importance to that of rendering the unit immune from the destructive effects of short circuits.

An interesting test, subjecting the turbo-alternator to a sudden single phase (line to line) short-circuit, when running excited at full voltage, was made at the Rotherham Corporation Electricity Works before finally passing the machine for service. This was described in our issue of May 4th, 1923, p. 483.

The Area Supplied and Costs.

Turning to the undertaking generally it may be mentioned that the greater proportion of the industrial works in the area supplied has already been " electrified," whilst those works which are still unconverted give evidence of change-over from old methods as soon as they can see sufficient steady future business to justify the first cost of the change-over. It will be appreciated therefore that the Rotherham Corporation have undertaken a great responsibility in the provision of a cheap and plentiful, also reliable supply of electricity, and there is every reason to believe that the efforts made will meet with the success so well deserved.

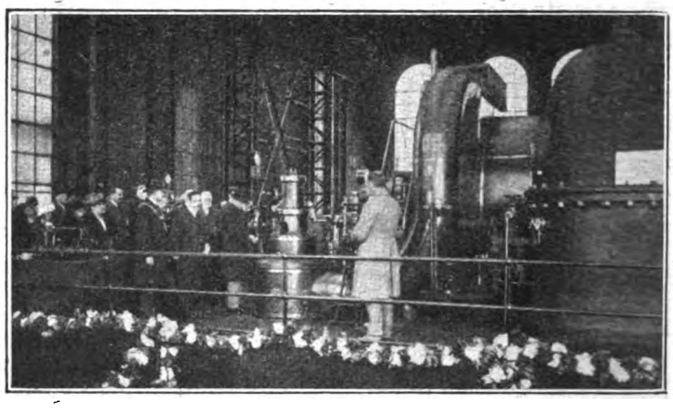

FIG. 4.

THE PRINCE OF WALES STARTING NEW TURBO ALTERNATOR.

In addition to the supply to the industrial works in the area, the department is responsible for the supply to the Rotherham Corporation Tramways, to the Mexborough and Swinton Co.'s Tramways besides the trolley vehicle systems to Maltby, Wath and Conisborough. Applications for supplies of electricity for domestic purposes are coming in as quickly as they can be dealt with, and at present there are 3 500 consumers connected. This progress is expected to continue, and it is also anticipated that when the new power station is fully in operation the prices offered for heating, cooking and other domestic purposes will be sufficiently attractive to cause considerable fresh demands in that direction.

Rotherham has always been well to the fore in matter of low station costs and at present its coal costs work out at 0·41d. per kWh sold with a total works costs of 1·16d. per kWh sold. With this new and efficient plant in full working order there is no reason why these costs should not go lower and there is every expectation that they will.

Mr. V. E. Pullin, director of radiological research, Woolwich Research Department, writes that the description of the X-ray apparatus shown at the recent Royal Society Conversazione which appeared in THE ELECTRICIAN of May 25th is not so clear as it might be. The electrode in the smoke chamber is changed to 400 V, not 15 400 V, and the principle involved is that the gas in the chamber is ionised by the beam of the X-rays. The ions cling to the smoke particles and are attracted from the flat-topped smoke cloud towards the electrode placed above it, in the form of a small jet, similar to a waterspout.

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A Steam Engineer on Electric Traction.

In the course of a Paper on "Possibilities of Increased Efficiency in Railway Locomotives," which he read recently before the North-East Coast Institution of Engineers and Shipbuilders, Mr. T. GRIME made some remarks, mostly critical, on the question of railway electrification.

Electrification was, he said, a matter which was now receiving a great deal of attention in many quarters, and in view of the grossly exaggerated reports frequently made in its favour, generally by electrical engineers without actual experience of railway operating conditions, it would be well to afford the subject some consideration in order that a few comparisons might be made.

The Advantages of Railway Electrification.

The advantages claimed for railway electrification might be briefly summarised as follows: (1) Greater economy of fuel consumption; (2) lower weight of electric locomotive as compared with a steam machine of equal capacity; (3) possibility of better acceleration and higher average speed, and (4) cleanliness.

Considering first the question of fuel economy, Mr. Roger T. Smith in a paper read before the Institution of Electrical Engineers in 1914, gave the following figures for power-house economy and transmission losses at various points:—

Average thermal efficiency of power station taken over a period of one year, 11 per cent.
Efficiency of transmission between power and sub-stations, 95 per cent.
Efficiency of sub-station, 79 per cent.
Efficiency of transmission between sub-station and train, 93 per cent.

These figures gave a thermal efficiency of 7·68 per cent. at the collectors.

Drawbar Efficiency.

Before an estimate could be formed as to the efficiency at the drawbar, it was necessary to know the approximate weight of an electric locomotive to perform a specified duty. Fortunately this was not very difficult. Sir Vincent Raven had stated that his new electric locomotive of the 4–6–4 type was capable of maintaining a tractive force of 8 400 lb. at 65 miles per hour and it weighed 102 tons. The resistance to traction per ton of weight was the same as that of a six-coupled steam locomotive and tender (a fair assumption when electrical losses and mechanical losses in gearing were allowed for), and this gave: resistance of engine on level 35·18 lb. per ton, 3 590 lb. Deducting this from the total of 8 400 lb. left 4 810 lb. available at the drawbar. The drawbar efficiency therefore was 57·3 per cent., and the overall thermal efficiency at drawbar was 4·4 per cent., which was approximately equivalent to the results that would be expected from a superheated-steam locomotive under similar conditions. Some comparative data as to the relative efficiency of steam and electric locomotives were given by Mr. J. E. Muhlfeld in a paper read before the American Society of Mechanical Engineers and other bodies on October 22nd, 1920. These results summarised were as follows:

RELATIVE THERMAL EFFICIENCIES OF STEAM AND ELECTRIC LOCOMOTIVES.

Kind of Locomotive.	100 per cent. Load rating. Per cent.	75 per cent. Load rating. Per cent.	50 per cent. Load rating. Per cent.
Electric	5·79	5·95	4·54
Steam (with superheater)	3·85	4·83	5·88
Steam (without superheater)	2·7	3·86	4·47

Mr. Muhlfeld remarked that, as 100 per cent. load rating conditions occurred in practice for very short periods and as the majority of the drawbar loads represented from 30 to 60 per cent. of the maximum capacity, comparisons should properly be made only with the net thermal efficiencies at 50 per cent. load ratings.

The Weight Claim.

Turning to the other claims there was a considerable saving of locomotive weight by the use of an electric locomotive for the simple reason that it was not a self-contained unit. The necessity of any self-contained unit having to carry its own fuel supply must inevitably result in a heavier unit than was the case for a machine not so handicapped. As an example, it would be interesting to compare the weight of the electric locomotive previously referred to with a steam locomotive of similar capacity. The maintenance of a 8 400 lb. tractive effort at 65 miles per hour involved a total horse-power of 1 454 H.P. Since the weight of the locomotive was 102 tons, 14·25 H.P. was exerted per ton of weight of engine under these conditions.

A Representative Steam Design.

For the steam locomotive the new Great Northern 4–6–2 locomotive was taken as being representative of really good design. This locomotive had a boiler heating surface of 2 930 sq. ft., excluding superheater. An evaporation of 12 lb. steam per sq. ft. of heating surface per hour and 21 lb. of steam to be required for 1 H.P. hour were assumed, and this gave 1 675 H.P., which could easily be maintained.

The weight of the engine alone was 92·45 tons, and that of the tender 56·3, making a total of 148·75 tons. The horse-power per ton weight of engine alone was therefore 18·15 H.P. and 11·26 H.P. per ton weight of engine and tender combined.

These figures showed that, neglecting the tender, the steam locomotive was, weight for weight, a considerably more powerful machine than its electrical competitor. When the tender was taken into consideration, however, there was a saving of weight of practically 30 per cent. in favour of the electric locomotive. In any case, however, since the thermal efficiency of the drawbar was practically the same in each case, the additional weight of the steam locomotive was of no great consequence.

A Question of Circumstances.

Whether better operation could be obtained by electrification or not depended entirely upon circumstances. The electric motor had a large reserve of power to draw upon, and was capable of taking a very large overload for short periods. This could be taken advantage of at starting, with the result that a considerably better acceleration was possible with an electric locomotive on suburban and similar service than with a steam locomotive. Especially was this the case when the multiple-unit system was employed, thus dispensing with the dead weight of a locomotive to a large extent. The steam locomotive was operating at its lowest efficiency when frequent starts, with consequent late cut-offs and also stand-by losses when coasting and standing were the rule. It was safe to say, as a rule, in suburban services with an average of perhaps three-quarters of a mile between the stations, that electrification would result in better operation and higher thermal efficiency. From a financial and operating standpoint, it was quite likely that equal results could be obtained from a steam engine of about twice the power usually employed, although if this was done drawbar efficiencies of the order of 30 to 40 per cent. were obtained, with consequent low overall thermal efficiency, even though the efficiency on an indicated horse-power basis might be quite good. Under average railway conditions the steam locomotive was ideally suited for its duty, and practically no improvement would result from a change to electrical operation. It must be remembered always that the electric locomotive was not a self-contained unit, and it was possible for a whole section to be stopped by a breakdown in the transmission system. A breakdown on a steam locomotive was seldom sufficient to cause a total stoppage, and even if it did, another engine could usually be commissioned to help matters. In the case of a breakdown in electrical transmission the whole section was stopped until the trouble was repaired, and in the meantime everything was at a dead standstill.

The Cleanliness Question.

The last item was that of cleanliness. It was, of course, evident that a certain amount of smoke was inevitable with steam operation. After all, however, the smoke from the railway was a very small part of the total smoke in a large city, and unless there were other advantages to be obtained, railways were not going to waste capital on that score alone. Should city corporations wish to enforce electrification on such grounds, then railway companies would be quite justified in charging extra fares to pay for the increased capital charges. If this was done it is most unlikely that the aforesaid corporations would persist in their attitude.

The Whole Problem One of Finance.

It might be said finally that the whole question of railway electrification was one of finance. The amount of capital involved was enormous. The cost of the locomotives alone amounted

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to two to three times the cost of modern steam locomotives of corresponding capacity, and in addition there were many expensive items, such as power and sub-stations, third rails or overhead gear, etc., to be paid for and maintained in working order. The scrapping of existing plant was also an enormous item. In actual maintenance the electric locomotive, due to the elimination of the boiler, was possibly cheaper than the steam, but to obtain a fair basis the maintenance of generating and transmission equipment must be added to the locomotive maintenance costs. In short, it might be said that only when very heavy traffic was the rule could any fair return be expected from electrification. Some interesting comments would be found in a contribution to the discussion on a paper on Railway Electrification delivered before the American Institute of Electrical Engineers in 1913, by Mr. A. H. Babcock. He says, with reference to reports made on electrification of mountain railways of Western America :—

For not a single one of these reports, which have been made in considerable numbers, could it be said that the operating economies which have been affected by superseding with electric locomotives the steam locomotives on such railways, are enormous, or indeed of such amounts as to defray in a few years the initial outlays for sub-stations, for feeders and contact conductors, and for electric locomotives. Quite the converse is the fact, and in every case on which a report has been made the conclusions have been adverse to electrification on precisely the reverse of these claims.†

The Future of Railway Development.

After considering the internal combustion engine Mr. Grime concluded : Speculations as to future railway development and the conditions likely to obtain in the future are difficult, as the opinions of loud talking politicians and a badly informed public appear generally to be the deciding factor rather than the carefully considered opinion of the engineer trained in these matters. A really efficient transportation scheme would employ all three systems (steam, electric and internal combustion) each in its best sphere. Thus if conditions such as the bottle neck effect seen at some of our terminal stations apply and electrification offers relief, then it should be resorted to. The general run of work can be well looked after by the steam locomotive, whilst isolated branch lines with infrequent and light services offer excellent fields for the development of the internal-combustion locomotive which could undertake more and more important duties as it increased in flexibility and reliability, which it is almost certain to do. It is to be hoped that the future will see all systems considered on their merits and adopted accordingly, as only by this means can we obtain increased efficiency in railway operation.

The Financial Prospects of Railway Electrification.*

By SIR PHILIP DAWSON, M.P.

In 1919 the author was instructed to prepare, for submission to the Ministry of Transport, a report on the economic results which might be expected from the completion of the electrification of the suburban line services and from the electrification of the main line services to Brighton, Eastbourne and Worthing, both passenger and freight.

The report was submitted to the Ministry of Transport in 1921. The conclusions arrived at were very favourable, and a further financial report showing the capital expenditure which the proposed electrification would entail and the resulting revenue was completed in the autumn of 1922.

The conclusions are based on actual results achieved with steam, and on experience derived from over ten years operation of electric trains over a portion of the Brighton Railway.

The author now presents some of the principal results of this financial investigation, summarised in a set of diagrams, based on data obtained from the following records :—

1. The company's half-yearly and yearly reports and accounts.
2. Figures supplied by the company's Accountant and Superintendent of the Line.
3. Returns made by the company to the Minister of Transport for 1920 and 1921.
4. Figures specially prepared by the accountants, locomotive, carriage, traffic, and electrical departments.

For the purposes of the investigation the lines to which electric haulage was proposed to be applied were divided into : (*a*) A northern area, comprising all sections over which suburban trains are operated and extending from the termini of London Bridge and Victoria to Epsom, Coulsdon and Oxted ; and (*b*) a southern area comprising lines extending from Coulsdon to Worthing, Brighton, Seaford and Eastbourne.

Proportional Effect of Electric Operation.

The figures in the railway company's accounts and abstracts being the totals for the whole railway, it was necessary in order to ascertain the proportional effect of electric operation on portions of the railway and to relate these to the complete statistics of the railway. Ratios to the totals of the railway of expenditure, receipts, train-miles and passengers relating to the areas and services affected having been established for a given period (1921), these ratios were employed for other years for the apportionment at charges, etc., to steam services. Complete statistics for electric operation, since its introduction, have been available. It was therefore possible to obtain direct division between electric and steam passenger charges and other data.

The actual division of the total locomotive expenditure between goods and passenger services was not available, and was therefore deduced from the respective costs for train-miles for these services, as furnished by the locomotive engineer.

Otherwise the figures employed were those of the published and other accounts and statistics of the railway company.

Only costs such as locomotive costs, train lighting, carriage maintenance and guards, and additional cost of permanent way maintenance due to increased train mileage, which are directly affected by the system of traction adopted, were considered and denoted as " expenditure."

The sections at present electrified do not represent the most profitable part of the railway system. Such lines as those from Purley, West Croydon and Sutton to London Bridge and to Victoria, *via* Thornton Heath, should bring in at least as much or even more revenue, owing to the density of the traffic and the greater average fare realised on the longer journeys.

Electric Operation and Increased Traffic.

From 1909 to 1920 there has been a steady rise in the number of passengers carried electrically. Passengers (carried by steam) decreased in number between 1909 and 1917, and then rose till 1920, when they only barely exceeded the numbers carried in 1909, and have been falling since much more rapidly than in the case of the electric services.

The gross and net receipts in the case of steam have been falling since 1920, whilst in the case of the electric services they are still increasing. Expenditure in the case of steam is still on the increase, whilst the gross receipts are diminishing ; the reverse is the case with the electric services.

There have been great fluctuations in train-miles with steam, whilst very small ones have taken place with electricity.

Expenditure per passenger carried has been on the increase with both steam and electricity, but the rise with steam has been more rapid. The gross receipts with steam have risen from 7·4d. per passenger in 1908 to 14·4d. in 1921. In the case of electricity they rose from 2d. to 4d.

The gross receipts per car-mile for steam have risen from 7·3d. to 16·5d., or 126 per cent., whilst on the electric line they have risen from 6·5d. to 21·3d., or 228 per cent. The expenditure with steam has risen from 2d. to 7·8d., an increase of 290 per cent., and with electricity from 3d. to 9d., an increase of 200 per cent.

The gross receipts per passenger-mile for all steam services has risen from 0·65d. to 0·98d., equal to 51 per cent., whilst in the case of electricity the corresponding figure has been 0·26d. to 0·62d. (138 per cent.).

The expenditure per passenger-mile in the case of steam has increased from 0·175d. to 0·45d., equal to 157 per cent., and with electricity from 0·125d. to 0·26d., equal to 108 per cent.

* Abstract of a Paper read before the Institute of Transport.

† "Proceedings of the American Institute of Electrical Engineers," November, 1913, p. 2132.

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As regards passengers per train-mile, there is little difference between the utilisation of the main line and suburban steam services. The passengers carried with steam in 1913 were between six and seven per train-mile, reaching a maximum in 1919 of between 11 and 12 and falling to between 9 and 10 in 1921. In the case of the electric services, the passengers carried were between 16 and 17 in 1913, rising to 30 in 1919, and falling to 24·5 in 1921. This shows the better utilisation of electric as compared with steam services.

Gross Receipts and Expenses.

The gross receipts per train-mile is naturally in favour of main line services. The receipts of suburban electric services have crept up from 38 to 100 pence per train-mile and were steady in 1921, while in the case of steam the receipts were on the decrease.

As regards expenses per train-mile, whilst the cost for steam are still on the increase, the electric costs are decreasing and are lower now than steam costs. This is due to the 8-hours day and to high costs of labour and materials.

Owing to the increase of costs and decrease of receipts in the case of steam, electricity as regards net receipts shows a very satisfactory result and is still increasing, while in the case of steam it is on the decrease.

The ratio of net receipts, as previously defined, to gross receipts, is best for the electric services and is still improving, whilst with steam it has declined steadily since 1918.

The fact that gross receipts with electric traction were still on the increase whereas operating costs were actually decreasing, whilst with steam the contrary was the case, can be clearly shown. Thus in 1913 the gross receipts per mile of track operated amounted to over £4 500 for the electric services, and these had risen to £11 300 in 1921. For the suburban steam service, these were £2 600 in 1913, rising to £3 200 in 1919, and falling to £2 800 in 1921. The comparison becomes still more striking if "the net results" are compared; even if the total expenditure, including that unaffected by system, were taken into consideration, the ratio between the results obtained with steam and electricity would not be greatly altered.

The net receipts for electric were £2 800 in 1913, £5 000 in 1919, and £6 500 in 1921. For the suburban steam service they were £1 200 in 1913, £2 100 in 1919, and £660 in 1921, or, in other words, the receipts per annum per mile of track operated were ten times as great with electricity as with steam. Nevertheless the electrified zone by no means serves the best areas. There are quite as good if not better areas at present served by steam as are dealt with electrically.

Results Achieved by Electrification.

The author next considers the results actually achieved by the electrification compared with those achieved whilst the present electrified lines were still operated by steam. As regards the South London line, serious competition existed from electric trams and motor omnibuses, and much traffic had been lost, but this was not the case on the Crystal Palace line.

Results on the Electrified Lines.

	Passengers carried.	Gross receipts.
Last year of steam ..	14 770 073	£152 578
1913	23 473 821	£220 312
Electric, 1919	34 896 090	£418 201
,, 1920	36 774 056	£519 509
,, 1921	31 088 860	£526 471

The total expenditure in connection with electrification charged to capital was £814 225.

Net Receipts, Deducting Operating and Maintenance Costs.

Last year of steam	£110 996
Electric, 1919	£236 205
,, 1920	£297 303
,, 1921	£305 392

In this connection it is worth remembering that previous to electrification the operating costs with steam per train-mile were 1s. 4d., and that these had risen in 1920 to 4s. per train-mile, as compared to 3s. 9d. per train-mile in that year for the electric service.

Benefits of Electrification.

The benefits resulting from electrification generally, and more especially the advantages of operating goods services electrically and of electric shunting, are well known, and need not be discussed in detail. But it is of interest to see how greatly the available terminal capacity can be increased by the substitution of electricity. This is based on an actual working time-table prepared in connection with the traffic department of the railway.

The increase in train service due to electrification over steam is as follows:—

	Per cent.
Main line, Victoria	220
Suburban line, Victoria	225
Main line, London Bridge	142
Suburban line, London Bridge	206

In the next section of the paper Sir Philip Dawson makes quotations from speeches made by the chairman at various annual general meetings of the London, Brighton and South Coast Railway. Thus Lord Bessborough in 1913 stated that as the result of electrification 8 739 trains were being worked in and out of Victoria Station, as compared with 496 previously. Mr. Macrae, in 1922, also stated that it was only by electrification that they had been able to increase the service without increasing the congestion at termini. Sir Robert Perks mentioned that the increased capital consequent on electrification was only 30 per cent. of the old capital, but the increase in passengers had been no less than 250 per cent.—a rise from 42 to 147 millions on that line.

Electric traction is essential satisfactorily to operate the dense services required over suburban lines in and round our great cities. It may be of interest to examine the results of main line electrifications to Brighton.

Table of Mileage of Brighton Electrification.

	Electrified or in course of electrification.	Completion of Brighton suburban system.	Total, purely Brighton suburban system.	Electrification to Brighton main line additional.
Route miles	42	22	64	45
Miles of single track running roads ..	123	70	193	121
Miles of siding	12	107	119	56

Capital Expenditure.

The suburban system would have first to be electrically equipped. In consequence of the high line pressure 11 000 V which would be used, little additional expenditure would be required on this portion of the system in connection with the main line electrification. A thorough investigation in detail has shown that, taking the total cost of this complete electrification, including the suburban and main line electrification, comprising line equipment, transmission lines, sub-stations, and rolling stock and equipment thereof, as well as all the track and station alteration entailed by electrification, and allowing for interest thereon during construction:—

1. The ratio between the capital expenditure involved in the suburban and in the main line electrification is as 7 is to 4.
2. The total cost of operating the suburban lines to that involved in the operation of main line traffic is as 7 is to 3.
3. If the gross receipts resulting from the suburban and the main line electrification are increased for the suburban as compared with the main line in the ratio of 2 to 1, then the net receipts in the two cases are in the ratio of 7 to 6.

In all that precedes it has been assumed that the carrying capacity is increased 140 per cent. in the case of the suburban system and 70 per cent. in the case of the main line system. Based on the capital expenditure involved, the operating costs and with the fares in force in 1922, an increase in gross receipts of 70 per cent. on the suburban and 35 per cent. on the main line would show a return of 8½ per cent. on the total capital expenditure required to carry out the electrification. Each further increase in the gross receipts of 20 per cent. on the suburban and 10 per cent. on the main line represents an additional 3½ per cent. on the capital expenditure. The additional operating costs involved in providing these additional facilities over present costs (1921-22 figures) would be only 42·8 per cent.

Brighton and the townships adjoining represent a population of about 500 000, and along the line from London to Brighton is a large and well-to-do population. The south coast towns would become suburbs of London, and an increase in gross receipts of 70 per cent. for suburban and of 35 per cent. for the electrification to Brighton should soon be materially exceeded.

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The Henley Pillar Unit and Micanite Insulation.

By ERNEST E. JUDGE, A.M.I.M.E.

The provision of micanite insulation in the Henley pillar unit has a meaning and significance of its own. In these days of research and investigation a departure of this kind is not the result of haphazard designing, but is born of knowledge gained by investigation, experiment and experience. It comes as a refreshing reminder, therefore, that W. T. Henley's Telegraph Works Co. have frequently shown the courage of their convictions by the introduction of new ideas which have created new standards of efficiency at the time, and are now universally adopted.

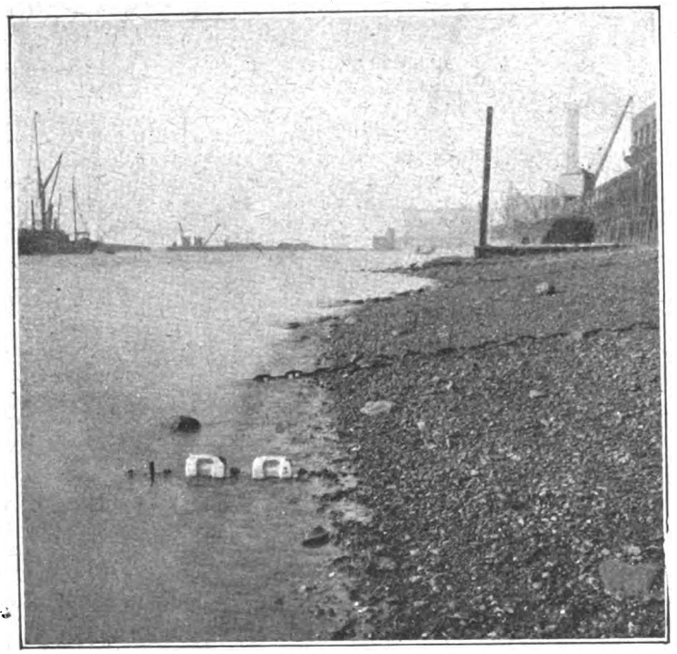

FIG. 1.—A MUD TEST OF A HENLEY PILLAR UNIT.

W. T. HENLEY'S TELEGRAPH WORKS CO. introduced mica insulation into their unit pillars because they were convinced by experiment and research that both electrically and mechanically, it offered many advantages not otherwise obtainable, and from the success they have achieved and the details of tests they have recently undertaken, it would appear that their confidence was well founded.

Engineers who are not familiar with the Henley pillar unit will be interested in the following description of the method of insulating the steel bars which form its backbone. At the same time they will observe the vast difference between micanite insulation applied in the Henley way, and the older method of slipping a micanite tube over an iron bar.

How the Micanite is Applied.

The Henley units are built up on solid drawn steel tubes of a special quality, the tubes before insulation being rendered permanently rust proof inside and out. The mica to form the insulation is applied in direct contact with the steel tube, and is gradually built up under great pressure while hot until the required thickness is attained. The tubes are next covered with a specially impregnated paper, rolled on under great pressure and are then stoved at a high temperature, the tubes being finally treated, both inside and out, with a coat of acid-resisting non-hygroscopic material. The result of this treatment is that the insulation cannot possibly deteriorate in any climate under the most stringent working conditions, and further there is no possibility of the micanite flaking off through mechanical abrasion or vibration.

Success in Bad Climatic Conditions.

Since 1918 many thousands of tubes insulated in the manner described have gone to all parts of the British Isles, the Continent, Australia and India. They have been approved by the Admiralty and adopted as a standard by large corporations in England and abroad. In no single case has a complaint been received. In India they are working under the worst possible atmospheric conditions, and the reason for their adoption by the authorities in that country is due entirely to the advantages derived from their use, both mechanically and electrically, in an especially trying climate.

Severe Tests Justified.

Before the master patents were taken out in 1916, the question arose as to whether this type of micanite insulation would be suitable for use in humid atmospheric conditions, and the question was settled in an interesting manner. A number of units were immersed in water for a week, and after the surface of the tubes had been superficially dried, breakdown tests were taken between fittings clamped over the insulation and the steel tubes which were earthed.

The lowest voltage at which breakdown occurred was 22 000 V, the average being 23 000 V, the interesting point to notice being that the average voltage under ordinary conditions is 23 000 V. It is therefore safe to conclude from this test, that a week in water had no effect whatever on the insulation.

Further convincing tests of a similar nature have recently been carried out. As illustrated on this page, Henley units were placed in the River Thames off Henley's jetty, one lying in the mud and one secured to the jetty, these units being alternately covered with water and exposed to the weather according to the tide. After seven days of this treatment, the units were washed down with water from a hose, superficially dried without the aid of artificial heat and subjected to a series of puncture tests.

The first breakdown occurred at the neutral fitting at 22 000 V. After running up the voltage again, the second breakdown occurred at the positive fitting at just over

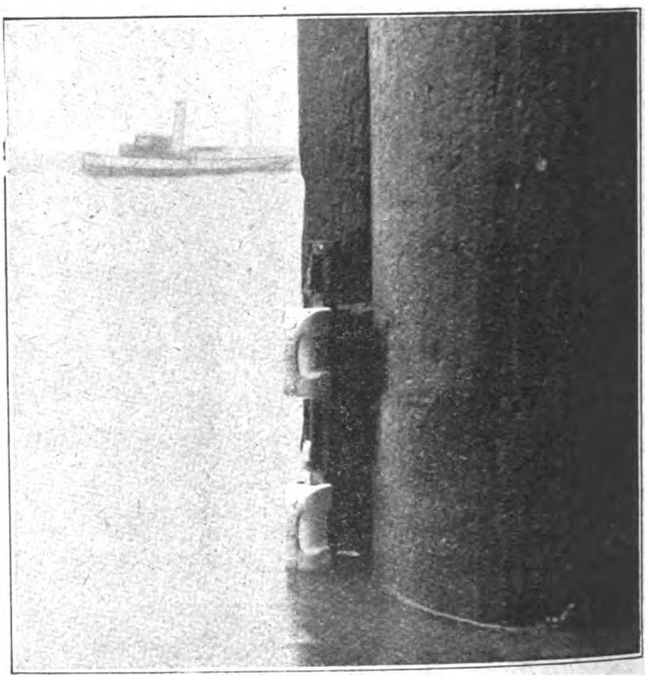

FIG. 2.—A HENLEY PILLAR UNIT ATTACHED TO A JETTY FOR TESTING.

22 000 V, while the third breakdown occurred, after running up again, at the negative fitting at 23 000 V.

Mica has for so long been the standard insulation for all types of electrical machinery, that it is surprising more use has not been made of it in other directions. Henley's units are also supplied in large quantities for building up sub-station and industrial distribution panels, for which they are particularly suitable. The increasing demand indicates that Henley's are thoroughly justified in the departure they have made, and that they are once again developing on sound, practical and progressive lines.

E.C.A. and E.D.A.

The Electrical Contractors' Association has now decided to make a joint subscription on behalf of the whole of its members to the funds of the BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION.

This valuable addition to E.D.A. support should secure wider activity in the provinces, assist the Association in building up district sub-committees, and greatly increase the interest of all contractors in the work of their representatives on the E.D.A. Council and Committees.

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An Advocate for the Contractor.

By "A SPECTATOR."

It is generally worth while to discuss an ideal, however unattainable it may appear, for a world without ideals is a world without a future, and it is by the selection of our ideal that we determine the direction of our progress.

To refer to an ideal when penning a few notes on the trading relations in the electrical industry is to invite the derision of the cynic. But let me ask the cynics to pause and ponder the great truth that after all there is no greater idealist than themselves. Therefore I ask those who are prone to treat this vital problem of the electrical industry, i.e., the trading relations in the industry, with the idealism which their own cynicism has created.

Chaos Not Yet Solved.

In a debate which recently took place at an informal meeting of the I.E.E. on this vital question, a lesson was pointed which is not actually cited in the text. We are far from the solution of the chaotic conditions which until now have been kept within the narrow limits of "manufacturer—factor—retailer," but should we not be wise to nail to the mast and discuss now the other phase of the problem? I refer to the question of the contractor and retailer (as a private trader) and electricity supply authorities trading as contractors and retailers. Is it not opportune now to examine the relationship of the private contractor to the supply authority and *vice versa?* The question is a simple one, but the task is not so simple as it would appear.

What is a Retailer?

In the contribution which I made to this discussion in the form of a series of articles entitled "Manufacturer—Factor—Retailer" (see THE ELECTRICIAN, dated January 26th, February 2nd, and February 9th, 1923) it was presumed that the title indicated the three parties concerned. In the case of the manufacturer and the factor we have a comparatively simple task to place them under their respective headings, but our difficulties commence with "retailers." What is a retailer? Is there any difference between a contractor and a retailer? Should a contractor also trade as a retailer and *vice versa?* And still another question—should supply authorities (either municipally or privately owned) trade as either? It is to be noted that in all the discussions that have been fermenting the trade all through the winter months these questions have not been clearly put or defined. The president of the E.C.A. at a recent meeting rendered a service by asking for a definition of contractor and retailer.

Let us begin by attempting to clear up this old confusion of thought. There need be no difference between a contractor and a retailer. In my judgment it is in the best interests of the trade that it should be recognised that a contractor can be a retailer, and a retailer can undertake contracting work. The two functions are so closely linked that nought but confusion would come of any plan to definitely treat them as separate traders.

Supply Authorities should not be Contractors.

Let me now state my argument quite plainly. I argue that all supply authorities (municipally and privately owned) should drop out of the activities of contracting and retailing. I feel that the present state of affairs, which means that the private trader is competing with the supply authority to get the same business is not in the best interests of the industry. There is every difference in the world in the functions of each. On the one hand it should be the function of the supply authority to supply current, and it should give minute and unremitting study to that problem. If the matter is given any thought, no one will gainsay that there is more than enough work for many years to come for supply authorities to look after the first essential, to wit, an abundant supply of current at "1d. per unit." In my opinion there can be no argument on this point.

Reviewing the feverish activities of certain supply authorities to "get in" on the retail business it might be imagined that this business was the principal function for which they were incorporated. It might also be supposed that they had no further need to give any study to their primary function, the supply end. When, however, the facts are analysed it is generally found to be the very reverse. I repeat with emphasis that none can deny that it would be far better if the supply authorities would stick to their last and provide the current. If, as they plead, the amount available for development is so limited, then it would be much better if this amount was spent in the right direction. This point is of particular importance, and needs to be kept well in mind, because although a large number of supply authorities are now in the retailing business, is the department being run at a profit? That is to say, a profit after the proper allocation of expense has been debited against it? Judging from some knowledge of selling expenses to-day, it is doubtful if they all could show a balance sheet on the right side.

An Anticipation of Replies.

I will anticipate a reply to the arguments that will be levelled against me. It will be argued that as a body contractors are a "poor lot" and could not bear all the heavy financial burden that a large programme of contracting work and merchandising work involves. This is admitted. The contractors are a poor lot, but it is very largely due to the conditions created by the competition of the supply authorities. They would feel the financial burden, but the hard conditions would weed out those in the contractors' ranks who admittedly should not be in, and in a very short while we should have a sound body of contractors-retailers. The ideal state which I advocate would strengthen the E.C.A.

It will be argued that a large number of supply authorities have no trading rights and that they have well-placed and elaborate showrooms is all to the benefit of the contractor-retailer in the district. This is admitted, but only in a very limited sense. The very conditions make for cumbersome and irksome system of trading. It is merely "playing at shops." This "co-operation" between the contractors and supply authorities by the latter opening a showroom for the former to use is a fallacy. It is well meant, but it tends to create in the contractor a sense of security which cannot be afforded and it eliminates competition between local men. To-day's argument that the elimination of competition is good for industry need not be argued here, but it can be said without fear of contradiction that healthy competition between local contractors is one of the first essentials to the success of the greater development of the electrical idea.

Hiring Not an Insurmountable Difficulty.

I shall be asked how it will be possible to deal with the question of "hiring out" such apparatus as cookers. This is a difficulty, but not an insurmountable one. It is not going outside my argument to suggest that this phase of electric supply belongs to the supply authority. I shall be asked how I shall deal with such problems as free wiring schemes or where wiring is done on the deferred payment plan. I shall be asked many practical questions, but we must remember that "the moment we begin to ask what we are attending to, we have ceased to attend to it," is a philosophy that is of no help to us in the electrical industry.

Thus, then, do I act as an advocate of the contractor, and time will prove me correct. There are probably few men who will deny the evils arising out of the existing state of affairs, but there are many who will deny the cause I now advocate. Is it that the body politic of the electrical industry is too unwieldy and too spineless for the application of any principle other than that of *laissez faire?*

Vacuum Arc for Visible and Soft X-Rays.

A simple vacuum-arc arrangement for spectroscopic work in visible as well as in soft X-radiations is described by H. Nagaoka and Y. Suguira of Tokyo in the "Astrophysical Journal." It makes use of a novel type of Wehnelt cathode. A carbon rod is dipped into a solution of nitrate of barium (or strontium) and then heated in the Bunsen flame so that the carbon becomes covered with a layer of barium oxide. This cathode is fitted into a glass bulb of ordinary X-ray type which is joined to a Gaede pump. The cathode is fixed into one of the three necks of the bulb by means of a rubber stopper; inside the bulb the carbon is sheathed with a silica tube, and a stout copper wire is screwed into the carbon for connection. The anode is another silica tube in which the salt or metal to be tested lies on another carbon rod; the seals are made by means of Kholinsky cement. Opposite the anode is a neck closed by a quartz prism. The bulb is started with a low-tension current of 150 V or less; when the glow appears in the bulb, the connections are switched to the poles of a direct-current generator of 500 V or more.

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Reviews.

The Mechanical Handling and Storing of Materials.

By G. F. ZIMMER, A.M. Inst. C.E. Pp. xx+804. £3 3s. net. (London: Crosby Lockwood and Son.) Third edition.

The circumstances under which the last edition of this book was reviewed in these columns in 1916 were peculiar in so far as the reviewer was at that time engaged on a somewhat similar, though larger, book. In consequence, had he not been able to speak well of "Zimmer" he would have had no other alternative than to ask to be excused. To review a book of this kind is a pleasure.

Of the 44 chapters, no fewer than 20 deal with the continuous handling of material and of these 20 chapters, three are devoted to the continuous handling of material by pneumatic and hydraulic means. To the intermittent handling of material eight chapters are given. Of the remaining chapters, four are devoted to the description of unloading and loading appliances, and a further five to the unloading of railway wagons. Miscellaneous installations and methods are described in chapters 39 to 42, and there is a chapter on the automatic weighing of material. That the author has not spared himself is evident from the fact that there are 1 143 illustrations in the book.

On turning over the pages, pausing at intervals to read, one is impressed by the large amount of useful information the book contains. Whilst retaining matter of historical interest in the development of the handling art, the author has either deleted obsolete appliances without such attribute or has replaced them by more modern examples. With regard to the latest developments, in the preface it is stated that only those appliances and methods have been embodied which may be considered to be beyond the experimental stages and successfully in use.

With a number of brilliant exceptions the art of materials handling is not yet practised in this country to anything like the extent it is practised abroad and, in view of this, we think the author would have done better had he retained typical examples of Continental and American practice instead of replacing such descriptions by examples of British manufacture. In our opinion the ideal to be aimed at in a book of this kind is to give parallel examples of American, British, and Continental practice.

As a case in point may be cited the handling of iron ore—a subject likely to be much to the fore in this county in the course of the next few years. Statistics shows that prior to 1914, Britain was a bad third as a producer of iron and steel, and that she was a bad third in her methods of production at the time mentioned has been established beyond question. Quite recently a paper has been read before one of our engineering institutions in which it was stated that the blast furnaces of an important iron-making district had not been altered since about the middle of last century. *And we shall deserve to occupy a bad third place, or worse, as long as we continue to use mid-Victorian methods instead of adopting twentieth century ideas and ideals.*

Our methods of handling iron ore, the time taken, the cost and the appalling inefficiency are matters of common knowledge. Although, owing to the widely different conditions prevailing in the two countries, we shall not improve our efficiency by slavishly copying American methods, it is probable that a close study of such methods would indicate a solution because in America the handling, distributing and grading of ore, grain and suchlike materials, is as exact as science and the wit of man can make it.

We introduce the word "grain" intentionally because, at a time when the people of Europe scarcely knew where to turn for bread owing to lack of shipping facilities, wheat to the value of many millions sterling was allowed to rot in the open air. In such cases the obvious thing to do is to endeavour to profit by experience and to adopt methods of storing and handling which are known to be economical.

For these reasons amongst others we think the author would do well in future editions to describe in detail the best methods of handling irrespective of country of origin. We also think—as we thought in 1916 when we reviewed the last edition—that, since the crane is the most widely used of all materials-handling appliances, space should be devoted to the discussion of many of the matters connected with this important subject.

From our criticism, however, it must not be inferred that we fail to appreciate the value of the author's work. We spoke well of the second edition and the present edition is even better than the last. The book is well-written, well-printed, and well-bound; the illustrations are good and the paper is excellent. It will not be the fault of the author if the reader fails to obtain a good return for his outlay.

H. H. BROUGHTON.

Factory Accounts in Principle and Practice.

By E. GARCKE and J. M. FELLS, C.B.E. Seventh Edition. (London: Crosby, Lockwood & Son). Pp. xx+290. 15s. net.

It is a long stage from the system of domestic or cottage industries or the Guild Factory system dating from the time of Henry VII to the large industrial organisations of the present day, but the use of scientific methods of accounting is a growth of recent years. It was in 1887 that Messrs. Garcke and Fells placed their "Factory Accounts" before English readers, this being the first attempt to give a systematised statement of the principles relating to the costing of factory production. At intervals further editions have been called for, and we now have to record the seventh.

The call for another edition is something more than a proof of the value of this "Handbook for Accountants and Manufacturers," it is also evidence of the growing recognition of the necessity for detailed analysis of expenditure in a manufacturing business and closer attention to "Cost Accounting." The advantage of "costing" systems gained particular prominence during the war, and the struggles to re-establish trade and commerce in these post-war days makes it increasingly necessary to pay particular attention to costs and carefully to consider methods by which, without impairing efficiency, economies may be effected. To those responsible for factory administration and management this book will be found of service. Careful attention has been paid to detail, and many forms have been included which will give valuable hints.

The book contains appendices on the nomenclature of machine details, and the rating of factories containing machinery, with a table for determining amortization of leases, &c., a glossary of terms and a copious index.

References in previous editions to economic and social questions in relation to the remuneration of labour and the allocation of profits have not been repeated. It is probably true that the problem of the future will be to prevent mass production and increased organisation destroying individuality by making men into machines, but we make no complaint that the authors have considered it desirable not to reintroduce into a technical book a subject which lies more within the province of the social reformer than with the accountant.

J. J. H. S.

Electric Ship Propulsion.

By Commander S. M. ROBINSON, U.S.N. (London: Simmons-Boardman Publishing Co.) Pp. vi.+274. 30s.

There has been a good deal of unrest lately amongst marine engineers and ship owners on account of the trouble which is being experienced owing to the introduction of double-reduction gearing on our turbine-driven ships. The return of valuable passenger ships with gearing all stripped, and the costly transfer of passengers from one ship to another, are a serious matter, and have caused the powers that be to hesitate. The question of the introduction of the electric drive on our large Atlantic liners is not far off, and it therefore behoves electrical engineers to learn all they can of the problems connected with this, and keep informed of the developments that have recently taken place.

Commander Robinson's book, recently published, on the electric propulsion of ships is quite up to date, and contains practically all that is known on the subject. Though a good deal of the information contained in the book has already been published in the American technical press, it does not lose any of its value on that account, as the journals in question may not be easily available to English readers.

The most interesting chapters to electricians are those on "Propeller Characteristics" and "Motors and Generators." The former is illustrated by many graphs, and the phenomena which take place when a ship is turning or reversing, as regards the working of the generators and motors, are very interesting and thoroughly explained.

There are many novel features in the book consequent on the different conditions in marine and land practice. In the

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chapter, for instance, on motors and generators, the point is brought out of the greater advantage of the synchronous motor on account of its greater air gap, apart from the power factor being 100 per cent. Now in land practice it is not considered good to have a large air gap.

In the description of the different systems in use and proposed for ship propulsion, nothing is said of the possible use of the phase advancer to raise the power factor of the induction motor, as proposed by W. E. Thaw in his paper before the Naval Architects in America. Commander Robinson says in his book that there is not much to choose in the matter of a motor as regards the synchronous and induction types, as one advantage of either type counteracts the other; at the same time, the tendency is to use synchronous motors wherever possible on account of the better power factor, therefore I do not agree with Commander Robinson on that point.

In the plans shown on page 268 of a proposed Diesel electric plant where the engines and generators are placed on the upper decks, it looks topheavy. The plans of the three fruit boats which are being built by Cammell Laird and Co., Birkenhead, show a better arrangement, where the engines and generators are placed amidships and the motors right aft in a separate compartment. In the description of the "Wulsty Castle," in chapter xv., it is a pity that some actual experiences could not have been given. The ship has been in commission some time now, and if there has been any trouble with the plant, it ought to be published, as nothing can be gained by keeping silence. The motors on the "Wulsty Castle" are geared, which in itself was a mistake. There is no reason why the generators should not be geared, but not the motors, as one of the advantages of electric propulsion is that all gearing is eliminated on the propeller shafts.

On page 3 the author refers to the backing losses under letter *a*. This might have been left out, as it is a disputed point, and it has been proved that the losses are only three-tenths of 1 per cent., and at most, half of 1 per cent.

Otherwise the book is a very good one, and can be thoroughly recommended to those interested either in the engineering or electrical trades and professions.

CHARLES RETTIE.

Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

THE INSTITUTION AND ATOMIC STRUCTURE.

To the Editor of THE ELECTRICIAN.

SIR,—It is with extreme regret that one notes the entire absence of an authoritative lecture in the immediately past session of the Institution of Electrical Engineers upon the present position of the enquiry into the question of atomic structure, on similar lines to the lecture given last year by Sir Ernest Rutherford entitled "Electricity and Matter."

The vast majority of the members of the Institution are necessarily involved in developing some special part of electrical work, and most of them have little time to read the various Papers which are read or printed during the year relating to this and similar subjects.

I thought it was going to be an established practice to have such a lecture, and I would suggest it is most desirable that the imaginations of the members should be excited at least once a year by a knowledge of the latest discoveries and theories in this direction.—I am, etc., J. SAYERS.

Derby,
May 23rd.

Unofficial Tests of Overhead Equipment.

In THE ELECTRICIAN of February 3rd, 1922, we gave an account of the continuing experiments which had been made by the Midland Railway Co. with the overhead equipment on the electrified section between Lancaster and Heysham, and of improvements which experience had required in the equipment to obtain greater flexibility. That flexibility had been unofficially tested, as was pointed out on a number of occasions and Mr. J. Sayers has given us details of another such unofficial test which occurred on September 21st last, and which are elucidated by the accompanying diagram.

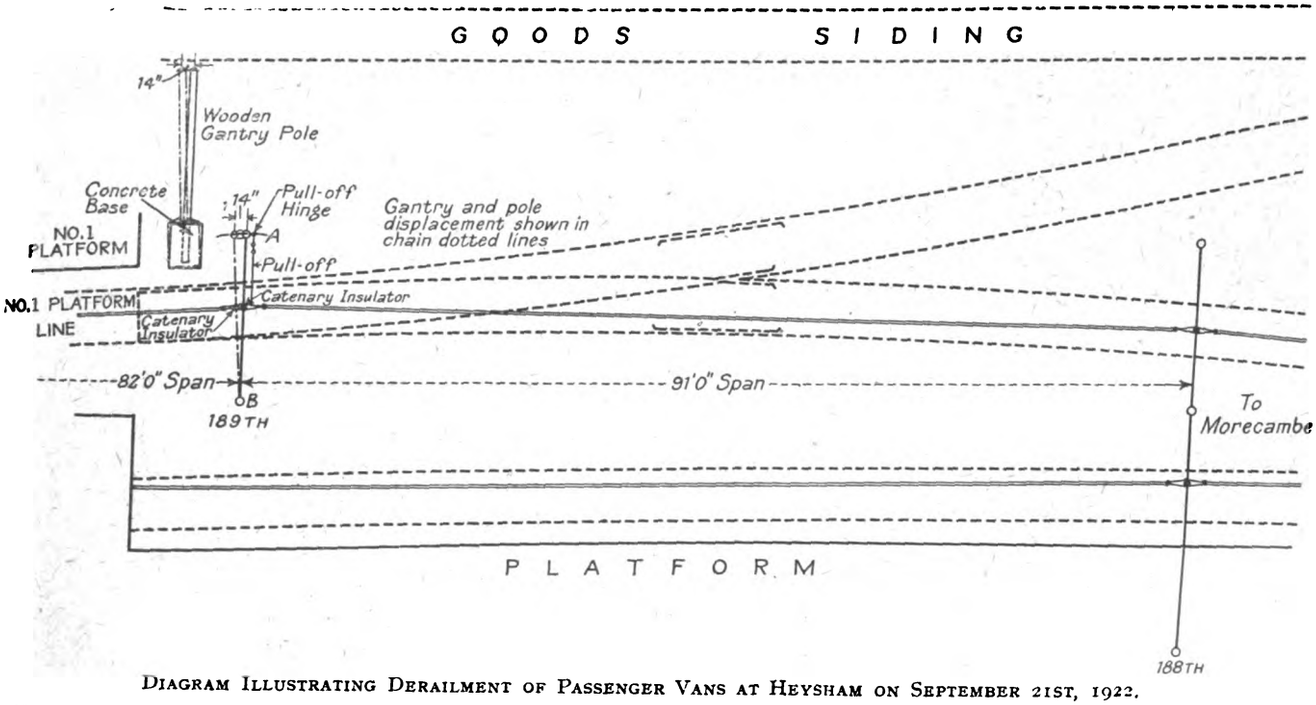

DIAGRAM ILLUSTRATING DERAILMENT OF PASSENGER VANS AT HEYSHAM ON SEPTEMBER 21ST, 1922.

During shunting operations at Heysham three passenger vans were derailed when leaving the goods sidings for No. 1 platform line. The pole marked "A" was struck by the buffer of the first van, about 2 ft. above the concrete base. The top of the pole was moved 14 in. from the vertical, the sandy nature of the sub-soil allowing the concrete base to move bodily with the pole. The overhead equipment was not damaged owing to the catenary wires being pulled through the catenary insulator grooves, and the earth wire being pulled through the clip on the gantry. The working of the pull-off hinge prevented any extra strain on the contact and auxiliary wires.

The absence of damage, Mr. Sayers points out, shows the value of flexibility in the whole arrangement, particularly in the method of supporting the twin catenary wires.

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Fans to Merchandise and Profit By.

Some Notes on Buying Fans.

In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

It is a happy fate that ordains that the reviewer of electrical "merchandise to sell and profit by" need take but scant heed of the weather. For, paradoxical as it may seem, it is possible to write with every assurance about one particular line of merchandise, even if it be snowing as the words are written, and that line is fans. This faculty, if a faculty it be, is the result of faith. Faith in the sound knowledge that, thoroughly and systematically merchandised, fans are all-the-year-round business.

It is not proposed to utilise space by elaborating arguments to prove this, because this was done in an article which appeared in the Annual Spring Trade Issue of THE ELECTRICIAN, published on March 30th. But it is proposed to make a brief comment on some of the best and most reliable fans on the market to-day. The word reliable is used deliberately, because this is the most important plank on which fan business can be built up. Efficiency must be given attention, but the average user of a fan (leaving aside users of a large number of exhaust fans) is more concerned with reliability than efficiency.

British Thomson-Houston Co.

There are many who argue that the only market for fans is in the cheaper and more "bread and cheese" fans. Such argument is wrong, and if persisted in will only mean more business to those few contractors and retailers who have the foresight to see that there is a big turnover to be done in better quality fans at slightly higher prices. This preface is peculiarly apposite to the range of fans offered to the trade by the BRITISH THOMSON-HOUSTON CO. This company have built up and maintained their large business in fans on one main factor—quality. This large business is an indication, therefore, that there is a buying public who want "something different" in fans, and who are prepared to pay a reasonable extra price for that difference. Fig. 1 is typical of the range of desk and

FIG. 1.—A TYPICAL B.T.-H. FAN.

table fans which the B.T.-H. can deliver from stock, but it should be mentioned that this company have a complete line of exhaust fans and ceiling fans in many sizes. Fig. 2 is an illustration showing the "talking points" of B.T.-H. fans. We give space to this illustration because it is an object-lesson, and reveals what a wealth of talking points there is in B.T.-H. fans, even although the list prices may be slightly higher than the average. One needs but little imagination to realise that a big turnover can be made on these fans if an attractive window display is arranged in such a manner that these talking points are brought out.

Burnley Components.

The BURNLEY COMPONENTS CO. limit their manufacturing programme to d.c. fans in three models: (*a*) A 12 in. desk fan, (*b*) a 12 in. wall or bracket, and (*c*) a ship fan of the bracket type. Judging from the specification, the fans are well built and are a line of fans to place under the heading of keen competitive lines.

Crompton and Co.

The range of fans offered by CROMPTON AND CO. is limited to ceiling fans. None the less, certain features of these fans are so distinctive that publications from the manufacturers should be carefully studied when it is necessary to supply ceiling fans. As ceiling fans are more generally installed in comparatively quiet situations, it is desirable to have quiet running fans. Particularly is it necessary to study this detail when a.c. fans have to be installed, because of the objectionable humming of many a.c. fans. Comptons claim to have solved this problem, and judging from the specification of the fans they have good ground for their claims.

The Enterprise Manufacturing Co.

The ENTERPRISE MANUFACTURING CO. factors and offers to the trade a comprehensive range of fans covering as it does, the ship's cabin fans, desk fans, with and without oscillating movements; also porthole and exhaust fans.

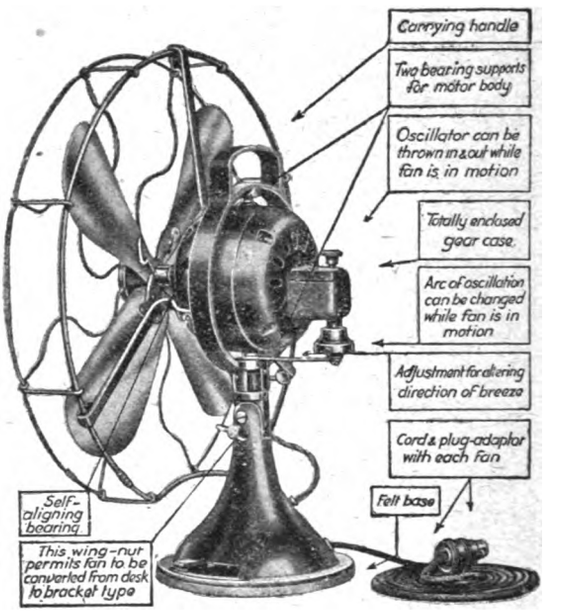
Carrying handle
Two bearing supports for motor body
Oscillator can be thrown in & out while fan is in motion
Totally enclosed gear case
Arc of oscillation can be changed while fan is in motion
Adjustment for altering direction of breeze
Cord & plug-adaptor with each fan
Felt base
Self-aligning bearing
This wing-nut permits fan to be converted from desk to bracket type

FIG. 2.—A B.T.-H. FAN TALKING.

S. G. Leach and Co.

S. G. LEACH AND CO. are so deservedly well known for reliable fans that it is almost unnecessary to mention the fact in these notes. They have just issued new lists covering the whole field of requirements. Exhaust fans with "Beedle" blades (which are the speciality of S. G. Leach) are listed in sizes from 12 in. up to 48 in.,

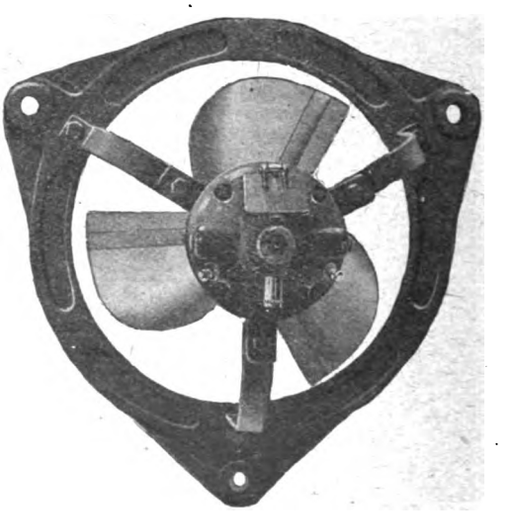

FIG. 3.—A THREE BLADE "BEEDLE" FAN.

also fans with box blades. The more "bread and cheese" desk fans are shown and described in a separate list, and a review of the types and sizes proves that the experience of years has taught S. G. Leach what the market requires. Ceiling fans form the subject of a still further list. We illustrate in Fig. 3 a three-blade exhaust fan fitted with Beedle blades.

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The Metropolitan-Vickers Electrical Co.

The programme of fans presented by METROPOLITAN-VICKERS ELECTRICAL CO. is a considerable one, ranging from the simple desk fans to large exhaust fans and including ceiling fans. The "Cosmos" electric fans have been designed to meet the most exigent demands of efficient fan service. The motors are of the series wound enclosed ventilating type, and are designed and constructed to ensure noiseless running. The lubricating system is automatic. The motor is designed to have a very low temperature rise both in the field and armature, so that it can be safely run for long periods. The windings are heavily coated with insulating varnish and impervious to moisture. Special attention has been directed to the design of the blades in order to ensure the highest air circulating efficiency and the least possible noise. The blade tip loss is minimised by properly

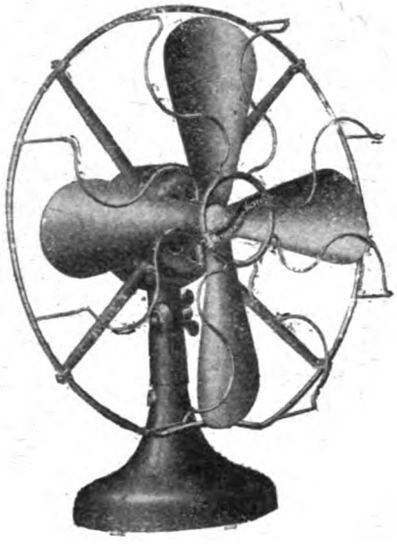

FIG. 4.—A "COSMOS" DESK FAN.

rounding the ends of the blades, and the concave contour of the blade surfaces accelerates the air uniformly and thus eliminates air pulsations.

Fig. 4 illustrates a 12 in. "Cosmos" desk fan which embodies the essentials of design just referred to.

Sun Electrical Co.

Prominent among the well-known factors who hold large stocks of fans is the SUN ELECTRICAL CO. This company holds stocks of some of the best makes of fans, and can be relied upon to supply at the best trade prices with a prompt delivery service.

Matthews and Yates.

It is accepted too philosophically by the average contractor that the only business he is likely to secure is for the ordinary domestic and office table fans and perhaps a sprinkling of exhaust fans. The obs meaning "big business" are not for the average contractor, it is

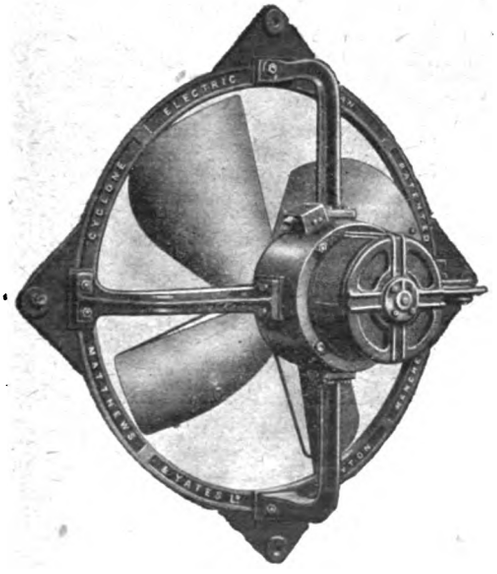

FIG. 5.—A "CYCLONE" PROPELLER BLADE EXHAUST FAN.

argued. The argument is wrong. Big lighting schemes involving large number of lighting units are handled by contractors as a result of close co-operation by the "Service Department" of the manufacturer. Why not so with ventilation jobs, even although it is admitted that the field is much more limited? We feel sure that manufacturers and architects would respond readily to any interest contractors may manifest in this idea.

Among the manufacturers who are ventilating engineers in addition to being fan makers is Matthews and Yates. Fig. 5 shows the "Cyclone" propeller blade exhaust fan manufactured by them, and which can be regarded as typical of the range of exhaust fans

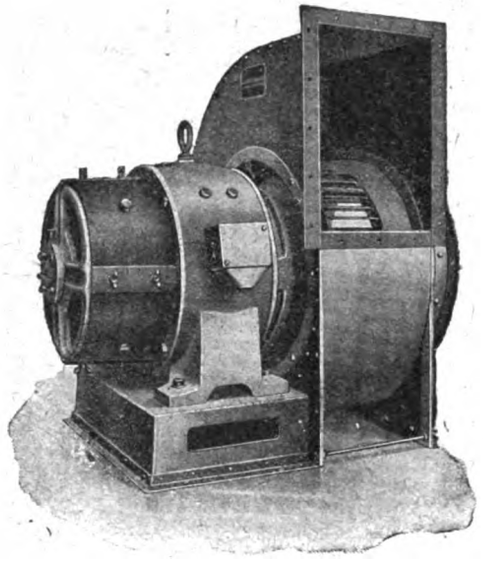

FIG. 6.—A "CYCLONE" MULTIVALVE FAN.

suitable for average jobs. Fig. 6 shows the "Cyclone" multivalve fan direct coupled to a motor. We illustrate this particular apparatus with the set purpose of demonstrating the "big business" idea which we have just touched upon. This is the business for electrical contractors. This ventilating unit is particularly well adapted for the ventilation of public buildings, restaurants and cinemas, where the resistance of air ducts has to be overcome.

James Keith and Blackman Co.

Following this line of thought on "big business" we must make our list of manufacturers complete by including the name of JAMES KEITH AND BLACKMAN CO. We venture the opinion that this company has, if not the most, certainly one of the most comprehensive ranges of equipment for ventilating by electric fans. The publications issued by them can be regarded as equal to the best text books on ventilation.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

The "Cressall" battery charging panel is described in a folder just published by THE ELECTRIC DEPOT, LTD.

All contractors and retailers should apply for a copy of a new price list of wireless apparatus recently published by AERADIO, LTD.

BRITTAINS ELECTRIC MOTOR CO. have issued a circular letter in the form of a large folder with illustrations of their new type of a.c. motors.

The "Callender-Hunter" four conductor protective system is fully described in a booklet just issued by CALLENDER'S CABLE AND CONSTRUCTION CO.

WALTER D. FAIR AND CO. have available for distribution a series of folders of the several American specialities for which they are the agents in this country.

The catalogue library will remain incomplete until a copy of JOHNSON AND PHILLIPS latest publication is included. It is entitled "A Catalogue of Outdoor Switchgear."

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI ask us to announce that their latest stock list is now ready and a copy will be immediately sent to any inquirer on request.

GENT AND CO. offer contractors and retailers a range of wireless apparatus which will surely find a ready demand. Leaflets Nos. 71 and 66B fully describe Gent's complete range of apparatus.

WATSONS AND SONS (Electro-medical) have just published a folder, No. 558, describing "Sunic" high frequency apparatus, and Bulletin No. 54S, being a list of second-hand X-ray and electro-medical apparatus.

The SWEDISH GENERAL ELECTRIC CO. announce the issue of a new stock list No. 112. The list is a most comprehensive one, quoting, as it does, prices and technical data on a.c. and d.c. motors and generators.

It is a sad fact that electrical men must have waste paper baskets. Therefore will those readers of THE ELECTRICIAN who now or in the future find that their present baskets are worn out with hard work, please note to ask MOSSES AND MITCHELL for particulars and prices of their "Valmos" vulcanised fibre waste paper baskets.

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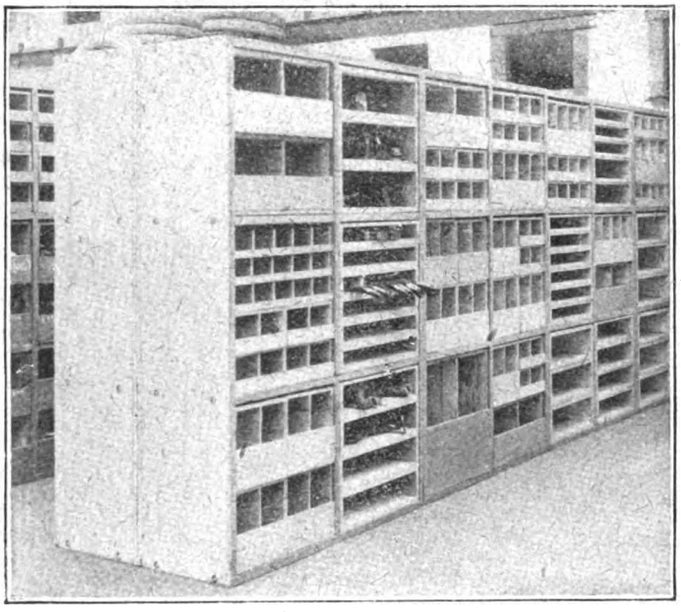
Modern Storage Equipment.

A Convenient System for Electrical Goods.

A useful storage system for factory or warehouse is illustrated below. Known as the "Favri" equipment, it consists of a strong rack, fastened together with 16 bolts, two at each end joint. The dimensions of the rack are 4 ft. 5¼ in. wide by 6 ft. 7 in. high, and 18⅞ in. deep. The back is ⅞ in. thick, the rest is 1⅛ in. thick, and the six openings are 24½ in. square. Each rack, which takes up comparatively small room, in "knock down" form, can be assembled within a few minutes. When fixed up the rack can be divided in several ways, as the illustration shows. The division is accomplished by means of loose boxes and shelves.



THE "FAVRI" STORAGE SYSTEM IN USE.

Loose boxes will divide an opening into two, four, eight, or 16 bins; and loose shelves may take half the opening, one-third, one-fourth, or one-sixth. Racks may be placed side by side and back to back, and the equipment may be added to at any time, interchangeable parts being always available. All particulars may be obtained from IRA MILLER AND CO., who are handling this equipment.

Two Notable Books.

Mr. H. H. Broughton's great work on "The Electrical Handling of Materials" (Ernest Benn, Ltd.), has been described in "Engineering" as "the most successful attempt that has yet been made to deal exhaustively with the many problems connected with electrical handling." To the first three volumes, dealing respectively with electrical equipment, structural steel work and mechanical equipment, and electric cranes is now added the last and final volume of the series, which deals with the handling and storing of bulk materials. The price of this volume, which is uniform in size with the third volume, is 50s. net.

The same firm will shortly publish "The Poulsen Arc Generator," by C. F. Elwell, the first book yet produced on the subject. The object of the author, who is perhaps more responsible for its practical development than any other one engineer, is to give a complete idea of how the Poulsen arc generator works, as well as to record the many forms which different designing engineers have given to it.

Books Received.

"Workshop Routine." By W. J. Hiscox. (London: Chapman and Hall, Ltd.) Pp. 158. 9s. 6d. net.

"Mining Electrician's Handbook." By Lionel Fokes. (Wigan: Thos. Wall and Sons, Ltd.) Pp. 414. 10s. 6d. net.

"The Internal Combustion Engine." By H. T. Ricardo, B.A. (London: Blackie and Son, Ltd.) Pp. 373. 30s. net.

"The Electrical Handling of Materials." Vol. IV. By H. H. Broughton. (London: Ernest Benn, Ltd.) Pp. xx.+334. 50s. net.

"Senior Magnetism and Electricity." By R. H. Jude, M.A., and J. Satterly, M.A. (London: University Tutorial Press). Pp. 446. 6s. 6d. net.

"The Principle of Relativity with Applications to Physical Science." By A. N. Whitehead. (Cambridge: University Press.) Pp. 190. 10s. 6d. net.

Report on "Glaciology," British (Terra Nova) Antarctic Expedition of 1910–13. By C. S. Wright and R. E. Priestley. (London: Harrison and Sons, Ltd.) Pp. 581.

Lead-boring Beetles.

American Recommendations for Cable Protection.

Experiments have been undertaken at various times by the Bureau of Entomology of the United States Department of Agriculture to determine any possible means of protecting lead cables from beetles. These insects are of a type which bore through the cables, but do not or cannot penetrate pure gum rubber, and have proved a serious problem in California and other parts of the States. The experiments made are summarised in a paper, issued as Departmental Bulletin 1107, "The Lead-Cable Borer in California," by Messrs. R. G. Hartman, H. E. Burke and T. E. Snyder.

The beetle bores circular holes in the lead sheathing of telephone cables, the holes being about 1-10 in. in diameter. Moisture enters through the holes, causing short circuits. Experiments have shown that the beetle is able to penetrate any lead alloy used as a cable sheathing or any poison or repellant placed on it. Probably it is able to penetrate the poisons because it does not feed as it bores through. Beef tallow, when sufficiently soft, will stick to the beetle and suffocate it, and has been used with some success on the rings which suspend the cable, since practically all the boring is done near the rings. Layers of friction tape impede the boring, and thin sheets of copper, zinc and steel prevent it. Sleeves of these metals can be placed round the cable at the rings, but the cost would probably be too great for general use. A new type of ring made of flattened steel wire stock and galvanised is now being installed by the telephone companies, and it is believed that this ring is better from the standpoint of preventing attack by the beetle than the old one. Meanwhile, tallowing the rings is the most promising method of control.

The Patent Office in 1922.

Increased Number of Applications.

A surplus of receipts over expenditure of £74 074 is the chief feature of the report of the Comptroller-General of Patents, Designs and Trade Marks for last year, which was issued last week. It is stated that the receipts from patents fees were £413 378, from designs fees £10 373, and from trade marks fees £46 045, as compared with £445 947, £9 648 and £47 803 respectively for 1921. The total receipts were £493 133 as compared with £525 500 in 1921, a decrease of £32 367. On the expenditure side, salaries amounted to £264 990 as against £299 140 in 1921, the decrease being mainly in the Civil Service cost-of-living bonus.

The total number of patent applications for the year was 35 494, an increase of 362 upon the number received in 1921. The complete specifications filed numbered 19 060, or 99 less than in 1921. The number of applications to register designs received during the year was 15 736, including 312 sets, as compared with 13 387, including 257 sets, in 1921.

Parliamentary Intelligence.

High Power Wireless Stations.

Following the Whitsuntide recess, Parliament re-assembled on Monday. The "Official Report" for that day contains a long tabular statement issued by Sir W. Joynson-Hicks (as Postmaster-General) giving particulars of the equipment and range of the high power wireless telegraph stations worked either by the Government or commercial enterprise in the United States, France, Germany and this country. The information was supplied following a recent request by Sir H. BRITTAIN.

Smoke Abatement Bill.

On Monday, the MINISTER OF HEALTH informed Mr. PENNY that the Government proposed to introduce a Bill on the subject of smoke abatement this session.

The Broadcasting Committee.

On Tuesday, Sir WALTER DE FRECE asked the Postmaster-General whether he proposed to lay the Report of the Broadcasting Committee before Parliament for consideration and approval; and whether, in view of the importance of the whole issue, special facilities would be given for such discussion apart from the Post Office Estimate?

Sir L. WORTHINGTON-EVANS: The Broadcasting Committee's Report will be laid before Parliament. The last part of the question had better be repeated when the Report is laid.

Sir W. DE FRECE: When is the Report expected?

Sir L. WORTHINGTON-EVANS: I cannot say yet. The Committee is still sitting.

Electrolytic Disinfecting Fluid.

In the annual report of Dr. F. W. Alexander, Medical Officer of Health for Poplar (London) there appears an account of the manufacture and distribution of ELECTROLYTIC DISINFECTING FLUID during 1922. There are seven distributing depots, and the fluid distributed was 113 040 gallons, compared with 102 660 in the previous year, and the quantity distributed has increased annually since 1916. The total cost was £285 13s. 10d., plus electricity for the motor driving the stirring apparatus, £3 0s. 2d. As we have stated on a previous occasion, chloride of magnesium, salt, caustic soda, water and electricity are used in the manufacture of the fluid, and it is supplied to municipal departments, the Guardians' institutions, hospitals, schools, public baths and private residents.

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Scottish Tramways Association.

Officials in Conference at Aberdeen.

Mr. James Dalrymple, general manager of the Glasgow Corporation Tramways, presided at the first annual conference of the SCOTTISH TRAMWAYS ASSOCIATION at Aberdeen on Friday, May 25th.

In a Paper dealing with the Aberdeen Corporation tramways undertaking, the general manager, Mr. W. FORBES, outlined the growth of the undertaking, and said that the Tramways Committee last year decided to scrap all the older type of open-top cars and put in their places vestibule cars with the top decks entirely enclosed. Three cars of this type had been built and placed on service on different routes within the last few months for the purpose of testing public opinion. Up to the present, so far as he was able to learn, they had proved extremely popular. They had a seating capacity for 64 passengers, and during wet and stormy weather would be able to carry under cover about 25 per cent. additional passengers compared with the open-ended type of covered car. If during the summer months they maintained their good reputation, as he confidently expected they would, they would be made their new standard type of car.

Closed or Open Cars.

Mr. R. STUART PILCHER, Edinburgh, in opening the discussion, congratulated Mr. Forbes and the Aberdeen Tramways Committee on the excellent display of rolling stock which the delegates had seen in Aberdeen. The question of closed and open cars had been considered in Edinburgh, but there they differed from Aberdeen in respect that in Edinburgh they left the car open. The reason for that was that they had in Edinburgh, as doubtless in most towns, a certain class of public who insisted on having fresh air. Those had to be catered for. In Edinburgh they did not allow passengers to stand on the top deck, insisting that they must take a seat, and in that way it was easier for the fares to be collected, while overloading was prevented. They had been going on the principle of reducing the height of the stairs and the height of the car as well, and he thought they had now got the height about right. There was much to be said in favour of steel construction of cars. The new cars being delivered in Edinburgh weighed only nine tons. The average car weighed from 11¼ to 11½ tons. Councillor J. MORRIS MANCOR, Edinburgh, as an engineer, expressed doubt as to the wisdom of continuing the policy of constructing double-deck tramcars, this being against the highest principles of engineering. Carrying a weight of three tons nine feet above the street level seemed to him to be like disturbing the centre of gravity. As they knew, if any accident happened, death generally followed. Was it not possible to carry passengers more economically, more specially and more comfortably in single-deck cars? He believed that could be done if a longer car were adopted.

A discussion was later initiated by Mr. G. T. BRANDER, of Monifieth, on "Permanent Way," and Mr. STUART PILCHER, tramways manager at Edinburgh, read a Paper on "Anti-Mud Splash Devices," dealing with motor vehicles.

Members of the Association were entertained at dinner by the Aberdeen Town Council on the evening of May 25th, and on the following day enjoyed an excursion by Charabanc.

Stimulating Electrical Interest in China.

An Interesting G.E.C. Enterprise.

In order to stimulate interest in China in matters electrical, the Hankow branch of the GENERAL ELECTRIC Co. have fitted up a Chinese houseboat as a travelling showroom, and are sending this forth on a long trip up the Han River.

This houseboat is fitted with a country house lighting set, consisting of an oil engine, dynamo, and switchboard, and the boat will make a stop at every Chinese town passed during the journey and demonstrations will be given.

A plenteous supply of advertisements and pamphlets printed in Chinese is being taken on the journey, and one of the well-known Osram poster signs with additional Chinese characters will be suspended from the mast.

It will be interesting to note what success attends this attempt to bring electricity and enlightenment to the up-country people in China.

Pulverised Fuel in U.S.A.

Orders have just been given by the Detroit Edison Co. for six water tube boilers each of 325 000 lb. normal evaporation from and at 212 deg. F. per hour, to be fitted throughout with the "Lopulco" system of pulverised fuel, the European rights of which are controlled by the Underfeed Stoker Co., of London. The Detroit Edison Co. may be numbered among the largest power users in the world, and as they have hitherto been opponents of pulverised fuel, this is another striking indication of the remarkable progress that is being made with this system of firing. These new boilers will dispute with the boilers now under construction for the Cleveland Electricity Co., also to be fired with "Lopulco" pulverised fuel, the distinction of being the largest boilers in the world. In Europe the record is at present held by the 160 000 lb. being constructed for Vitry in France, and in Great Britain the largest unit is 100 000 lb.

Armagh County Council has decided to oppose the BANN HYDRO-ELECTRIC POWER SCHEME. The Lagan Navigation Co. and the Ulster Farmers' Union are also to oppose the scheme.

I.M.E.A. Convention Programme.

A Judicious Blend of Work and Pleasure.

The programme of the twenty-eighth annual Convention of the INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION which has just been issued indicates that those attending will have both an instructive and enjoyable time, if only the weather be kind. The president is Lieut.-Col. W. A. Vignoles, D.S.O., borough electrical engineer of Grimsby, and the meeting place Scarborough, which is a break-away from the tradition that the Convention must be held in the president's town. The Convention will be held from June 18th to 23rd, and about 500 people are expected to be present.

On Monday, June 18th, the Convention Inquiry Office will open at the Royal Hotel, Scarborough, for the issue of badges, and at 8.30 p.m. there will be a reception by the Mayor and Mayoress at the Town Hall.

On Tuesday, June 19th, at 10 a.m., the Convention proper will open in the Council Chamber, Town Hall, when a civic welcome will be extended to the Association by the Mayor of Scarborough (Councillor G. Whitfield). This will be followed by the Presidential address and by a Paper on "Showroom and Sales Department in a Small Town," by Mr. T. Hall, borough electrical engineer, Burton-on-Trent. In the afternoon a short tour will be made to places of interest in Scarborough, and in the evening a reception and dance will be held at the Royal Hotel by invitation of the Mayor, Chairman, and Electricity Committee of Grimsby.

On Wednesday, June 19th, at 10 a.m., a meeting will be held at the Town Hall, when a Paper on "Transmission and Distribution of Electricity by Overhead Lines," by Mr. J. E. Storr, will be read and discussed. In the afternoon there will be an informal meeting in the Council Chamber to discuss "The Development of Cooking Apparatus." The discussion will be opened by Mr. R. B. Mitchell, city electrical engineer, Glasgow, and chairman of the I.M.E.A. Special Committee on Electrical Apparatus. In the evening there will be a gala night at the Fol-de-Rols Concert in the Floral Hall, Alexandra Gardens.

At 10 a.m. on Thursday, June 21st, a meeting will be held in the Council Chamber, Town Hall, when a Paper on "Modern Generation Applied to Existing Distribution," by Mr. F. W. Purse, borough electrical engineer, West Ham, will be read and discussed. In the evening the annual dinner will be held at the Royal Hotel.

The annual general meeting will be held on Friday, June 22nd, and on Saturday, June 23rd, visits will be paid to the Scarborough electricity works and the motor car works of Mr. F. W. Plaxton.

The programme contains a map and other useful information about Scarborough, among which we find the note: "Care should be exercised by persons walking along the beach southwards of the Spa in the direction of Carnelian Bay when the tide is rising." Does this mean anything but what it says?

Electrical Exhibition at Ilford.

On Tuesday a comprehensive exhibition of electric light fittings and domestic electric appliances was opened at Ilford Town Hall. At the opening ceremony Councillor H. G. ODELL, chairman of the Electricity Committee, said the Council's electrical undertaking had gone through some ups and downs, and for a time had worked at a loss. The Electricity Committee, however, aided by Mr. Shaw, the electrical engineer, had tackled the question in a businesslike manner and they had got out of their difficulties. They had not, like some of their neighbours, a very large power demand, and this exhibition had been organised with the object of increasing the day load by encouraging the use of domestic appliances.

In addition to the General Electric Co., the British Electric Transformer Co., and the Jackson Electric Stove Co., all of whom give electric cooking demonstrations, the exhibitors include the Ilford Electricity Department, Rylands Electrical Co., Belling and Co., the Carron Co., the Hotpoint Electric Appliances Co., W. H. Sugden and Co., of Barking, and three Ilford firms, the Ajax Co., A. Howes and Co., and Edgar C. Porter.

The "Open" Clause in Contracts.

The Contracts Committee of the FEDERATION OF BRITISH INDUSTRIES is asking trade associations to co-operate in obtaining the removal of the "open" clause which at present often figures in contracts. Where this clause operates, the offer is made of certain classes of goods at certain prices, and the acceptance is for such of the goods in question as the buyers may from time to time order over a certain period. In other words, the contractor is bound as regards price and unknown quantity of goods, but the purchaser is free to take advantage of the offer or place his order elsewhere. It is pointed out that such a practice is unfair to contractors, who, after making purchases and other arrangements against their offers, find possibly that the customer's requirements may be placed elsewhere owing to fall in price.

Vickers and the Spearing Boiler Co.

We are informed that VICKERS, LTD., have acquired a substantial interest in the Spearing Boiler Co., and that the name of the latter company will be changed to Vickers-Spearing Boiler Co. The new Board consists of Mr. A. H. Spearing, chairman; Mr. J. Kerr-Bock, of the Spearing Boiler Co.; Mr. Douglas Vickers, chairman of Vickers; and Sir Vincent Caillard, a director of Vickers.

It is intended that the manufacture of all classes of land boilers shall be carried out at the Vickers works at Barrow.

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Imperial Notes.

AUSTRALIA.

Melbourne Electricity Department's Good Year.

The revenue of Melbourne (Victoria) Corporation electricity department for the year ended December 31st, 1922, was £403 750, against £356 446 for the previous year, while the expenditure was £243 626, compared with £234 655. After providing for interest and depreciation and renewals account and a special writing down of coal stocks by £5 000, there remained a balance of £69 088. Deducting sinking fund contribution, £7 070, and various appropriations amounting to £21 263, including a special contribution of £5 000 to the officers' superannuation fund and a special reserve transfer for undergrounding mains amounting to £10 055, there remained a net profit of £40 755. This has been transferred to the town fund. The amount expended on new works during the year was £139 927, including mains £44 125, machinery £32 241, switchgear £30 559, buildings £15 107, sub-stations, transformers, etc., £12 698.

CANADA.

Electricity Supply Statistics.

According to a report just received by the High Commissioner for Canada in London from the Dominion Bureau of Statistics at Ottawa, central electric stations in the Dominions generated for sale and distributed during 1921 an aggregate of 5 614 132 000 kWh, at an average charge to the consumer of slightly over three-quarters of a cent per kWh. Over 97 per cent. of this electrical energy was generated by water power. The total amount of capital employed in the central electric stations of Canada on December 31st, 1921, was $484 669 451, which figure represents an increase of 8 per cent. during the year. Revenues increased in 1921 by 12 per cent., aggregating $73 376 580, while operating expenses increased only 4 per cent. The number of employees was 10 714, the total pay roll amounting to $15 234 678.

The pole line mileage was 21 714, of which 7 928 miles were used for transmission and 13 792 miles for distribution. There was a 4 per cent. increase in mileage during the year. The number of subscribers or customers in 1921 was 143 150 for commercial power and light, and 830 062 for private houses. The total number of central electric stations in Canada in 1921 was 857, of which 259 were hydraulic and 251 were fuel stations; there were also 347 non-generating plants. Water wheels and turbines numbered 604, of a total H.P. amounting to 1 826 357; steam reciprocating engines totalled 187, their H.P. aggregating 45 450, and there were 43 steam turbines of 90 705 H.P.; gas and oil engines used for electricity supply numbered 203, of 15 345 H.P.

INDIA.

Electricity in Baroda State.

From the report of the Industries' Department of the Baroda State for 1921-22, it appears that the existing Electricity Act is found defective in working, and it is considered desirable to amend the Act and bring it in line with the Indian Electricity Act recently revised in British India. The draft is ready. During the year, the Sidhpur electric installation was opened for supply to the public, and two licenses at Kida and Naosari were given. At the latter place the construction of a power house has been commenced.

Electricity in Mining Operations.

Speaking last week at the annual meeting of the Balaghât Gold Mines, Ltd., the chairman, Sir Donald Robertson, said: "Various improvements and additions to the plant on the mine have been made during the year, and I would mention particularly the installation of a fairly large electrically-operated winding engine for Tennant's shaft, which takes the place of the old steam winder. By using the electric power which is generated at the Cauvery Falls, and which is supplied under arrangement with the Government of Mysore, substantial saving is shown as against using steam power. Compressed air is one of the essentials of working these mines, and the air supply has been improved by the addition of a 200 H.P. electrical compressor, which has enabled us to throw out of use a steam driven plant which has become obsolete."

The Tata Power Company.

The demand for electric power in Bombay bids fair in the immediate future to outstrip the supply afforded by the Tata Hydro-Electric Power Supply Co., which has been operating for eight years, and the Andhra Valley Power Co., which has recently begun to function. Work is therefore being expedited on the scheme of the Tata Power Co. which was started some three years ago. This company was formed with the object of developing a very fine water storage site which had been located at the junction of the Nira and Mutha rivers, near the village of Mulshi, which is situated about twenty-five miles due west of Poona. When work was first commenced more than two years ago, the greatest difficulty was that of providing communications. The cart tracks were totally unsuited to the conveyance of the vast amount of the heavy machinery required in the construction of the 4 000 ft. dam and the cutting of the three mile tunnel, which is to carry the water through the ghats and pass it into the pipeline which will convey it to the turbines and generators at the foot of the ghats. The construction of two separate railway lines was therefore decided upon, each about 23 miles in length. One connects Mulshi with Chinchwad, a station on the G.I.P. Railway, about ten miles from Poona, and the other connects the site of the power house at Bhira with Roha, the latter an inland but tidal port, about twenty miles south of Dharamtar. These lines go through the heart of the jungle, and are now completed and in use. Another big undertaking was the blazing of a motor road between Mulshi and the tunnel inlet, and a further road by a roundabout route from the tunnel inlet to the outlet on the other side of the ghats. Lastly, comes the construction of a temporary power supply, over a distance of something like seventy miles, in order that all the pumps and compressors, stone mills and cranes, may be driven by electricity. This has been accomplished by the rather novel method of tapping the 100 000 V transmission lines of one of the other hydro-electric companies near Panvel and carrying electricity along the route on the same poles which will eventually be used for bringing the current from the power house to Bombay.

Foreign Notes.

EUROPE.

The German Electro Technical Industry.

Reports issued by Prussian Chambers of Commerce state that business generally continued quiet during April. In the electro-technical industry a further decline was recorded. It is stated that the difficulties in the way of obtaining coal and semi-manufactured goods owing to the occupation of the Ruhr, were overcome, but delivery contracts were delayed in consequence of railway transport difficulties.

German Railway Electrification Policy.

Unqualified public and professional interest, says the "Engineer," is centred on the German Government's present efforts to circumvent the coal shortage by electrifying the State railways. By demonstrating the superiority in service and economy efficiency of electricity over steam, it is hoped to offset the handicap to German railway transportation resulting from the occupation of the Ruhr coal fields and the deliveries previously made under the Versailles Treaty. Not only railways, but factories, will be compelled to use electric power. Lack of coal has forced the German State Railway administration to withdraw a large number of trains. Even now the remaining trains run principally on imported English bituminous coal. Leipzig is already the terminus of several electrified lines.

LATIN-AMERICA.

A Big Telephone Scheme.

It is stated from New York that a big telephone scheme, linking the countries of South America, is under consideration. It is proposed to take the Bell system as a model, and the American Telephone and Telegraph Co. and its allied Western Electric Co. are placing their patents and the benefits of their experience at the disposal of the International Telephone and Telegraph Corporation, which is now making an exhaustive survey of the field. The telephone is by no means unknown in Latin-American countries, but there is no telephone communication between countries. The International Telephone and Telegraph Corporation is already in control of the telephone systems of Cuba and Porto Rico. Controlled jointly and equally with the American Telephone and Telegraph Co., it owns and operates the longest submarine telephone cable in the world, from Havana to Florida. Through this connection it is possible for a Bell subscriber in North America to get into direct verbal communication with subscribers in Cuba.

U.S.A.

A 220 000 V Transmission Line.

The 220 000 V transmission line of the Southern California Edison Co. was switched on on May 6th. These lines have been operating for some time at 150 000 V. The change over has necessitated the addition of extra insulators and the erection of cast aluminium shield rings to distribute the electrostatic stress uniformly along the insulator slings.

Electrical Exports in February.

Preliminary figures in the official American "Commerce Reports" show that the exports of electrical goods from U.S.A. in February amounted in value to $4 839 738. Although representing a decrease on the amount shipped during the previous month, the difference is not great when allowance is made for the shorter number of business days. One item also accounts for a difference of $874 000, this being the value of the large locomotive shipments made in January, no exports of electric locomotives occurring in February. Compared with the exports of electrical goods during February, 1922, there was an increase in the same month of 1923 amounting to $454 344. February, however, was the low month of 1922. Substantial increases over January's exports occurred in the shipments during February of motors over 200 H.P., electric fans, domestic heating and cooking appliances, radio apparatus and parts and railway signalling equipment. The exports of mechanical-drive turbines during February decreased to the extent of $118 000 worth as compared with January, and only about half the number of self-contained lighting outfits were shipped. Telegraph apparatus exports also fell off considerably during February, as did also exports of wiring supplies and fixtures and bare copper wire. Exports of the remaining classes during February were about equal to the previous month.

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Electricity Supply.

Extensions and Developments.

NORWICH City Council is applying to the Commissioners for sanction to a loan of £34 000 for the provision of electricity mains and services.

HORNSEY (London) Borough Council is applying to the Commissioners for sanction to a loan of £27 250 in connection with the new sub-station at Highgate.

SHREWSBURY Town Council has applied to the Commissioners for sanction to a loan of £10 000 for cables, distributing mains, etc., including £1 172 overspent on a previous loan.

CHEADLE AND GATLEY Urban Council has applied to the Commissioners for a loan of £5 685 for the extension of the electricity scheme in the Finney Lane and Heald Green Districts.

REDDITCH Urban Council has sealed an agreement with the Shropshire, Staffordshire and Worcestershire Electric Power Co., transferring the town's electricity undertaking to the company on certain terms.

WILLESDEN (London) Urban District Council has received sanction from the Commissioners to a loan of £6 300, in respect of mains and switchgear, in connection with the proposed change over from d.c. to a.c.

PAISLEY Corporation has decided to accept, subject to certain modifications, a joint tender for the bulk supply of electricity made by the burghs of Greenock and Kilmarnock and the Clyde Valley Electrical Power Co. A tender was also received from Glasgow, but after consideration the competing joint tender was found more acceptable. The bulk supply was sought following the embargo placed by the Commissioners on the extension of the Paisley Corporation electricity works.

Alterations in Charges, Proposed and Actual.

CREWE Town Council has reduced the charges for electricity by an additional 15 per cent., as from April 1st last.

The charges for lighting, power and general supplies have been reduced at WOLVERHAMPTON from 75 per cent. to 60 per cent. over pre-war rates.

FLEETWOOD Electricity Committee recommends a further reduction of ½d. per kWh, making a total reduction of 2d. per kWh in six months.

The following reductions have been agreed upon for the added areas under the CHESTER Electricity (Extension) Special Order:—(1) A fixed charge not exceeding 2s. 6d. per quarter for each H.P. connected. (2) A charge not exceeding 2½d. per kWh for the first 1 000 kWh per quarter, 2¼d. per kWh for the second 1 000, 2d. per kWh for the third 1 000, 1¾d. per kWh for the fourth 1 000, and 1½d. per kWh beyond.

LIVERPOOL Electricity Committee has made the following recommendations for price reductions:—Flat rate for lighting from 5·95d. per kWh to 5·25d. per kWh; flat rate for power from 3d. to 2½d. per kWh; maximum demand rate, war percentage increase to be reduced from 70 per cent. to 50 per cent.; rateable value scale (private houses), from 10 per cent. on rateable value, plus 25 per cent., and 1d. per kWh plus 70 per cent., to 10 per cent., plus 20 per cent., and 1d. per kWh plus 50 per cent.; rateable value scale (business premises), from 14 per cent., plus 25 per cent. and 1d. per kWh, plus 70 per cent., to 14 per cent., plus 20 per cent., and 1d. per kWh, plus 50 per cent.; new rateable value scale (for private houses only), 25 per cent. on rateable value, plus ½d. per kWh, and no percentage increase. The latter alternative scale is introduced to encourage the use of electricity for power, heating and cooking in private houses. A scheme for supplying customers with electric cookers, etc., on a hire-purchase or hiring arrangement will shortly be submitted by the city electrical engineer. For the Urban District of Waterloo with Seaforth and Great Crosby, the committee has recommended the following reductions:—Flat rate charges.—For lighting, the increased charge to be reduced from 70 per cent. to 50 per cent. plus 1½d. per kWh; for shop lighting, the increased charge to be reduced from 35 per cent. to 25 per cent.; for power, the increased charge to be reduced from 25 per cent. to 12½ per cent.

Tapping New Areas.

Residents at BAGENALSTOWN (Ireland) have guaranteed £5 000 for an electric lighting scheme.

FEATHERSTONE Urban Council has sealed an agreement with the Electrical Distribution of Yorkshire, Ltd., for a supply of electricity for public lighting by September 1st next.

WANTAGE Urban Council has decided to consent to the application by the Western Electrical Distributing Corporation, Ltd., for an order to supply electricity to the town.

SHERINGHAM Urban District Council is taking a leading part in the promotion of a scheme for the supplying various towns in North Norfolk with electricity from Norwich.

WORCESTER Corporation is applying to the Electricity Commissioners for a special order extending the area of supply under the Worcester Electric Lighting Order, 1890, so as to include parts of Droitwich, Martley, Upton-on-Severn and Pershore rural districts.

The BARFORD Electric Supply Co. is applying to the Commissioners for consent to use overhead lines for supplying electricity for power and light to the villages of Walton, Wellesbourne, Combroke, Kineton, Charlecote, Hampton Lucy, Tiddington and Alveston.

WOKINGHAM Rural Council has consented to an application by the Thames Valley Electric Supply Co. for an order to supply electricity to all the parishes in the Council's area, with the exception of Wokingham Without and Finchampstead. The maximum charge to be placed in the order is 1s. per kWh.

BEDFORD Town Council has applied to the Commissioners for a special order to extend the area of supply to the Urban District of Kempston, the parishes of Wootton, Kempston Rural, Stagsden, Biddenham, Bromham, Pavenham, Oakley, Clapham, Milton Ernest, Ravensden, Wilden, Renhold, Goldington, Willingdon, Cople, Cardington, Eastcotts, Willshamsted, Elstow, Great Barford, Felmersham, Carlton, Chellington, Turvey, Stevington and Roxton, in the Rural District of Bedford, and the parishes of Moggerhanger, Northill, Blunham, Sandy, Tempsford, Everton, Potton and Sutton, in the Rural District of Biggleswade.

Inquiries and Orders.

At HOVE on Tuesday, Col. Ekin opened an inquiry on behalf of the Commissioners with reference to the Corporation's application for sanction to a loan of £20 000 for the construction of an electricity converter station in Hove Street. The Hove Ratepayers' Alliance is protesting against the proposed site, contending that the existing power station might be utilised.

At HUDDERSFIELD last week, Col. Ekin, on behalf of the Commissioners, held an inquiry to decide whether certain districts around Huddersfield—namely, Marsden, Lepton, Kirkburton, Kirkheaton, Slaithwaite and Meltham—should be supplied with electricity by the Electrical Distribution of Yorkshire, Ltd., which obtains its current from the Yorkshire Electric Power Co. or by the Huddersfield Corporation. Following the taking of a considerable amount of evidence for both parties, the inquiry was adjourned until June 8th.

Personal Items.

Following the completion of the power station at Douglas (I.O.M.), Mr. BERTRAM KELLY has been appointed borough electrical engineer.

Mr. T. B. HOYLE, formerly with Palmer, Riley and Co., Accrington, has arrived in Los Angeles, California. In a letter home he gives a glowing account of the country.

Hornsey Borough Council has increased the salary of the electrical engineer, Mr. N. STANILAND, by two amounts of £75 each, to date from June 1st and October 1st next.

Mr. H. E. YERBURY, deputy general manager and engineer of the Sheffield Corporation Electricity Supply Department, has been elected president of the Yorkshire Association of the Institution of Civil Engineers.

East Ham Town Council has increased the salary of Mr. W. R. ELLIOTT, chief electrical assistant, to £400 as from April 1st, with further increases to £422 as from April 1st, 1924, and to £450 as from April 1st, 1925.

At the next meeting of Glasgow Corporation, a recommendation that the salary of Mr. JAMES DALRYMPLE, tramways manager, be increased from £1 500 to £1 700 will be considered. A member of the Corporation has given notice that he will propose an increase to £1 850.

To mark his completion of 25 years' service as borough electrical engineer of Barrow-in-Furness, Mr. H. R. BURNETT has been presented with a silver salver and silver coffee jug by the staff and employés. Mr. J. F. Heslop, who presided at the presentation, remarked that during the whole of the time Mr. Burnett had been at the Corporation Electricity Works there had not been a single dispute at those works.

Mr. A. T. BLACKALL, signal and telegraph engineer, Great Western Railway, is retiring on June 14th. He will be succeeded by his chief assistant, Mr. R. J. S. INSELL, and Mr. C. M. JACOBS will become assistant signal and telegraph engineer. In consequence of the retirement of Mr. F. J. EVANS, electrical engineer to the late Barry Railway Co., Mr. V. N. JOLIFFE, assistant electrical engineer at Newport, has been appointed assistant electrical engineer in charge of Barry as well as Newport Docks.

Consequent on the resignation of Mr. G. H. WION from the position of assistant chief engineer of signals and telegraphs, Victorian Government Railways, the Victorian Railways Commissioners have approved of the following appointments dating from March, 1923:—Mr. S. PERCY JONES, signal and telegraph maintenance engineer, to be assistant chief engineer of signals and telegraphs; Mr. GEORGE H. CROOK, power signalling construction engineer, to be signal and telegraph maintenance engineer; Mr. WILLIAM FORREST, assistant engineer, signal and telegraph branch, to be power signalling construction engineer.

Mr. SIDNEY SIMPSON, who was formerly on the staff of the Yorkshire Electric Power Co. as assistant to the engineer and manager, Mr. W. B. Woodhouse, and has been since 1919 associated with Mr. J. E. Schofield, Bradford, and Mark Shaw and Sons, Huddersfield, has now commenced practice on his own account as (independent) consulting engineer in connection with the steam, heating, power and lighting requirements of the various West Riding industries and of rural and urban districts and estates. His offices are at 9, Market Street, Bradford, at which address he will be glad to receive manufacturers' catalogues. His telegraphic address is "Therm, Bradford," and his telephone number is 6705.

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Tenders Invited and Accepted.

GREAT BRITAIN.

SOUTHEND-ON-SEA CORPORATION.—Steel surface tramcar traverser, petrol or electrically driven tower wagon, and 10 000 tons of coal suitable for mechanically stoked boilers. Particulars from Mr. Robert Birkett, Borough Electrical Engineer and Manager, Light Railways and Electric Lighting Department.

SALFORD GUARDIANS, June 5th.—Re-wiring wards of the Infirmary at Hope, Pendleton. Specification from the Clerk, Poor Law Offices, Eccles, New Road, Salford.

MANCHESTER CORPORATION, June 6th.—Six months' stores for the Electricity Department. Particulars from Mr. F. E. Hughes, Town Hall, Manchester. June 9th.—Pressure-testing equipment, for the Electricity Department. Specifications from Mr. Hughes.

NEWCASTLE-UNDER-LYME CORPORATION, June 8th.—500 kW rotary converter, with e.h.t. and l.t. switchgear. Specification from the Borough Electrical Engineer.

BETHANIA CHAPEL, MOUNTAIN ASH, June 9th.—Electric light wiring and fitting of Bethania Chapel and schoolroom and manse. Specification can be seen at the schoolroom, Phillip Street, Mountain Ash.

BARNES URBAN DISTRICT COUNCIL, June 11th.—Electrically propelled dust collecting van. Particulars from the Engineer, Council House, Mortlake, London, S.W.14.

NOTTINGHAM CORPORATION, June 14th.—Twelve months' supply of general stores to the Electricity Department. Forms of tender from the Engineer, Electricity Station, Talbot Street, Nottingham.

INDIA STORE DEPARTMENT, LONDON, June 15th.—Insulated, braided, v.i.r. copper wire and wrought-iron or mild steel galvanised tubing. Forms of tender from the Director-General, Store Department, Branch No. 12, Belvedere Road, Lambeth, S.E.1.

RHONDDA URBAN DISTRICT COUNCIL, June 18th.—Wiring and fitting about 177 points at the Council schools. Specification from the Engineer, Electricity Works, Porth, Glam.

PORTSMOUTH CORPORATION, June 25th.—Removal of electrically-operated bascule bridge at the Camber. Specification from the Borough Engineer.

BRISTOL DOCKS COMMITTEE, July 2nd.—Two 2-ton movable electric jib cranes. Specification from Mr. T. A. Peace, Engineer, Avonmouth Docks.

LEEDS CITY COUNCIL, July 2nd.—Single phase (2 000 and 6 600 V), three-phase (6 600 V) and Scott-connected transformers with total capacity of 14 600 kVA, and for further supplies of similar transformers over a period of two years. Specifications from Mr. C. Nelson Hefford, manager of the Electricity Department, 1, Whitehall Road, Leeds.

AUSTRALIA.

SYDNEY CITY COUNCIL, June 18th.*—18 000 gallons of transformer oil.

SYDNEY CORPORATION, July 2nd.*—Tungsten and carbon filament lamps (Contract 732).

NEWCASTLE (N.S.W.) CORPORATION, July 26th.*—Switchgear and metering equipment.

POSTMASTER-GENERAL'S DEPARTMENT, BRISBANE, July 31st.*—Cable terminals.

VICTORIAN ELECTRICITY COMMISSION, August 31st.—Aluminium steel cored 0·0707 sq. in. cable. Specification (23/77) from the Agent-General, Melbourne Place, Strand, London, W.C.2.

IRELAND.

DUBLIN UNITED TRAMWAYS CO., June 5th.—Six months' supply of general stores, including cables, car fittings, electric lamps and fittings, trolley fittings, ironmongery, etc. Forms of tender, etc., from the General Manager, 112-113, Marlborough Street, Dublin.

NEW ZEALAND.

PUBLIC WORKS DEPARTMENT, WELLINGTON, July 31st.*—Oscillator test set for Mangahao power scheme, and metering equipment in connection with Lake Coleridge power scheme.

SOUTH AFRICA.

CAPE TOWN CORPORATION, June 28th.*—Motors.

WORCESTER (CAPE PROVINCE) CORPORATION, August 2nd.*—Additional generating plant.

For electrical installation work at the Town's Yard and the Borough Hospital ASHTON-UNDER-LYNE HEALTH COMMITTEE have accepted the tender of H. Thornley.

EDINBURGH CORPORATION has accepted the tender of the Air Brakes Company for safety brakes for tramcars run in the districts of Edinburgh which include exceptionally steep gradients.

BETHNAL GREEN (LONDON) BOROUGH COUNCIL have accepted the tender of H. J. Cash and Co. (lowest tender) for wiring and fitting 45 tenements, at £440. Seven tenders were received, the highest being £610.

Babcock and Wilcox have received certain contracts in connection with the equipment of the generating station which the VICTORIA FALLS AND TRANSVAAL POWER CO. is about to establish at Witbank, Transvaal.

* Particulars from the Department of Overseas Trade.

The Electricity Committee recommend CHESTER CORPORATION to accept the tender of the Metropolitan-Vickers Electrical Co. for switchgear required in connection with the supply of electricity from Queen's Ferry, at £695 10s.

MANCHESTER CORPORATION have accepted the tenders of the following firms for electric light installation on the housing estates: W. Spreadborough, 90 houses, Blackley estate; E. L. Bellhouse and Co., 60 houses, Clayton estate; J. V. Pyatt, 16 houses, Catterick Hall estate.

Forty Years Ago.

"The Electrician," June 2nd, 1883.

BROOKLYN BRIDGE.—This bridge, which unites New York and Brooklyn, has just been opened with great pomp. It is a wonderful piece of engineering enterprise. It is to be lighted by arc lamps the United States Electric Light Co. having obtained a contract for the work.

ELECTRIC LIGHTING IN THEATRES.—Part of the Gaiety Theatre, London, is to be lit with Swan lamps, the current being supplied by the Electric Storage Co.'s accumulators. The branch wires will be laid in Longden-Welch's patent grooved slate. The contract has been obtained by Mr. H. Bury, of 40, Market Street, Manchester, who, we believe, is also to light up the Princess's Theatre in that town.

ELECTRIC LIGHTING FOR MUSEUMS.—In the House of Commons, on Thursday week, Mr. Coope asked Mr. Shaw-Lefevre whether he was aware that the electric light had been used in the South Kensington and Jermyn Street Museums for upwards of two years without any accident occurring; whether he was aware that a code of regulations had been adopted jointly by the electric lighting companies and the fire insurance offices, reducing fire risks to a minimum; and whether he was prepared to take measures whereby the National Gallery and the British Museum might be lighted by electricity? To which Mr. Shaw-Lefevre replied that while admitting all that the hon. member had said to be true, he still remained of opinion that we have not had sufficient experience of the electric light to justify him in advising the trustees to use it in the National Gallery.

ELECTRIC LIGHTING AT BUCKINGHAM PALACE.—On the occasion of the State Ball at Buckingham Palace, on Tuesday night, the ballroom was most brilliantly lighted by means of 700 Swan incandescent lamps. The work of fitting up the lamps, wires, etc., was carried out by the officials of the royal household under the superintendence of Mr. W. H. Massey, a well-known electrical engineer, assisted by Messrs. E. H. Liveing and A. H. Walker. The work was carried out in a very short space of time, and for a week before the night of the ball, those concerned were engaged night and day. The result was a grand success, and we believe that H.R.H. the Prince of Wales was very pleased with the lighting. The incandescent system is to replace gas on all State occasions for the remainder of the season. We shall hope to be able to give our readers some further details of this installation in a future issue.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"Bathroom Furnishing"; "Furniture for Gardens and Summer Houses"; "The Decoration of Furniture."

THE CHEMICAL AGE.—"Stainless Steel in the Chemical Industry"; "Methods of Costing for Chemical Works," by F. M. Potter.

THE EUROPEAN COMMERCIAL.—"New German Exchange Regulations"; "Motor Trade Notes"; "The Forthcoming World Dairy Congress."

THE FRUIT GROWER.—"Horticultural Research—Digest of Results"; "The Marking of Imported Produce"; "Physiological Diseases of Fruit."

GARDENING ILLUSTRATED.—"The Chelsea Show: Special Report with Illustrations"; "Week's Work in the Garden."

THE GAS WORLD.—"Monthly By-Product Coking Section"; "The Removal of Carbon Monoxide from Town Gas"; "The Stamping of Gas Meters."

THE HARDWARE TRADE JOURNAL.—"Tools and Plant—The Setting and Fixing of Machinery"; "Chats on Silver and Plate"; "System in the Retail Hardware Business."

Business Items.

Mr. THOMAS WILLIAM CLARKE, Horbury (Yorks), has added to his business a branch for electrical work.

Mr. WILLIAM G. DODD, electrical engineer and contractor, has opened new premises at 175, High Street, Ayr.

The WESTERN WIRELESS AND ELECTRICAL CO. (Messrs. A. G. Williams and E. J. Watts) have opened premises at 98A, Fisherton Street, Salisbury, for the supply of wireless and electrical goods.

The NORTHERN ALUMINIUM CO. have removed from 31, Budge Row, London, E.C.4, to Caxton House, Westminster, S.W.1. Their new telephone numbers are Victoria 1114 and 1115, and their telegraphic address is "Noraluco, Vic., London."

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Electric Traction.

Tramway Extensions and Developments.

Issued last week, the BRADFORD Corporation (Trolley Vehicles) Order, authorises the Corporation to run trolley vehicles on seven routes with a total length of over 18 miles.

BELFAST Corporation has adopted the considered recommendation of the Tramways Committee that the tender of Mr. M. A. Boswell, of Wolverhampton, for the reconstruction of the tramways permanent way (third section) should be accepted at £205 348 11s. 4d.

LONDON County Council has under consideration the question of seeking Parliamentary powers to make tramways (1) from Charles Street to Ludgate Circus, *via* Farringdon Street; (2) from Gray's Inn Road to Farringdon Road, *via* Holborn and Charterhouse Street; and (3) from Southwark Bridge Road to Upper Thames Street, *via* Southwark Bridge. The Corporation, whose opinion was asked, has declined to assent to the last two, but consented to the first, providing Farringdon Road be widened at the expense of the London County Council.

LEEDS City Tramways Department is constructing at the Kirkstall Road works 25 tramcars of a new pattern, which increases the passenger capacity from 58 to 70 and adds to the comfort of the upperdeck travellers by giving a completely enclosed saloon. The length of the body has been increased from 16 ft. 4 in. to 17 ft., giving seating room for 24 instead of 22 in the lower saloon. The chief change from the old pattern is the abolition of the upperdeck platform. All the seats are now inside, and the rearrangement, together with the greater length, has increased the upstairs passenger accommodation by 10. The first of the new cars was put into commission a few days ago.

SUNDERLAND Tramways Committee chairman, Alderman New, estimates that it will cost the Corporation £20 000 as its share for the construction of the proposed new light railway joining up the tramway systems of Sunderland and South Shields. The scheme, he says, will not be a burden on the rates. He believes that it will be possible to have through fares of 5d. (9d. return), as against the 9d. single and 1s. 6d. return third class fare on the railway. Cars might be run every 20 minutes. There is also a proposal on foot to extend the Corporation tramway system across the fields to Silksworth. The suggested route has been inspected and approved by members of the Corporation.

Fares, Receipts and Passengers.

At BLACKBURN the passengers during the four days of Whitsuntide were reduced from 283 430 in 1922 to 205 061 this year, whilst the receipts declined from £2 504 to £1 564.

A motion is to come before GLASGOW Tramways Committee to the effect that all children under 14 years of age be allowed on the tramway cars during the summer holidays at a maximum fare of 1d. or a car token.

At HASLINGDEN Town Council, on May 24th, Alderman Russell, chairman of Tramways Committee, said penny tram fares had been experimented with for three months and they had proved very successful. They had sold 12 197 penny tickets.

Whitsuntide traffic on BURNLEY tramway system showed a decline as compared with a year ago. The passengers carried on Whit-Saturday, Sunday and Monday were 204 588, compared with 225 482 last year; and the receipts were £1 907, against £2 250.

The Minister of Transport has informed WORCESTER City Council that he is unable to supply a copy of the report made by the Tramway Charges Advisory Committee with regard to the application by the Worcester Electric Traction Co. for the continuance of 1½d. minimum fare on the tramways. The application was successful.

Manchester Tramwaymen's Wages Claim.

A heavy financial claim, it is stated, is to be made upon the MANCHESTER Corporation on behalf of its employees who served with the colours during the war. The "Manchester Guardian" states that a Manchester firm of solicitors has been entrusted with the task of presenting the claim, and that 6 000 ex-servicemen in the Corporation service, most of them tramwaymen, have agreed to contribute 5s. each towards the preliminary expenses. The argument upon which the claim rests is that the Corporation did not fulfil the promise which it made to the men before they entered the forces. The effect of that promise, it is stated on their behalf, was that no man should suffer financial loss through his enlistment, and that in any event he should receive from the Corporation not less than half-pay during his war service. The Local Government Board, however, decided that the total pay from all sources of the employee on active service must not be more than 25 per cent. above his pre-war pay. Thus the Corporation—which, as the men admit, was apparently desirous of paying the amount it had agreed to pay—had perforce to reduce the allowances.

Hull Tramways and the Unemployment Grant.

The Unemployment Grants Committee has intimated to HULL Tramways Committee that all grants will be conditional upon the contracts for or incidental to the works contemplated being placed in this country. The Committee, in view of this decision, are not hopeful of obtaining further grants towards the cost of the extensive renewals of the tramway track, the rails for which have been purchased from Belgium.

Wireless News.

The Broadcasting Committee at Work.

Sir L. Worthington-Evans, the new Postmaster-General, can scarcely have had time to consider the broadcasting question and the policy which he will follow with regard to it. It is unlikely, however, that the departure of Sir William Joynson-Hicks will make any difference to the Committee which he appointed to consider the agreement between the Post Office and the British Broadcasting Co., and the future of broadcasting.

This Committee, under the chairmanship of Major-General Sir Frederick Sykes, is now meeting three times a week. A considerable amount of evidence has been given by representatives of the Post Office, the British Broadcasting Co., and the manufacturing and trading interests concerned. Lord Riddell, the chairman of the Newspaper Proprietors' Association, gave evidence before the Committee on Tuesday on the broadcasting of news and its effect on the Press. Further evidence on this aspect of the question is to be given by representatives of the Newspaper Society and the principal news agencies.

Troubles of the B.B.C.

Meanwhile, the path of the B.B.C continues to be anything but smooth. The Society of West End Theatre Managers has intimated that it does not want to resume negotiations with the Company, and is evidently very sore that it is not represented on the Committee referred to above. For the fact that it is not so represented it blames the B.B.C., stating that, had the company so desired, it could have used its influence to secure representation for the Society. The Society asserts, however, that so far as it is aware, the Company took no steps in that direction, and continues: "On the contrary, you appear to have considered that our interests must always be subservient to yours."

A Protest from the Manufacturers' Association.

A protest has also been made by the British Radio Manufacturers and Traders' Association to the Postmaster-General regarding "an improper use of the facilities of the B.B.C." in using broadcasting "for the purposes of propaganda in defence of their position in the present broadcasting arrangements."

Sir W. Joynson-Hicks has replied that "the action to which you refer is really directed largely against myself, and that being the case, I do not desire to exercise such powers as I may possess in any way to prevent such criticism. My actions are always open to criticism, from whatever source, and I at least shall take no steps to prevent it."

The B.B.C., in reply, has asserted that the Association's letter is inaccurate, and states that it has "written the Postmaster-General and the chairman of the Government Committee offering facilities for examining every statement which has been broadcast either before or since the appointment of the Government Committee."

Authors and Broadcasting.

The attitude of the Society of Authors, Playwrights and Composers towards broadcasting is somewhat more reasonable than that of the theatrical managers. In fact, at the Society's dinner last week "Ian Hay" stated that they had parted company with the theatrical managers, who wanted broadcasting stifled, as they said it kept people in at night. He went on to state that the Society would be willing to help the B.B.C. if they paid a reasonable fee, by supplying lists of authors willing to have their works broadcast or to assist in any other way.

Earlier in the day the annual meeting of the Society passed the following resolution: "That this meeting recommends members of the Society of Authors not to give permission for their works to be broadcast without payment of a fee, and that in cases where they give permission on payment of a fee, members should notify the secretary of the society of the terms on which they are dealing with the British Broadcasting Co. or any other company."

Broadcasting Stations in the U.S.A.

On April 1st of last year, says the "Engineer," the number of broadcasting stations in operation in the United States numbered only 137. This meant that there were large areas in the country where broadcasting could be received only from stations at a great distance. The situation now, however, is much different, there being over 500 broadcasting stations licensed at the present time. These stations are so well distributed over the whole country that there is no place, with the exception of one point in the south-western section, which is over 150 miles from a good broadcasting station.

Miscellaneous Wireless Items.

A new journal, the "Wireless Review and Science Weekly," is offering £500 for the most successful demonstration of the possibility of wireless "television."

The "Leicester Daily Mercury" has been informed that the Postmaster-General cannot grant facilities for broadcasting by wireless telephony to a particular newspaper which (owing to risk of interference) he would be unable to grant generally to other newspapers and organisations. The journal's application has been referred to the Broadcasting Committee.

An Oxford firm, Wootton, Ltd., has succeeded in receiving the programme broadcasted from London on touring omnibuses whilst at Maidenhead and Henley, and also whilst travelling along the road from London to Oxford. A four-valve Burndept Ethophone "V" receiver with amplifier and loud speaker was used.

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Companies' Reports, Dividends, etc.

PERNAMBUCO TRAMWAYS AND POWER CO.—The report for the past year shows gross receipts £310 486 and working expenses £230 701, leaving gross profit £79 785. After providing for interest, amortisation, etc., there is a debit balance of £17 574.

MIRLEES, BICKERTON AND DAY, LTD.—Dividend recommended of 7½ per cent. on the ordinary shares, less tax, placing £5 000 to reserve and carrying forward £3 390. The net profit for the year to March 31st was £22 523, plus £2 858 brought forward.

ELECTRIC CONSTRUCTION CO.—The profit for the year ending March 31st, after providing for debenture interest and £10 000 for depreciation, was £50 333, making with the amount brought forward £72 406. After deducting the interim dividends paid, there remains £61 209. Final dividend recommended of 9 per cent. on the ordinary shares, making 7½ per cent. for the year, plus bonus of 2½ per cent., all less tax, transferring £17 287 to general reserve, making it £160 000, and carrying forward £20 725.

Cable, Telephone and Telegraph Companies.

ANGLO-PORTUGUESE TELEPHONE CO.—The accounts for 1922 show a gross income of £61 115, and an expenditure of £67 722, leaving a loss of £6 607 (against a profit of £20 285 for 1921). The total loss, after paying taxes, £2 458, and meeting debenture interest and sinking fund, £7 136, amounts to £16 201. A credit balance of £9 940 was brought in, leaving a debit balance of £6 261 to be carried forward. The average rate of exchange for the year was 3$\frac{31}{32}$d. per escudo (against 6$\frac{1}{8}$d. per escudo for 1921). The floating assets and liabilities in Portugal at the close of the year have been converted into sterling at 2$\frac{31}{32}$d. per escudo. Capital expenditure for the year was £48 492 (against £81 534 for 1921).

WEST INDIA AND PANAMA TELEGRAPH CO.—The accounts for 1922 show that the receipts amounted to £81 357 (against £93 971 for 1921) and expenses were £88 926 (against £95 490), leaving a loss of £7 569 (against £1 519). Including £330 for interest on investments, there is a net deficit of £7 239. This is added to the debit of £77 911 brought forward, and the loss of £384 on sale of an investment, making a total debit balance at the end of the year of £85 534. The report states that trade in the British West Indies continued stagnant and the traffic receipts thus suffered badly, as also from competition at Porto Rico. In December last consent was given by the Government to an increase of charges, but the increased rates could not be brought into force until January 22nd owing to the difficulty of obtaining the consent of the Western Union Telegraph Co., which consent could only be obtained through the waiver of certain of the Panama Co.'s rights under the old agreement. This waiver means the loss in earnings of many thousands of pounds. The new rates remain in force until September 30th. Regarding the Government's contemplated new service in the British West Indies, the directors state that it is obvious that the establishment of such a service must inevitably lead to the liquidation of the company.

First Report of Whitehall Electric Investments.

The first report of WHITEHALL ELECTRIC INVESTMENTS, LTD., for the year ended March 31st, 1923, issued last week, shows a gross income of £538 764, and the net income, after charging expenses and debenture interest, and providing for income and corporation profits taxes, amounts to £318 786. This has been allocated as follows:—Preference share dividend, £112,500; preliminary expenses written off, £70 029; discount on debenture stock written off, £36 257; leaving £100 000, with which it is proposed to pay a dividend of 2 per cent. for the year on the ordinary shares.

The undertakings in which the company is interested have, the report states, in the aggregate shown satisfactory results and realised expectations. The additional hydro-electric plant and the extensions to the distributing system of the Cia. Chilena de Electricidad have now been completed to a point where more power is available for sale and immediate benefits should accrue to that company. The new steam power-house of the Cia. Electrica del Tampico is approaching completion, and the hydro-electric extensions of the Puebla Tramway, Light and Power Co. have been commenced. Opportunities of adding to the company's investments are receiving the attention of the directors.

New Issue.

CHARING CROSS, WEST END AND CITY ELECTRICITY SUPPLY CO.—The directors have determined to issue 16 000 ordinary shares of £5 each, forming part of the unissued ordinary capital of the company, at the price of £7 10s. per share. These shares will be offered to the holders of the ordinary shares as registered in the books of the company on June 2nd, the holder of each complete five shares being offered one new ordinary share.

New Companies.

SEATON AND DISTRICT ELECTRIC LIGHT CO., LTD.—Reg. May 7th. Cap., £10 000 in £1 shares. To carry on the business of suppliers of electricity. Reg. office: 1, Violet Terrace, Fore Street, Seaton, Devon.

A. J. BENNETT AND WEAVER, LTD.—Private. Reg. May 1st. Cap., £10 000 in £1 shares. To adopt an agreement with A. J. Bennett and to carry on the business of mechanical and electrical engineers, instrument makers, manufacturers of motors, etc. Reg. office: 28, Broadway, Bexley Heath, Kent.

MARCHAPHONE, LTD.—Private. Reg. May 2nd. Cap., £5 000 in £1 shares. To acquire the undertaking and all or any of the assets and liabilities of Gilbert Marchat, and to carry on the business of manufacturers of and dealers in wireless apparatus, etc. Reg. office: 27, Chancery Lane, London, W.C.2.

DEFIANCE ELECTRICAL CO., LTD.—Private. Reg. April 30th. Cap., £100 in £1 shares. Exporters, importers and manufacturers of electrical, gas, oil and lighting goods, and accessories and wireless insulating appliances, etc. D. J. Phillips, 39, Groton Road, Earlsfield, London, S.W.18, manufacturer, is a subscriber.

NEWPORT ELECTRICAL CO., LTD.—Private. Reg. May 8th. Cap., £2 000 in £1 shares. To take over the business of an electrical and consulting engineer and contractor carried on by H. Winslow at 3, Dock Street, Newport, Mon., as H. Winslow and Co. Sec.: J. P. Brown. Reg. office: 3, Dock Street, Newport, Mon.

POMEROY FOUNDRY, LTD.—Private. Reg. May 7th. Cap., £100 in £1 shares. To carry on the business of iron and brass founders, engineers, manufacturers of and dealers in mechanical, steam, electrical, gas, oil, petrol and all other engines and appliances. Solicitor: W. A. Zabell, 11, Queen Victoria Street, London, E.C.4.

HAMBLING CLAPP AND CO., LTD.—Private. Reg. May 8th. Cap., £1 000 on £1 shares. To take over the business of manufacturers and factors of and agents for wireless sets and apparatus and electrical appliances and accessories carried on by Hambling Clapp and Co., at 110, Strand, W.C. Reg. office: 110, Strand, W.C.

HALL AND BRENARD, LTD.—Private. Reg. May 2nd. Cap. £1 000 in £1 shares (300 6 per cent. cumulative preference). To adopt an agreement with G. H. L. Hall and R. Brenard, and to carry on the business of wholesale radio and electrical engineers and suppliers carried on by them at 10, Manor Gardens, Purley, Surrey.

E. SHIPTON AND CO., LTD.—Private. Reg. May 9th. Cap., £1 000 in £1 shares. To adopt an agreement with E. Shipton, trading as E. Shipton and Co., and to carry on the business of telephone, wireless, electrical, mechanical and general engineers, etc. Secretary: H. C. Mundy. Reg. office: 14, King Street, Covent Garden, London, W.C.

RADIO SLOT MACHINES, LTD.—Private. Reg. May 8th. Cap., £2 000 in £1 shares. (1 200 preference and 800 ordinary). To acquire and turn to account coin-operated time-switches for use in connection with radio apparatus and to adopt an agreement with Tower Carriers, Ltd., G. C. Barclay, H. T. R. Cripps and R. C. Graseby. Reg. office: 13, Earl Street, Westminster, S.W.1.

PHILLIPS AND SONS (CHISWICK), LTD.—Private. Reg. April 26th. Cap., £1 000 in £1 shares. To adopt an agreement with W. J. Jackson and H. Dubbury, trading as "Phillips and Sons," and to carry on the business of electrical, mechanical and general engineers, manufacturers and workers of and dealers in electricity, motive power and light, etc. Reg. office: 403, High Road, Chiswick, London, W.4.

P. ORMISTON AND SONS, LTD.—Private. Reg. April 11th. Cap., £5 000 in £1 shares. To adopt an agreement with Dorothy F. Ormiston, and to carry on the business of wire drawers and electric wire coverers, manufacturers of and dealers in fine wires in copper and other metals, resistance wires, fuse wires and brush wires, fine flex copper and other cords, etc. Reg. office: 79, Clerkenwell Road, London, E.C.1.

E.E.E. CARBON CO., LTD.—Private. Reg. April 23rd. Cap., £6 000 in £1 shares (5 000 6 per cent. cumulative participating preference and 1 000 ordinary). To act as agents for Gebr. Siemens and Co., Berlin, in the sale of carbons and other articles manufactured by them; to carry on the business of electricians, electrical and mechanical engineers, etc. Reg. office: 109–11, New Oxford Street, London, W.C.

LIGHT O' DAY ELECTRIC LAMP CO., LTD.—Private. Reg. April 30th. Cap., £15 000 in 5 000 "A" and 7 000 "B" cumulative participating preference shares of £1, and 60 000 ordinary shares of 1s. To take over the business of applying to electric lamps a lac known as Oriona Lac, carried on by R. Gordon and C. Barclay, at 20, Copthall Avenue, London, E.C. Reg. office: Walter House, Bedford Street, London, W.C.

RISSIK, FRASER, SPINKS AND CO., LTD.—Private. Reg. April 30th. Cap., £10 000 in £1 shares. Manufacturers of and wholesale and retail dealers in vulcanite, ebonite, ebonite dust, powdered rubber and articles in the manufacture of which ebonite, vulcanite, rubber or any substitute therefor is used, electrical and scientific instruments, etc. F. A. Rissik, 11, Warwick Mansions, Cranwell Crescent, London, S.W.5, is a director.

HEADPHONES (MANCHESTER), LTD.—Private. Reg. May 3rd. Cap. £2 000 in £1 shares. To take over the business of dealers in electrical supplies and accessories carried on by W. Hall and Mary Shaw at Manchester as the "Oxford Electric Co." and to carry on the same and the business of manufacturers of wireless and other scientific instruments, etc. W. F. Peck, "Beechwood," Anson Road, Victoria Park, Manchester, is a permanent director.

WILLMER CONTRACTS, LTD.—Private. Reg. April 27th. Cap., £1 000 in £1 shares. To construct, manage or control railways, tramways, docks, harbours, piers, wharves, canals, reservoirs, roads, embankments, irrigations, reclamation, improvement, sewerage, drainage, sanitary, water, heat, gas, electric light, telephonic, telegraphic, wireless and power supply works, and hotels, warehouses, markets, public buildings, etc. Reg. office: Parliament Mansions, Victoria Street, London, S.W.1.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

ARROTA ELECTRICAL AND MOTOR ACCESSORIES CO., LTD., Louth, electrical and motor engineers. £12 10s. 6d. April 16th.

MANSFIELD, Mr., 41, Narborough Road, Leicester, electrical contractor. £11 5s. April 4th.

WEST, H. AND J., 78, Stoke Road, Gosport, electrical engineers. £13 1s. 11d. April 10th.

Receiverships.

A. AND A. ELECTRICAL CO., LTD.—G. E. Sendell, of 36, Walbrook, E.C., was appointed receiver on May 14th, 1923, under powers contained in debenture dated November 15th, 1921.

YORKSHIRE AND DISTRICT ELECTRIC LAMP REPAIRING CO., LTD.—H. Cawood, of 68, Eyre Street, Sheffield, was appointed receiver and manager on May 11th, 1923, under powers contained in debentures dated November 29th and 30th, 1922.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

CROWLEY (J.), and FRANCIS (J. I.), electrical engineers and contractors, trading as CROWLEY AND FRANCIS, 24, Orange Street, Swansea. Creditors were called together recently at the offices of Poppleton, Appleby and Hawkins, accountants and auditors, 4, Charterhouse Square, E.C., when a statement of affairs was presented which showed liabilities of £549, against assets amounting to £434. It was stated that the debtors had carried on the business in partnership since September, 1920. The debtors made an offer of a composition of 17s. 6d. in the £, payable as to 2s. 6d. in three months, and then 5s. in the £ every subsequent six months. After a short discussion it was decided to accept the debtors' offer, and that a deed should be executed to Mr. E. H. Hawkins, together with a committee consisting of the representatives of the Metallic Seamless Tube Co. (creditors for £120), the Edison Swan Electric Co., Ltd. (£115), and the English Electric and Siemens Co. Ltd. (£80).

MIDGLEY (J. B.), LTD., electrical engineers, etc., 26, Caledonian Road, N. At the statutory first meeting of creditors in this voluntary winding-up, the liquidator, Mr. A. A. Hall (Hall, Baxter and Co.), 69, Broad Street Avenue, E.C., presented a statement of affairs showing liabilities £627 and assets £331, a deficiency of £296. It was reported that the company was incorporated on February 22nd, 1921, to take over the business of J. B. Midgley and Co. The capital was £500 in £1 shares. The directors were Mr. J. B. Midgley, Mr. J. J. Tanner, Mr. F. Johnson and Mr. P. E. Gallagher. It was stated that most of the company's business was done at Worcester Park, where they had a store. Mr. Houstoun, of Messrs. Corfield and Cripwell, asked what had happened to the stock that was at Worcester Park, and the liquidator replied that it had been removed from there and taken to 26, Caledonian Road. The company never had any stock at Caledonian Road before the liquidation. The premises were taken at a weekly tenancy of £1 a week. The drawings of the directors had been in the neighbourhood of £3 to £3 10s. a week each. The matter was fully discussed, and the opinion was expressed that some further investigation should be made. Mr. Hall intimated that he was quite willing to resign his position as liquidator, and eventually a resolution was passed appointing Mr. William Osborne (Corfield and Cripwell, Balfour House, Finsbury Pavement, E.C.) as sole liquidator in the place of Mr. Hall. The following are creditors:—Edison Swan Electric Co., £40; Watsham's, £92; Markes Ward, £101; General Cable Co., £19; General Electric Co., £177; Metropolitan-Vickers Electric Co., £64; Siemens Electric Lamp Co., £18.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Companies Winding-Up Voluntarily.

DIRECT UNITED STATES CABLE CO., LTD. William Miles, 240, Winchester House, appointed liquidator.

RUSSELL ELECTRICAL APPLIANCES CO., LTD. Alfred Neill, 76, Kingsland High Street, E.8, appointed liquidator. Meeting of creditors at Bank Chambers, 76, Kingsland High Street, E.8, on Friday, June 1st at 2 p.m.

Bankruptcy Information.

DUFFIN, Albert Harold, and KERSHAW, George, carrying on business at Provincial Buildings, Conway Road, Colwyn Bay, under the style of A. H. DUFFIN AND CO., electrical engineers and contractors. First meeting, June 1st, 2.30 p.m., Official Receiver's Office, St. Peter's Churchyard, The Cross, Chester. Public examination, July 13th, 11.30 a.m., Court House, Bangor.

SLATER, Thomas Gascoigne, carrying on business as SLATER BROS., 25, Dickinson Street, Mount Street, Manchester, electrical engineer. Receiving order, May 18th. Debtor's petition.

Notice of Dividend.

WILDE, Frederick, 18–20, Vauxhall Road, Liverpool, trading as THE LIVERPOOL ENGINEERING CO., electrical engineer. First dividend of 1s. 9d. per £, payable May 31st, Trustee's Office, 19, Castle Street, Liverpool.

Bankruptcy Proceedings.

THORNE, George John Cecil, and THORNE, Albert Harry (trading in partnership as the LAWRANCE ELECTRICAL TRADING CO.), late of 159, High Street, Notting Hill Gate, W. At the statutory first meeting of creditors a statement of affairs was submitted to the meeting showing ranking liabilities £1 10s and net assets £375. It appeared that debtor, G. J. C. Thorne, after his discharge from the army, began business in partnership with another person as electrical engineers in Cornwall, but at the end of 1921 withdrew from the firm, and in February of last year began business in partnership with his brother as electrical engineers under the style of the Lawrance Electrical Trading Co. In addition, they carried on business as general agents under the style of Thorne Bros., taking premises at 41, South Molton Street, W. They possessed a capital of £100, which they borrowed and was still owing. Some six months later they removed the business to High Street, Notting Hill Gate, W. They established a fairly good trade, but in consequence of lack of capital they found that it was impossible to continue the business, and on May 7th a private meeting of the creditors was held, when they offered to execute a deed of assignment of their property, under which a cash creditor for £600 was willing to stand aside for the benefit of the trade creditors. That offer was, however, refused, and a resolution for bankruptcy was passed, whereupon the debtors closed the business and filed their petition. The failure was attributed to trading on borrowed capital. The following are creditors:—Central Ignition Co., London, £45; Just, Einva, London, £60; Three Star Accumulator Co., Ltd., Tottenham, £34.

Prices of Metals, Chemicals, etc.

TUESDAY, May 29.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£67 10 0	—	£3 10s.
Electro Wirebars	,,	£74 10 0	—	£3 10s.
H.C. Wire, basis	per lb.	10½d.	—	⅛d.
Sheet	,,	10 15/16d.	—	¼d.
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2½d.	—	⅜d.
Brass 60/40—				
Rod, basis	,,	7½d.	—	—
Sheet, basis	,,	10½d.	—	—
Wire, basis	,,	10½d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£6 7 6	—	—
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 10 0	—	—
Lead Pig—				
English	,,	£27 0 0	—	5s.
Foreign or Colonial	,,	£25 17 6	—	10s.
Tin—				
Ingot	,,	£197 0 0	—	£5 15s.
Wire, basis	per lb.	2s. 7½d.	—	⅛d.
Aluminium Ingots	per ton	£115 0 0	—	—
Spelter	,,	£30 12 6	—	£1 5s.
Mercury	per bottle	£10 12 6	—	—

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2⅛d.
,, (Roll-Brimstone)—,, £8 5s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. ,, £26 10s. per ton, £7 10s.
Boric Acid (Crystals). ,, £50 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 2¼d.; plantation 1st latex, 1s. 2⅛d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

180 330 AUTOMATIC TELEPHONE MANUFACTURING Co. Telephone systems. (23/5/21.) (Addition to 158 276.)
193 339 Soc. DES ETABLISSEMENTS GAUMONT. Sound-producing apparatus or electro-magnetic receiving or emitting device. (17/2/22.)
185 409 METROPOLITAN-VICKERS ELECTRICAL Co. Control mechanism for electric ship propulsion. (1/9/21.)
187 971 NEDERLANDSCH-INDIE. Reception of wireless signals. (29/10/21.)
189 459 BRITISH THOMSON-HOUSTON Co. Incandescent lamp mounts. (25/11/21.)
193 361 AUTOMATIC TELEPHONE MANUFACTURING Co. and C. REMINGTON. Mine signalling systems in which signals consist of a single series of impulses. (15/11/21.) (Divided Application on 193 128.)
193 434 BRITISH THOMSON-HOUSTON Co. and A. S. FITZGERALD. Differentially acting electro-responsive apparatus. (22/8/21.)
193 438 W. H. WILSON. Wireless telegraphic apparatus. (29/8/21.) (Cognate Application, 16 305/22.)
193 460 J. H. GOODWIN and C. R. COWAN. Lighting of vehicles by electric lamps. (14/11/21.)
172 008 FORGES ET ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE JEUMONT. Commutation of d.c. machines. (23/11/20.)
172 013 WESTERN ELECTRIC Co. Switches. (26/11/20.)
193 484 J. F. MONNOT. Electrical switching devices particularly intended for use with sound-warning signals. (22/11/21.)
193 490 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.) Switches. (23/11/21.)
193 508 W. E. BOTTOM, M. H. GOLDFARB, and W. M. BARRINGTON. Electric fuses. (25/11/21.)
193 518 T. B. DIXON. Telegraphy. (28/11/21.)
193 522 R. M. LINFOOT. Electric igniters for pipes, cigars, and the like. (29/11/21.)
193 525 S. G. FROST. Thermionic valves. (30/11/21.) (Cognate application, 17 265/22.)
172 320 GES. FUR DRAHTLOSE TELEGRAPHIE. Generation of electrical oscillations by thermionic valves. (4/12/20.)
193 538 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.) Switches. (2/12/21.)
172 628 E. G. BUDD Co. Automatic electric welding machines. (13/12/20.)
193 545 P. G. MITCHELL. Anti-climbing devices for posts carrying electric transmission wires. (5/12/21.)
193 548 BRITISH THOMSON-HOUSTON Co. and F. P. WHITAKER. Electrical machines. (6/12/21.)
172 960 L. KAHN. Automatic electro-magnetic cut-outs. (13/12/20.)
193 566 A. ONWOOD. Control of valve transmitters. (14/9/22.)
193 578 G. H. SCHOLES, A. W. and L. B. CLAREMONT (legal representatives of E. A. Claremont, deceased). Junction boxes for cables. (19/12/21.)
193 579 E. V. FORD. Conductor terminals. (19/12/21.)
193 580 P. T. KING. Motors. (19/12/21.)
193 585 W. H. BOORNE. Electrodes for arc welding. (20/12/21.)
193 604 F. C. RAPHAEL. Electric fittings and means for fixing same. (5/6/22.)

APPLICATIONS FOR PATENTS.

May 14.

12 806 A. M. TAYLOR. Electric transmission of power.
12 809 E. D. YOUNG. Thermo-telephone receiver.
12 814 A. F. S. ROWE. Voltaic cells and batteries.
12 818 T. C. WINFIELD. Arc welding holder.
12 830 J., W. and A. CONNELLY. Wireless receiving apparatus.
12 834 J. W. BARNARD and T. C. DAWKINS. Electric heating device for singeing hair, etc.
12 847 H. F. A. SANDERSON. Tuning wireless receiving circuits.
12 849 A. F. R. COTTON. Telephonographs, etc.
12 859 H. J. WIEGAND. Resistance control devices. (15/5/22 U.S.)
12 862 HEWITTIC ELECTRIC Co. Rectifying apparatus for a.c. (15/5/22 France.)
12 872 N. H. DEAN. Electric machines.
12 884 H. B. CLAPP. Resistances.
12 894 BULLO-FAHRZENGBAU GES. Electrically-operated motor cycle. (12/5/22 Germany.)

May 15.

12 910 H. CAEN. Radio-telegraphic aerial supports.
12 911 H. CAEN. Radio telephonic inductances.
12 913 E. E. FOURNIER D'ALBE. Telegraphic transmission of pictures.
12 921 H. B. and H. R. STOCKS. Contact breakers for ignition systems.
12 957 J. A. ORME. Locking electric lamps in holders, etc.
12 960 R. BLAKOE and H. A. H. DUNCAN, Wireless detector.
12 984 GENERAL ELECTRIC Co. Opening incandescent lamps. (1/6/22 U.S.)
12 994 W. DORNIG. Frequency multiplying transformers. (9/8/22 Germany.)
12 995 W. DORNIG. Circuit for frequency multiplying transformers. (29/11/22 Germany.)
12 997 W. A. APPLETON and J. JOSEPH. Electrical apparatus.
13 003 PHILIPS GLOFILAMPENFABRIEKEN. Cutting continuously moving glass tubes, etc. (16/5/22 Holland).
13 006 J. W. GEE and W. F. HIGGS. Undercutting insulation in commutators.
13 032 A. J. BARNETT and S. JONAS. Wireless receiving apparatus.
13 034 G. C. BEDDINGTON. Thermionic valve devices.
13 037 WARD LEONARD ELECTRIC Co. Resistance units. (24/8/22 U.S.)
13 042 LAMBERTS, LTD., and R. E. LAMBERT. Mounting for electric lamps.
13 044 A. E. WHITE (SANGAMO ELECTRIC Co.). Pivotal mountings for instruments of precision.

May 16.

13 061 H. HARDWARE and F. WINSTONE. Crystal detectors.
13 085 COVENTRY AUTOMATIC TELEPHONES, LTD., and J. E. COLLYER. Relay for telephone systems.
13 106 D. R. COCHRANE. Contacts for wireless crystal sets.
13 110 W. B. GOOD. Electric measuring instrument.
13 116 W. HADDON and J. M. BURNETT. Accumulator grids or plates.
13 117 W. HADDON and J. M. BURNETT. Unit for accumulator plates.
13 118 W. HADDON, J. M. BURNETT, and J. A. FULLILOVE. Accumulator plates.
13 119 W. HADDON and J. M. BURNETT. Accumulators.
13 128 H. J. BETTS. Electric terminals, etc.
13 131 ELECTRICAL APPARATUS Co. and R. H. BARBOUR. Receiving apparatus for wireless signalling.
13 133 A. F. R. COTTON. Means for producing variable electric frequencies.
13 135 C. R. BELLING. Electric ovens.
13 136 C. R. BELLING. Electric heaters.
13 140 E. POHLER. Charging batteries.
13 142 G. SEIBT. Variable condensers. (30/5/22 Germany.)
13 145 C. BERNER and A. CLIFFORD. Telephone systems.
13 151 W. J. RICKETS and E. A. GRAHAM. Intervalve-transformer systems for use in thermionic valves.
13 155 A. J. FIPPARD. Electromagnetic clutch and variable speed gear.
13 157 H.T.C. ELECTRICAL Co., M. COOPER, C. F. HURST and A. H TRIGGS. Transformers for telephony and wireless signalling.
13 163 BRITISH THOMSON-HOUSTON Co. and A. S. FITZGERALD. Switches, etc.
13 164 BRITISH THOMSON-HOUSTON Co. (INTERNATIONAL G.E. Co.) Electric heaters.

May 17.

13 178 H. E. DANSE. Automatic brakes and starters for motors.
13 179 SVENSKA ACKUMULATOR AKTIEBOLAGET JUNGNER. Insulation for batteries. (12/12/22 Sweden.)
13 180 WINFIELD BROS. and C. J. C. WINFIELD. Crystal detectors.
13 196 G. E. DOCKRAE. Wireless receiving apparatus.
13 206 A. REYROLLE AND Co. and P. F. HARRIS. A.c. electromagnets.
13 211 W. A. LOGAN. A.c. motors for coal cutting machines.
13 213 W. K. BARKER and S. G. and F. A. JONES. Telephone receivers.
13 218 W. G. ASTON. Wireless tuning device.
13 233 A. K. E. STRATHDEE. Thermionic valve holders.
13 248 W. H. DERRIMAN and J. ROBINSON. Thermionic valves, etc.
13 250 A. GARBARINI. Amplifying valves.
13 252 J. E. POLLAK (HENGELOSCHE ELECTRISCHE EN MECHANISCHE APPARATEN FABRIEK). Protecting electric networks.
13 253 W. M. MORDEY. Electromagnetic separation or concentration of minerals.
13 255 EASTERN TELEGRAPH Co. and H. V. HIGGITT. Motors.
13 260 BRITISH THOMSON-HOUSTON Co. and A. S. FITZGERALD. Switches, relays, etc.
13 263 A. J. MARCELIN. Telesitemeter listening apparatus. (19/7/22 France.)
13 265 W. E. SCHALL. Controlling vacuum in X-ray tubes.
13 269 R. AMBRONN. Apparatus for testing long bodies of magnetisable material.
13 271 L. ROSENGART. Portable electric lamps. (18/5/22 France.)

May 18.

13 300 W. T. JONES. Controlling electric lights, etc.
13 322 WESTERN ELECTRIC Co. Wire drawing machines.
13 328 W. J. POLYBLANK. Signalling apparatus.
13 334 C. J. COLEMAN. Displaying and vending wireless crystals.
13 335 M. DACOMO. Electric ceiling lamps for motor cars.
12 337 J. A. FLEMING. Telephone receivers.
13 344 W. G. MOORES, W. AMOR and H. K. FOSTER. Regenerating electric cell.
13 353 ENGLISH ELECTRIC Co. Hydraulic installations.
13 356 V. C. H. GIBSON. Connecting telephone terminals, etc.
13 362 HOGARTH ENGINEERING Co., H. C. HIGHFIELD and G. E. DOCKREE. Variable coupler for radio telegraphy.
13 366 J. L. P. MACNAIR. Motor starters.
13 380 L. D. HILL and G. M. WRIGHT. Wireless receiving sets.
13 382 Soc. FRANCAISE RADIO-ELECTRIQUE. Wireless telephone receivers. (18/5/22 France.)
13 383 Soc. FRANCAISE RADIO-ELECTRIQUE. Vibratory diaphragms. (20/5/22 France.)
13 394 A. B. ELSBURY. Detectors for radio-telegraph apparatus.
13 398 T. L. R. COOPER. Plug and socket couplings.
13 401 L. DARIMONT. Primary cells.
13 403 E. DOBSON. Switches.

Arrangements for the Week.

FRIDAY, JUNE 1st. (To-day.)

INSTITUTION OF ELECTRICAL ENGINEERS (WESTERN CENTRE).
Summer Meeting at Plymouth (June 1st–June 4th).

ROYAL INSTITUTION OF GREAT BRITAIN.
9 *p.m.* At the Institution, 21, Albemarle Street, Piccadilly, London, W.1. Lecture on "The Radiation of Light," by Prof. H. A. Lorentz.

MONDAY, JUNE 4th.

INSTITUTION OF RUBBER INDUSTRY.
At the Institution, Charing Cross House, London, W.C.2. Paper by Mr. W. S. Flight on "The Use of Rubber Products as Dielectrics."

BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION.
3 *p.m.* At the Mining Exhibition, Agricultural Hall, Islington, London, N. Paper by Prof. Douglas Hay on "Recent Electrical Developments in Coal Mining."

TUESDAY, JUNE 5th.

THE RONTGEN SOCIETY.
8.15 *p.m.* At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2. Annual General Meeting. Papers on "The Effects of X-Rays of Different Wave-Lengths on Animal Tissue," by Prof. Sidney Russ, and "The Establishment of a Definite Relationship between Exposure and Density in an X-Ray Plate," by Mr. T. Thorne Baker.

WEDNESDAY, JUNE 6th.

INSTITUTION OF ELECTRICAL ENGINEERS.
At the Institution, Savoy Place, Victoria Embankment, London, W.C. Lecture on "Wireless Direction-Finding in Steel Ships," by Mr. C. E. Horton.

FRIDAY, JUNE 8th.

DIESEL ENGINE USERS' ASSOCIATION.
At the Institution of Electrical Engineers. Paper on "Losses in Heat Engines and Means of Avoiding Them," by Engineer-Com. W. P. Sillince, R.N.

PHYSICAL SOCIETY OF LONDON.
5 *p.m.* At the Imperial College of Science, South Kensington, London, S.W. Lecture on "A General Solution of the Problem of Finding the True Vertical for All Types of Marine and Aerial Craft," by Prof. J. G. Gray.

INSTITUTION OF ELECTRICAL ENGINEERS.

SUMMER MEETING AT NORTH WESTERN CENTRE.

TUESDAY, JUNE 5th (Manchester.)

9 *a.m.* Visits to the electrically-driven rolling mill equipment of R. Johnson and Nephew, Ltd., Manchester, and the engineering works of Mather and Platt, Ltd., Manchester.
12.45 *p.m.* Civic reception by the Lord Mayor.
2.30 *p.m.* Visits to the Pilkington Tile and Pottery Works, the Chloride Electrical Storage Works, London, Midland and Scottish Railway power station, and the Lancashire Electric power station.

WEDNESDAY, JUNE 6th (Manchester.)

9 *a.m.* Visit *via* Manchester Ship Canal to Manchester Corporation's new generating station, Barton.
12.15 *p.m.* Visit to works of the Metropolitan-Vickers Electrical Co., Trafford Park.

THURSDAY, JUNE 7th (Liverpool.)

9 *a.m.* Visits to the British Insulated and Helsby Cable Works at Prescot, Liverpool Corporation Tramways, Lambeth Road Works, Automatic Sub-station (Walton), Lister Drive power station, and inspection of the Cunard Company's liner, s.s. *Scythia*.
2.30 *p.m.* Visit to Lever Bros., Port Sunlight, works of the Automatic Telephone Manufacturing Co., Liverpool Corporation Tramways, Lambeth Road Works, the Automatic Sub-station, Walton, and the Lister Drive power station. Alternative visits to the Mersey Power Co., Runcorn, United Alkali Company's power station, Widnes, the London, Midland and Scottish Railway, Southport Electrified Line.

FRIDAY, JUNE 8th (North Wales.)

11 *a.m.* Leave Llandudno for inspection of the hydro-electric power station and the works of the Aluminium Corporation, Ltd., Dolgarrog, the North Wales Power Company's hydro-electric power station, Beddgelert, and Lord Penrhyn's slate quarries, Bethesda.

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CONTENTS.

Notes of the Week	611	B.E.A. Annual Meeting	630
The Electricity Controversy in Victoria	613	E.C.A. President in Ireland	630
Notes on Wireless Matters. By Prof. G. W. O. Howe. Illustrated	614	Electricity Supply	631
Three-Phase Auto-Transformer Connections. By F. A. Dahlgren. Illustrated	615	Personal Items	631
Reviews	617	Foreign Notes	632
Railway Electrification in South America (Concluded). Illustrated	618	Imperial Notes	632
Institution of Electrical Engineers: Annual General Meeting and Report	621	Electric Traction	633
The Institution Summer Meeting	623	Wireless News	633
Parliamentary Intelligence	627	Profitable Hull Telephones	633
Glasgow All-Electric Flats. Illustrated	627	S.E. Lancashire Advisory Board	633
A New Vogue in Lighting Equipment. Illustrated	628	Companies' Reports, Dividends, etc.	634
I.E.E. Council Nominations	630	New Companies	634
I.E.E. Western Centre	630	Tenders Invited and Accepted	635
I.E.E. South Midland Centre	630	Forty Years Ago	635
Portable Wireless Publicity. Illustrated	630	Business Items	635
		Reference Index to Recent Wireless Publications	636
		Commercial Intelligence	637
		Prices of Metals, Chemicals, etc.	637
		Patent Record	638
		Arrangements for the Week	638

Notes of the Week.

The I.E.E. Summer Visit.

If the co-operation of the Clerk of the Weather can be secured the summer meeting of the Institution of Electrical Engineers, which opened at Manchester on Tuesday, is already assured of success. Nearly five hundred members and guests are attending, and an extensive and rather exhausting programme has been arranged. Perhaps the most interesting day was Wednesday, when visits were paid to the new Barton power station of the Manchester Corporation and the works of the Metropolitan-Vickers Electrical Co. at Trafford Park. But some of the other visits were even more instructive, as they indicated how the use of electrical equipment is of economic advantage to manufacturers of iron, steel and textiles. The mills of the Dunlop Rubber Co. at Rochdale and the works of Richard Johnson and Nephew are cases in point. The former is a mill which has been electrically driven from the beginning, not, as is usual, converted from steam operation. The fullest use of the flexibility of electrical methods has therefore been possible, and should have a good effect on the production. From the nature of the case the output of a wire mill may have a poor load factor, and the electrical drive which gives a relief from the standing charges inseparable from steam plant is therefore worth consideration, while the nature of the load itself makes its advantages more conspicuous. But in the broader way electrical engineers may learn much from these visits, as the interest of the processes themselves is intrinsically high, and they show what is being done in other trades to secure greater and more economic production. At Trafford Park and at Mather and Platt's works visitors were, of course, at home, but the lesson of the other visits must not for that reason be lost.

Silvanus Thompson.

The more than usually large attendance at the annual general meeting of the Institution of Electrical Engineers on Thursday of last week was not due to anything unexpectedly novel in the proceedings (though a surprise was sprung in the course of the evening), but was due to a desire to pay a tribute to a personality unfortunately no longer with us. Silvanus Thompson was not only an electrical pioneer, not only a past-president of the Institution, he was a teacher of the young idea, a lambent flame which lighted many an inspiration, and there are not many electrical engineers living to-day who owe nothing to his wisdom and his mode of expressing it. "The true university to-day," said Carlyle, "is a collection of books." Thompson realised the truth of that statement and set an example which it would be well were it more universally followed. Partly by happy chance and partly by the enterprise of a committee of which Mr. W. M. Mordey was the moving spirit, Thompson's unrivalled library has now become the property of the Institution. We say unrivalled, not only because it contains volumes which are no longer easily obtainable, but because its collection was a labour of love, and upon it is impressed the touch of a wonderful human spirit. It is with books, in fact, that Thompson's name will always be indissolubly connected. His elementary work, known the world over as "E. & M.," is a classic, a model which has been followed, not always successfully, many and many a time. In no better way, therefore, could Thompson's name be kept alive than by the constant care and the constant use of the books he has left behind him.

A Pleasant Surprise.

The President had a pleasant surprise for those who waited after the presentation of the Thompson library and portrait and bust to conduct the formal business of the annual general meeting. It will be remembered at a

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lengthy and rather heated meeting some two years ago it was agreed to increase the subscriptions of all classes of members of the Institution. But Mr. W. R. COOPER succeeded in inserting a qualifying clause which made it necessary that the matter should be reconsidered this year. The council have done this with results satisfactory to members; and the subscriptions of all classes of members which were then raised are now to be reduced by corresponding amounts. The final position is that from January 1st next the subscriptions will be very little above pre-war level. In adopting this course the council have taken some risks. Large sums for the repayment of the loan on the building have to be met each year; adequate contributions to a sinking fund for the same purpose are necessary; salaries are quite rightly an item which is not likely to decrease; and the "Journal" remains a burden which is not likely to be lightened by recent methods which the council have thought wise to adopt. Whether the reduced subscriptions are justified or not financially depends, therefore, on the rate at which new members are recruited. This rate, though less than it has been, is still satisfactorily high. Still it is not realised, as it should be, that the more representative the institution, the more powerful it must be. It should be the duty of all those connected with the profession and industry to enter the appropriate class of membership. Its prestige is already high, but it could well be increased.

The Institution—The New Council.

THE official nominations for the vacancies on the Council of the Institution of Electrical Engineers which occur on September 30th next have, in accordance with the by-laws, to be in the hands of members not later than May 31st. They therefore reached us too late to be dealt with in last week's issue, and a week of publicity during which other nominations might have been made has been lost. This may seem a small matter. It will be argued that groups of members who wish to make fresh nominations will, if they have not already come together for the purpose, have received their papers on the statutory date, and that no hardship is caused by the deferment of a wider publicity to the following week. But in matters of this kind the Press has considerable influence, and a determination or otherwise to make additional nominations may well be consolidated by the comments of those who are able to take the broadest view of the question. We do not suggest that any injustice has been done, but in keeping back publication of the names to the latest possible date, and so, no doubt unintentionally, delaying comment upon them, the Institution has shown itself once again rather out of touch with modern methods of procedure. Next year, thanks to the calendar, matters will be different.

The President-Elect.

IN nominating Dr. ALEXANDER RUSSELL as president in place of Mr. FRANK GILL, the Council have followed the precedent of last year, when a member who had been but was not then a vice-president was raised to the premier position. Dr. RUSSELL has been a vice-president, and is now on the Council, so that he is more favourably placed than was Mr. GILL as regards the conduct of business. In Mr. GILL'S case this disability had no obvious drawback, and if Dr. RUSSELL is as successful as his predecessor in the chair he will do well. The president-elect's appointment is an interesting "throw-back" to the days when teachers of the young electrical engineer were familiar figures in the presidential chair. In late years those engaged more or less closely with the conversion of that early won knowledge into pounds, shillings and pence have almost invariably occupied the chair, but it is only necessary to mention the names of AYRTON, PERRY, SILVANUS THOMPSON and KAPP to remind our readers that no new ground has been broken by nominating Dr. RUSSELL. Frankly, we are glad to see an educationist in the presidential chair. The development of the profession and industry depends on more and more knowledge, and methods by which that knowledge can best be acquired demand earnest consideration. Dr. RUSSELL'S experience should be most valuable in bringing about a solution of these vital problems. We wish him every success.

The Nominations Considered.

OWING to the new by-laws, the list of nominations to the other vacancies on the Council is shorter than usual. Sir JAMES DEVONSHIRE relinquishes the honorary treasurership to become a vice-president, all the other vice-presidents except Dr. ECCLES remaining in office. Mr. P. D. TUCKETT, who has already served a term on the Council, takes Sir JAMES'S place as honorary treasurer. The vacancies among the members on the Council caused by the retirement of Sir WILLIAM NOBLE, Dr. A. RUSSELL and Messrs. P. V. HUNTER, A. H. W. MARSHALL, and C. VERNIER, are to be filled by the nomination of Col. T. F. PURVES, Capt. J. M. DONALDSON, Prof. W. M. THORNTON and Messrs. G. W. PARTRIDGE and P. ROSLING. Of these, Prof. THORNTON and Mr. PARTRIDGE have already served on the Council, the latter quite recently as vice-president. In the main, the Council are to be congratulated on their list. Supply has two nominees, and manufacturing, telephony and telegraphy, and education one each. The present representation is therefore not disturbed, except that wireless loses its one non-official representative in Dr. W. H. ECCLES. Mr. S. W. MELSOM is nominated to replace Mr. A. W. TAIT among the associate members and associates on the Council. We shall be interested to learn whether any other nominations are to be made. Any action of this kind on the part of members would at least indicate their interest in the doings of the Council, and make it what it should be, a body truly representing the members and the profession.

A Lead from Lancashire.

THE South-East Lancashire Electricity Advisory Board have now become a statutory authority, Parliament having confirmed the Order constituting the Board made by the Minister of Transport upon the recommendation of the Electricity Commissioners. It will be remembered that the Commissioners held an inquiry into this scheme in January, 1922, and put forward a statement of their conclusions and decisions in the following April. An order constituting the District and establishing the Advisory Board was published in February last. This decision has been arrived at in face of much well-founded criticism that a Joint Authority would be better than an Advisory Board, but the electricity authorities concerned, being unanimous on the subject, won the day. They will have to operate the area, and their decision will before long be justified or otherwise by their works. As a matter of fact the Board have already done useful work in formulating regulations for charging for bulk supply, and they will in future exercise control over all new plant and extensions to ensure that they are in accordance with the agreed technical scheme. On the face of it their powers are not very different from those of a Joint Authority, but it is upon such seemingly unimportant things as names and constitutions that Empires have been wrecked. Incidentally, through getting to work much later than many other areas the South-East Lancashire Advisory Board are the first authority to be set up as the result of the recent legislation for reorganising the electricity supply industry. They are, therefore, to be congratulated.

Progress in Industrial Lighting.

Mr. LEON GASTER recently read a paper reviewing progress in industrial lighting, and dwelling more particularly on the work of the Home Office Departmental Committee on Lighting in Factories and Workshops, which issued three reports, in 1915, 1921 and 1922. Much of the paper was concerned with the relation between inadequate lighting and accidents—the latter term being used to denote not only accidents to persons, but also mistakes in the execution of work, mishaps to plant and other similar matters. A

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new outlook was also illustrated in the lecturer's efforts to trace the relation between bad lighting and "industrial fatigue." People are too apt to assume that the primary result of poor lighting is damage to eyesight, an effect which no doubt exists, but which is difficult to trace with precision owing to the variety of other factors which enter into the problem. There is, however, little difficulty in showing how insufficient light, glare or inconvenient shadows contribute to industrial fatigue and experience has shown that it is mainly when workers are below par that accidents occur and costly spoilage of work is liable to take place.

Illumination and Output.

Mr. GASTER quoted many interesting recent researches to show the direct relation between conditions of illumination and output, and pointed out that the cost of good lighting is small, usually less than 1 per cent. of the wages bill. Others who joined in the discussion contributed corroborative evidence in regard to the relation between bad lighting and the quality of work, and the general tendency was to advocate detailed legislation, on the lines prescribed in American codes. Mr. GASTER, as usual, was in favour of moderation, and this strengthened his case for the inclusion in the Factory Acts of a provision requiring good lighting, based on the moderate recommendations of the Home Office Committee. He was also able to show by many effective pictures of typical modern lighting installations that these recommendations can be easily complied with. It was therefore gratifying to receive from Sir MALCOLM DELEVINGNE, assistant Under Secretary of State, Home Office, who presided, an assurance that such a provision will be included in the next Factory Act.

Gas and Gaiters.

HOWEVER joyous the occasion, a note of sadness is always to be heard by the attentive among all the jubilations. The opening of Lyons and Co.'s New Corner House (which incidentally is not at a corner) is no exception to this rule. All the cooking in what we are led to believe is the most modern of modern enterprises in the restaurant business is to be done by gas, and we are informed by the Gas Light and Coke Co. that gas is therefore the fuel of the future, and that Lyons' Corner House is up-to-date in every respect. We object to both statements. Gas may be the fuel of the present, but we can hazard a shrewd guess as to what the fuel of the future will be. To be up-to-date in the true rather than in the literal meaning of the term means to be in front of and not among the common ruck. Twenty years ago it was up-to-date to ride in a motor car, but few people were doing it. The majority, the Lyons of their time, were drawn by horses. To-day it is up-to-date to use electricity for cooking. The Lyons use gas. Incidentally we note that at this new establishment as much gas is used as in a town of 10 000 inhabitants, and that every year the firm use as much gas as Walsall, a town of 100 000 inhabitants. This is rather a testimony to the energy of the Walsall electricity undertaking, and we congratulate Mr. HOWIE on the fact that his enterprise has been recognised by the gas interests.

Electrical Hot Water.

WE hope that Lyons and Co.'s action will be a stimulant to those who are working out the problem of how best to provide electrical hot water for the house. It should be a stimulant, for electrically provided hot water is not going to stop with the house, and its extension to restaurants and hotels is therefore only a question of time. The reason for this is clear. Given well-designed and efficient apparatus, to obtain hot water electrically is even more attractive to the large establishment than to the small. The demands for hot water are greater and are spread more continuously over the day. The load on the station will be greater, and this greater demand should be reflected in the tariff. The labour costs will be reduced, and there will be less dirt. The clients will be better served, as there will be always hot water, which is by no means usual at present. For all these reasons the electrical industry requires a device for obtaining hot water which can be made and marketed with confidence, and we look to our readers to provide this. We remind them that the last day for sending in designs is June 29th.

The Electricity Controversy in Victoria.

The controversy over the extended powers demanded by the State Electricity Commission of Victoria shows no sign of abating, and the friction engendered among the friends of electrical progress is calculated to have a prejudicial effect upon the supply industry. The Bill to confer additional authority upon the Commission is being opposed by the existing municipal undertakers, headed by Melbourne Corporation.

The Commissioners' Ambition.

Originally called into being as an administrative authority for co-ordinating and unifying the systems of supply in the State, the Commission rapidly developed a desire to become generators and suppliers in bulk of electricity. This ambition was gratified in 1920, and now it wishes to go still further and engage in the retail distribution of electricity in any part of the State except in Melbourne and within 25 miles of the city. This exception is, apparently, for the purpose of placating the Corporation of Melbourne, though in view of the general attitude of the Commissioners and of their definition of bulk supply, it is doubtful if the opposition can be bought in this manner.

A Definition of Bulk Supply.

Recently the Commission defined bulk supply as "either an unusually large supply to a single consumer, or a supply to a distributing authority, such as a municipal council or a private corporation." If this elastic and unusual definition were acted upon the Commission could supply the principal consumers in Melbourne itself, and thus ruin the prosperous electricity undertaking of the Corporation. We are not, therefore, surprised that all undertakers are suspicious of the acts of a body which could contemplate such a flagrant breach of the 1920 Electricity Act.

Loan Periods Too Long.

It is not only in connection with the exercise of its administrative powers that the policy of the Commission can be challenged. It has fixed periods for the repayment of loans raised for its Morwell brown coal scheme which are not, we believe, justified by engineering practice or by the facts of the case. For the power house, terminals and sub-stations it has allowed 25 years, for the transmission line 40 years, and for h.t. underground mains 50 years. In this country only 15 years are usually granted for repaying municipal loans for generating sets and 20 years for converting plant and switchgear, though 30 years are conceded for substantial buildings. The period for overhead lines is 25 years in this country, for mains laid in an approved manner 40 years, and for approved mains drawn into conduits 30 years.

The British practice, which is the outcome of a long experience, is based on the average useful life of the various items, and is generally accepted as being more or less consonant with facts. It will be noticed that the Victorian figures are substantially higher and will, therefore, enable the Commission to escape, for some years at least, with lighter demands for capital and depreciation charges.

In this way it will enable it to show an artificial appearance of prosperity and to sell electricity cheaper than it could if prudent financial practice were followed. We are not unacquainted with these devices, for in the early days of electricity supply several British local authorities, including the London County Council, borrowed money for 42 years. With British experience to guide it, there is, therefore, no justification for the position taken up by the Victorian Commission.

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Notes on Wireless Matters.

By Prof. G. W. O. HOWE, D.Sc.

The Radiation of Wireless Waves.

In a letter published in THE ELECTRICIAN of April 27th, Mr. L. B. Turner, in criticising a previous article of mine with the above title, makes the following remark: "With regard to an explanation of the radiation from the aerial, Prof. Howe does not attempt here what, he says, Sir Oliver was attempting—viz.: 'to make a complicated phenomenon clear to the non-mathematical reader.' He describes the cycle of events *if* the oscillation is accompanied by loss due to radiation of energy. A satisfactory non-mathematical picture of the flicking-off process is, in my opinion, still to seek and urgently wanted."

Removing a Reproach.

The present article is an attempt to remove this reproach and to present a reasonably simple explanation of the process of radiation. It is not entirely non-mathematical, because it is intended to give a quantitative as well as a qualitative solution of the problem.

The high-frequency current in the aerial consists of a rapid backward and forward movement of the free electrons

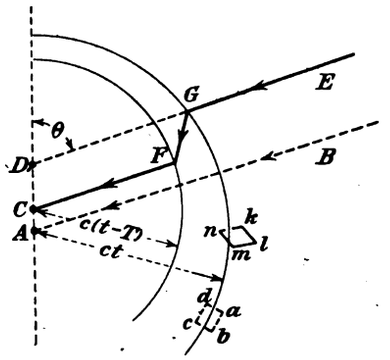

FIG. 1.

in the wire, that is, of small negative charges of electricity which have temporarily broken away from the atoms, and moving about between the atoms, are exposed to the directive effect of an applied electric force. Although the number of electrons involved is enormous—a current of 1 A representing the passage of no less than 6 450 000 000 000 000 000 electrons per second—the total radiation is the summation of the effects of all these electrons, and it simplifies matters if we fix our attention upon a single electron, and consider the radiation due to its movements. An isolated electron in space would have a radial electric field directed towards it; the atom from which the electron has been removed has an equal positive charge, and, if it were isolated in space, it would have an equal radial field, but directed outwards. Although when the electron joins the atom and makes it neutral, the external field vanishes, it is helpful in some cases to picture the two equal and opposite radial fields as co-existing in space.

Sub-heating Stopping an Electron.

If an electron be moving upward along the dotted line in Fig. 1, with a uniform velocity v, small compared with the velocity of light which we shall call c, its radial field will move with it. Now just as it arrives at A let its velocity be decreased so that it comes to rest at C, and let the deceleration be uniform, so that the average velocity between A and C is $v/2$, then if the time taken from A to C is T, the distance $AC = vT/2$. Let us now consider the state of affairs in the surrounding space at a time t after the arrival at A, and therefore a time $t-T$ after reaching C. Any electromagnetic disturbance is propagated through space at the velocity c,* and if a sphere be drawn about the point A as centre with the radius ct, its surface represents the boundary beyond which it cannot yet be known that the electron has ceased to move upward with the uniform velocity v.

Hence outside this sphere the lines of electric force will radiate from the point D at a distance vt from A, since this is the point which would have been reached at this moment, had the electron continued its original motion.

Result of the Stoppage.

The further fact that the electron has come to rest at C will be known everywhere within the sphere of radius $c(t-T)$, about the point C as centre, and within this sphere the lines of force will radiate from C. In Fig. 1 we consider a single line of force represented by AB at the moment of arrival at A; t seconds later it will be represented by the broken line $CFGE$. The kink FG is travelling outwards with the velocity of light, and becoming steeper as it goes, because the point D is travelling upward with the velocity v.† This is true in every direction, and we see that the result of the stoppage of the electron is to send through space with the velocity of light a spherical shell within which a tangential electric force is superposed upon the normal radial field. This is what happens when an electron strikes the target of an X-ray bulb.

From Fig. 1 it is easy to show that if q be the charge of the electron, r the mean radius of the shell at the moment considered, and E_t and E_r, the tangential and radial components of the electric field, then

$$E_t/E_r = \frac{CD \sin\theta}{cT} \text{ and since } E_r = \frac{q}{r^2}$$

$$E_t = \frac{1}{c^2} \cdot \frac{q}{r} \cdot \frac{v}{T} \sin\theta.$$

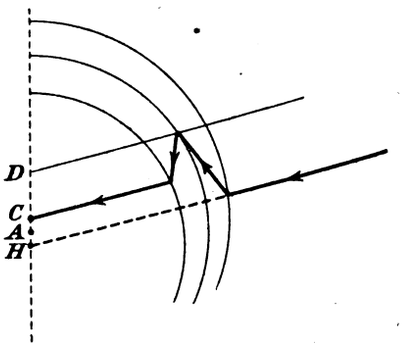

FIG. 2.

If in the neighbourhood of the electron there is an equal positive charge at rest, its radial field will be equal and opposite to the radial field of the electron, neutralising it at distances which are great compared with the separation of the two charges. At such distances the spherical shell will carry merely the tangential component of the electric field, and this we see is proportional to the charge q, to the acceleration or deceleration v/T and inversely proportional to the distance r.

The Dual Nature of the Wave.

So far we have only considered the electric field, but it is not difficult to see that the spherical shell must also carry a horizontal magnetic field equal in strength at every point to the tangential electric field. This is perhaps best seen by considering the path around *abcd*; since the side *cd* lies in the electric field there is an electromotive force around this closed path which must be associated with a

* This assumption may be regarded by some as begging the whole question, but in the writer's opinion it is a justifiable assumption.

† The radial component of the field falls off as the square of the distance, whereas the tangential component falls off as the distance, hence the resultant must become more and more tangential as the distance increases.

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changing magnetic flux through the area as the front of the shell sweeps over it. Similarly, by considering a path *klmn* through which the advancing electric field produces a dielectric current, we see that there must be a magneto-motive force around the closed path. By combining these two fundamental laws of electrical engineering it can be shown that $H=E$ and that the wave must advance with the velocity of light.

Knowing H and E at every point in the spherical shell and knowing that the electric and magnetic energies per cub. cm. are equal to $E^2/8\pi$ and $H^2/8\pi$ respectively, it is a relatively simple matter to calculate the total energy

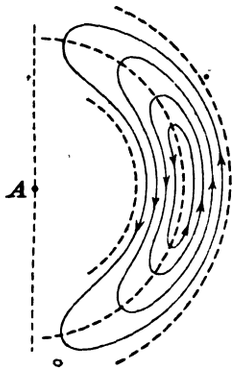

FIG. 3.

radiated in the whole spherical shell. It is found to be $\frac{2}{3}\cdot\frac{1}{c^3}\,q^2\,\frac{v^2}{T}$ ergs, and since this was radiated uniformly during the time T, the rate per second is $\frac{2}{3}\cdot\frac{1}{c^3}\cdot q^2\left(\frac{v}{T}\right)^2$, or writing the acceleration in the form dv/dt, the radiated power $=\frac{2}{3}\cdot\frac{1}{c^3}\cdot q^2\left(\frac{dv}{dt}\right)^2$ ergs per sec.

Electron Assumed at Rest.

If, instead of starting from the assumption of an electron moving upward with uniform velocity, we go back a moment and assume that the electron was at rest at H (Fig. 2) and was then first uniformly accelerated from H to A and then brought to rest as before, we obtain Fig. 2 instead of Fig. 1. The acceleration produces a shell of electric force in one direction, whilst the deceleration produces a similar shell of force in the other direction, each accompanied by its appropriate magnetic field. If now the electron moves continually backward and forward, successive shells of electric force in alternate directions will be sent out. If the oscillations are harmonic, the variation of field strength will be harmonic; since it is proportional to the acceleration of the electron. If the total travel of the electron is l and the frequency $\frac{\omega}{2\pi}$ the formula for E (we need no longer use the suffix t) becomes

$$E_{max}=H_{max}=\frac{1}{c^2}\cdot\frac{q}{r}\cdot\frac{\omega^2 l}{2}\sin\theta,$$

and the average rate of the radiation of energy

$$=\frac{q^2l^2\omega^4}{12\,c^3}\text{ ergs per second.}$$

It is seen that for a given charge with a given amplitude the radiated power is proportional to the fourth power of the frequency.

The positive charge will neutralise the radial field in Fig. 2 and leave only the tangential component within the spherical shells; outside these shells there will be no field at distances great compared with HAC. The actual nature of the electric field sent out by the electron moving from H to C will be as shown in Fig. 3. Over the surface of the middle sphere it will be noticed that there is a certain radial field remaining; this can be explained from Fig. 2, but we do not propose to go into this point here.

Hertzian Oscillator.

We can now consider a Hertzian oscillator in which large numbers of electrons rush backwards and forwards in a wire charging the end capacities alternately in opposite directions. If the current i is in amperes and the charge q in electrostatic units (Fig. 4)

$$i=\frac{10}{c}\frac{dq}{dt}\text{ and if }q=Q_{max}\sin\omega t,$$

$$i=\frac{10}{c}\omega Q_{max}\cos\omega t\text{ and }I_{max}=\frac{10}{c}\omega Q_{max}.$$

It will be noticed that in this case when the charge is $-Q_{max}$ at one end, it is $+Q_{max}$ at the other, and *vice versa*, as if there were a negative and a positive charge oscillating in opposite phases. This so-called dipole will give twice the field strength and four times the radiated energy of the single oscillating charge considered above; hence

$$E_{max}=H_{max}=\frac{1}{c^2}\frac{Q_{max}}{r}\omega^2 l\sin\theta$$

$$=\frac{\omega}{10c}\cdot\frac{l}{r}\cdot I_{max}\sin\theta$$

and the average radiated power

$$=\frac{I^2_{max}\,l^2\omega^2}{300c}\text{ ergs per sec.}$$

Antenna with Large Upper Capacity.

This may be regarded in the usual way as the upper half of a Hertzian oscillator of length $l=2h$ (see Fig. 5). Hence

$$E_{max}=H_{max}=\frac{2\omega h I_{max}}{10cr}\sin\theta$$

$$=\frac{4\pi}{10}\cdot\frac{h}{\lambda}\cdot\frac{I_{max}}{r}\cdot\sin\theta\text{ since }c=f\lambda=\frac{\omega\lambda}{2\pi}.$$

and the average radiated power

$$=\frac{I^2_{max}\cdot 4h^2\cdot\omega^2}{600\cdot c}\text{ ergs per sec.}$$

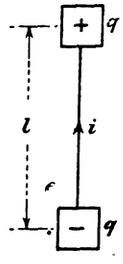

FIG. 4.

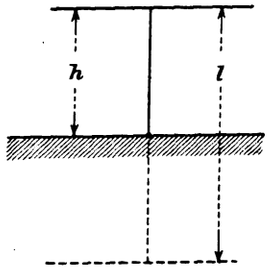

FIG. 5.

since power is only actually radiated from the upper half of the fictitious Hertzian oscillator. This may also be expressed as

$$792\left(\frac{h}{\lambda}\right)^2 I^2_{max}\text{ W}$$

$$\text{or }1\,584\left(\frac{h}{\lambda}\right)^2 I^2\text{ W}$$

where I is the R.M.S. value of the aerial current.

It is a small step from this to any other type of aerial, and we feel that we have carried this far enough to enable anyone who has followed the argument to apply the formulæ to other cases. We doubt if it is possible to explain the phenomena more simply while retaining the quantitative values of the different magnitudes involved. We have developed the practical radiation formulæ, such as are employed by the radio engineer, from fundamental principles by methods which do not make very great demands on one's knowledge of mathematics or electrical theory.

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Three-Phase Auto-Transformer Connections.

The Relative Advantages of Possible Arrangements.

By F. A. DAHLGREN.

The use of auto-connected transformers is restricted to cases where the primary and secondary systems need not be electrically insulated from each other. Auto-connection is only advantageous when the ratio of transformation does not depart much from unity, very little benefit being derived when the ratio is greater than 3 or 4 to 1.

The purpose of this article is to discuss the relative advantages of various methods available for the connection of three-phase auto-transformers, and to give formulæ and curves relating to each method.

The advantages of auto over double-wound transformers may be summarised under three headings:

(1) For given output and voltages, an auto-transformer needs less active material and is consequently cheaper.

(2) The losses will be lower and the efficiency higher in auto-transformers, in consequence of the smaller amount of active material.

(3) For the same reason the ohmic and inductive drops are reduced by auto-connection.

For three-phase auto-transformers several methods of arranging the windings and tappings are available, and the

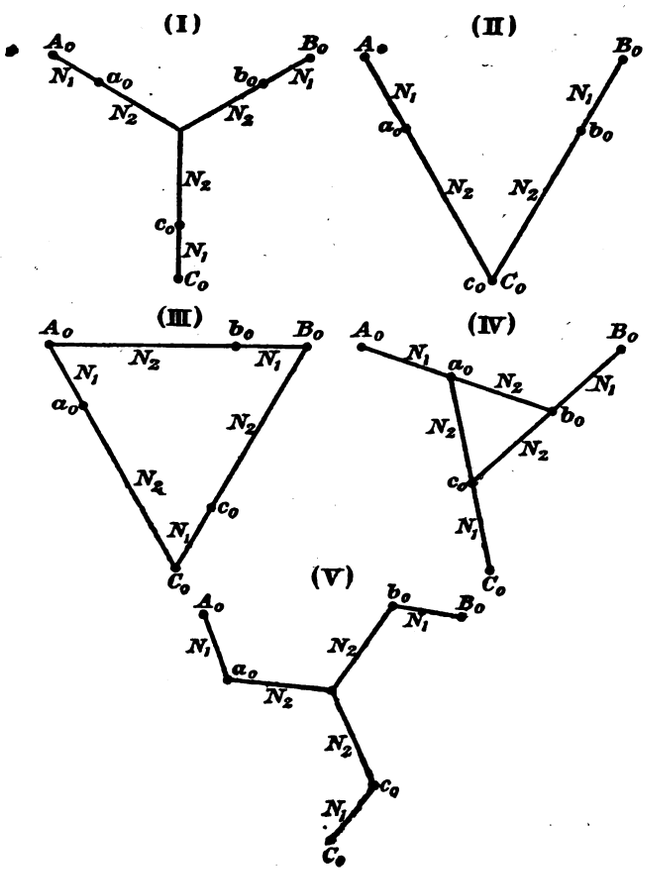

FIG. 1.

most suitable should be chosen according to the requirements of each particular case. The economy obtained under the three headings given above varies in each case.

The most important three-phase auto-transformer connections are given by the diagrams in Fig. 1.

In these diagrams the high-tension terminals are denoted by $A_0\ B_0\ C_0$, while the low-tension terminals are denoted by $a_0\ b_0\ c_0$, irrespective of which is the primary and which is the secondary. N_1 and N_2 denote the number of series turns in the sections of the phase windings.

The diagrams, which are drawn as potential vector diagrams, show that in cases III, IV, and V, the secondary voltages are subject to a phase displacement with regard to the primary voltages, this displacement being a function of the ratio of transformation. In the case of connection II, the primary and secondary neutrals are not coincident. These points must be kept in mind when transformers of this description are designed for parallel working.

Simplest Method of Connection.

The simplest way of connecting a three-phase auto-transformer is in accordance with diagram I, but cases occur when this method is not satisfactory. As an example, consider the case of a transformer connected to a system whose neutral is earthed somewhere in the primary or secondary network, while the neutral of the transformer is insulated. Should any point of the transformer windings be earthed, the current to earth through the fault will meet a high impedance in the two undamaged phase windings, resulting in small extra currents in all phases. The working of automatic releases will be rendered doubtful and the potential disturbances will in consequence be large. In such a case any of the connections II, III, IV or V would be preferable, since the extra currents will be approximately balanced in all phases.

It should be noted that a three-phase core must be used for connection II, the unwound leg acting as a return path for the symmetrical three-phase flux. This leg may be utilised by providing it with a magnetising winding.

It will be evident that connection III can only be used when the ratio of low tension to high tension voltage is equal to or greater than $\frac{1}{2}$.

When the neutral point must be available for earthing purposes, the only suitable connections are according to diagrams I and V. It must, however, be noted that these connections do not make it possible to take out unbalanced load between phase and neutral without disturbing the balance of ampere turns in the windings, except in the special case of connection V, when the transformer is used for stepping up the voltage and ratio of turns is $\frac{N_2}{N_1}=1$, i.e., the ratio of voltages is $\frac{1}{\sqrt{3}}$. Even when this is not exactly the case, connection V gives better results than connection I so far as taking out load from the neutral point is concerned. The above statements only hold, of course, when the neutral of the transformer is not connected to the neutral of the supply.

For design purposes we need to know the economy and voltage drops relating to these various connections. We introduce therefore the following symbols.

Let x = ratio of turns $\frac{N_2}{N_1}$ (see Fig. 1).

" r = ratio of open circuit voltages, low tension to high tension, both being measured to neutral, or both between lines.

Let s = ratio of actual internal kVA in the auto-transformer in all windings, to twice the number of output kVA. This ratio is identical with the coefficient of reduction in size due to auto-connection.

The ohmic and inductive drops (expressed in percentage of the full voltage) for an auto-transformer, are equal to S times the corresponding quantities for the same transformer when used as a double-wound transformer with the same load in copper and in iron, and with correspondingly lower output. The truth of this is sufficiently obvious so far as the ohmic drop is concerned, and it can be shown to be true for the inductive drop. Consequently the inductive drop for an auto-transformer is most simply obtained by treating the transformer as double wound and multiplying the figure so obtained by S.

The no-load current, expressed in percentage of full-load current equals S times the no-load current for the same transformer used with separate windings.

A geometrical treatment of the voltage and current diagrams for the various methods of connections shown on

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Fig. 1 gives the following formulæ for the quantities X and S as functions of the ratio r:

Connection.	$x=$	$s=$
I and II	$\frac{r}{1-r}$	$1-r$
III	$\frac{1+2r^2+\sqrt{12r^2-3}}{2(1-r^2)}$	$\frac{1-r^2}{r\sqrt{3}}$
IV	$\frac{3r+r\sqrt{3}\sqrt{4-r^2}}{2(1-r^2)}$	$\frac{\sqrt{4-r^2}-r\sqrt{3}}{2}$
V	$\frac{r^2+r\sqrt{4-3r^2}}{2(1-r^2)}$	$\frac{\sqrt{4-3r^2}-r}{2}$

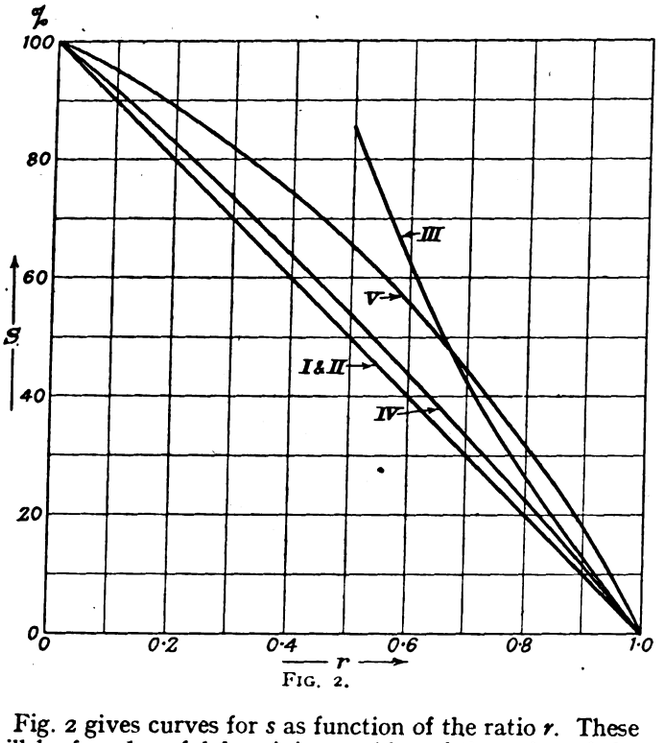

FIG. 2.

Fig. 2 gives curves for s as function of the ratio r. These will be found useful for giving an idea of the value of the various connections so far as losses and economy of material are concerned.

Reviews.

Alternating Current Electrical Engineering. Second Edition. By PHILIP KEMP, M.Sc. (London: Macmillan and Co.). Pp. xi. + 515. 17s. net.

The first edition of this book appeared in 1918, and the fact that a new edition was called for in three years proved its success. The standard set by the author is the A.C. Paper of Grade II of the City and Guilds Examination, and the book is also intended as a preparation for B.Sc. Examinations. It must, of course, be borne in mind that the individual City and Guilds examinations are less general in character than ordinary university examinations. In order to gain a technological certificate, a candidate must show evidence of specialised knowledge within the range of a definite syllabus. Judged from this standpoint there are places where Mr. Kemp has been too meagre in his treatment. For example, what he has to say on high-resistance, low-loss steel is poor in the extreme. On the other hand, there are parts, such as the section on wave forms, which practically tell the reader all he needs to know about the particular subject. In the main, however, it may be said that the author has fulfilled his intention.

The earlier chapters deal with the properties of a.c. circuits in an admirable manner, though we shall permit ourselves to complain of the stepmotherly treatment granted to the unbalanced three-phase circuit—it is not even proved how easily the power can be measured in such a system. The author regrets the inferior mathematical attainment so commonly met with, and attempts to encourage the student by putting applications of the calculus in footnotes. But really, Mr. Kemp, this is unnecessary! If a reader is sufficiently intelligent to master the contents of your book, a very short period would suffice for him to digest the few simple rules necessary for the mathematical part. Indeed it is really a kindness to make the reader learn elementary mathematics—the old bogey of a.c. work being hard because of the calculus has had far too long an innings. And if we are to admit that the elements of the calculus are too hard for Grade II candidates, what are we to say about the mathematics needed by the poor devil one stage further on, when he comes to be examined on transients, short-circuit and switching phenomena and such-like problems.

We like the chapter on instruments—the author shows his appreciation of the importance of wattmeters and oscillographs in a.c. working.

When we come to the section on machines, we find a few oddities mixed up with a lot of good matter. Such places generally indicate that the author has not kept up to date on all points. This we know is a harsh statement in every way, but we cannot allow, for example, his "reversed poles test" of alternators to pass unnoticed. This test has been satisfactorily dealt with years ago. Also to refer to the output coefficient as empirical is not the right way to teach students. By all means let us give credit to Esson for discovering this relationship empirically, but its scientific basis is now well understood.

There is a new and useful chapter on a.c. protective devices, which gives a fairly good resumé of this wide subject. Also the importance of matters such as power factor improvement and rectifiers is appreciated. We have said enough, however, to show what we think of the book. It is probably the best book there is of its kind, and this makes it all the more regrettable that certain items are inadequately treated. A few well-chosen references would do much to remedy this defect, but unfortunately remarkably few are given. Our last word, however, is one of praise and recommendation.

S. PARKER SMITH.

Maintenance and Repair of Electrical Measuring Instruments. By H. G. YARRILL. (London: Percival Marshall & Co.) Pp. 78. 2s. 6d. net.

Although purporting to cover electrical measuring instruments in general, only ammeters, voltmeters and wattmeters are actually dealt with, except for a few lines on the subject of the maintenance of graphic instruments. That "a little learning is a dangerous thing" is evidently not the view taken by Mr. Yarrill, who, with the help of four pairs of pliers, a watchmaker's eyeglass, five other implements and six pages of "hints," is ready to turn out the complete instrument repairer.

On p. 29 we are told that "on alternating current a moving iron ammeter is generally within 2 per cent. of its continuous current values." This is certainly true, but in the case of any self-respecting ammeter the figure could be halved and still be well within the mark. On p. 59 the statement is made that "the usual method now adopted by manufacturers is to state a certain limit of accuracy as being within so much per cent. B.S.C. (British Standards Committee)." Apart from the fact that the British Standards Committee has long ceased to exist, it is not clear what kind of a thing a "per cent. B.S.C." really is.

Incidentally, is not the following rather hard on the reader who has followed the author diligently through 53 pages—"Don't leave meters lying about anywhere; that *other* silly chap will be sure to barge into them and do some damage"? (The italics are the reviewer's.)

Useful advice is given as to the selection of suitable ranges, and the reader is rightly warned, on the one hand, against fixing the maximum reading of an instrument too high, and, on the other, from selecting too low a minimum range in the case of a multi-range instrument. The explanation of the action of induction instruments, as depending upon the "peculiar shape" of the metal disc, is unfortunate, seeing that the sole object in view in shaping the disc is to even out the scale divisions, which would otherwise follow a "square law."

The illustrations, on the whole, are clear, but are marred in several instances by unnecessary and apparently meaningless lines, and by the showing in full of parts which are actually hidden by other parts. This kind of "X-ray" drawing, which seems to run throughout the book, spoils what would otherwise be helpful sketches. The general get-up of the book is good, and to anyone with little or no knowledge of even the simplest forms of ammeters and voltmeters it should prove useful.

K. E.

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Railway Electrification in South America.

(*Continued from page* 568.)

The equipment of the track consequent on the electrification of the Buenos Ayres suburban lines contains some interesting features. The conductor rail is of steel, weighing 86 lb. per yd., and is laid in 40 ft. lengths. The electrical resistance is approximately 6.7 times that of copper of equal volume. The insulators are of Doulton's single-shed round porcelain, the caps and clips being of malleable cast-iron. The bonds are of the British Insulated and Helsby Cable Co.'s solid head and pin type, and the sectioning gear is of the English Electric Co.'s 800 V remote operated type.

Track Bonding.

The track rails are used throughout for the return circuit of the traction current. The joints on the main-line track are bonded with two copper bonds of the ribbon type, with solid heads giving a total cross-section of ½ sq. in. of copper. To reduce the risk of loss by theft, the bonds are fixed under the fishplates. This involved the provision of new fishplates with sufficient clearance for the bond between the plate and the web of the rail. The two rails of each track are cross-connected every 100 yds. with stranded copper bonds carried in wooden trough fixed to the sleepers. Adjacent tracks are cross-bonded every 100 yds. At the Once terminus, the rails are used for track circuiting with alternating current. To permit of the same rails being used as a path for the traction current, impedance bonds are placed at the ends of the track-circuiting sections. These bonds, consist of heavy choke coils contained in oil-filled cast-iron cases which are placed between the sleepers.

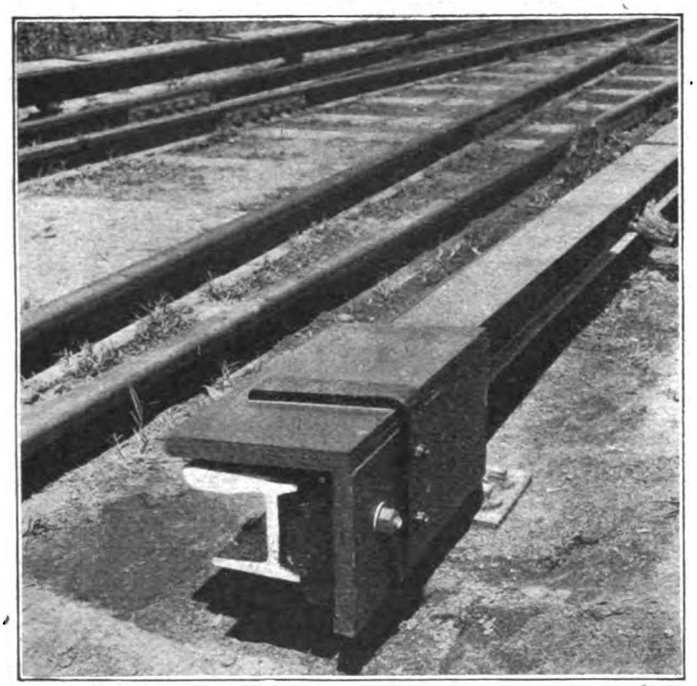

FIG. 7.—CONDUCTOR RAIL SHOWING ARRANGEMENTS FOR PROTECTION.

Conductor Rail.

The form of conductor rail with its protection is shown in Fig. 7. This arrangement occupies the minimum space consistent with proper clearance, and it also permits of complete insulating covering. The fishplates are single, and are applied to the back of the rail, the bolt head being countersunk in the web to leave a free passage for the toe of the skate. Two bonds with solid plug-heads are fixed under the fishplate, giving a cross-section of 0·33 sq. in. of copper at each joint. Where gaps occur the rails finish off with cast-steel ramps 5 ft. long, shaped to guide the skate into position without jarring. The rails and ramps are covered with a protection of lapacho wood boards, which embrace the edges of the top table and foot of the rail. The rail is carried on malleable iron castings cemented into porcelain insulators, which stand on the ends of specially long sleepers, and are fixed to them by malleable iron clips. The sleepers are of Argentine hardwood called "quebracho." In order to allow for the wear of the rails into the sleepers, and also the wear of the running rails, the insulators are placed on packing pieces of soft wood and felt, these being removed as required.

Anchoring Arrangements.

To prevent creepage every length of conductor rail is anchored. The anchors are of three types: (*a*) Insulated links attached to a plate either fixed in a block of concrete or fastened down to a sleeper; these are used on long lengths of rail. (*b*) Clips on the foot of the rail which bear against the cap of a special insulator; these are used on moderate lengths of rail. (*c*) Clips on the rail which engage the lug of a standard insulator; these are used on short lengths of rail.

Track Sectioning.

The conductor rail is divided into sections by switches mounted in signal cabins, and so arranged that the signalman can quickly isolate any faulty section, leaving the rest of the system unaffected. Paralleling of the "up" and "down" conductor rails is also provided for in order to make use of their combined conductivity. The switchgear is of the circuit-breaker type, but is automatic or non-automatic according to position. All switchgear is mounted in chambers separate from the signal cabin operating chamber, and controlled by lever of the signal cabin type. Emergency switches are provided at cross-overs, and special work to section up the track in case of necessity. These switches are mounted in cast-iron boxes adjacent to the tracks.

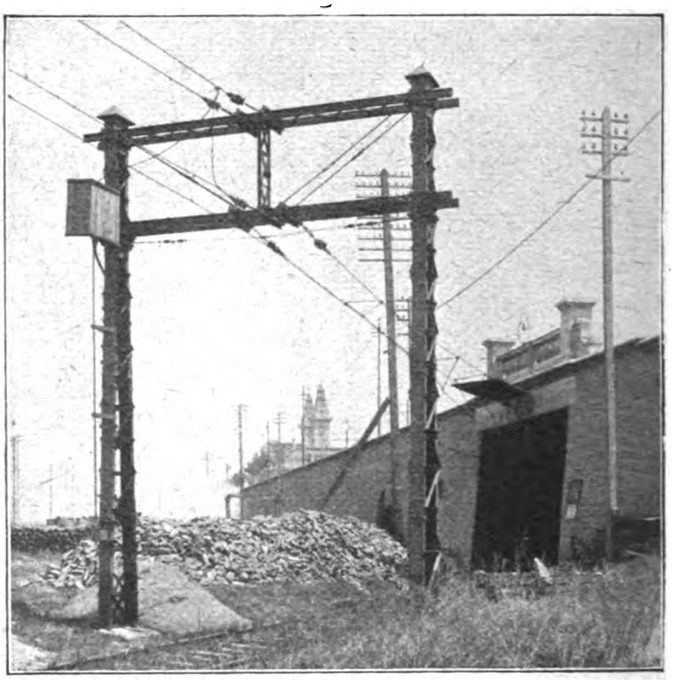

FIG. 8.—TYPICAL CATENARY CONSTRUCTION.

Overhead Track Equipment.

The tracks in the Port section of the electrified lines system are equipped with an overhead construction for supplying current to the electric locomotives. Fig. 8 shows the general type of catenary construction adopted. The overhead contact wire consists of a single 0·166 sq. in. section hard-drawn copper conductor. This wire is supported by a stranded copper catenary wire 0·20 sq. in. section, from which it is suspended by means of copper wire droppers. The main copper catenary wire is supported from the steel structures by means of special insulators, double insulation being used throughout. The normal span between the steel structures is 80 yds., depending on the conditions existing. The normal height of the contact wire from rail level is 19 ft. 8 in.; but at the entrance to the cargo tunnel (Fig. 8) this is reduced to 15 ft. 9 in.

Each steel structure carries a steadying arm, the purpose being to fix the position of the contact wire relatively to the track, but at cross-overs and special work, special pull-off

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wires with lapacho distance pieces are required. The contact wire is staggered in the usual way to prevent undue wear of the bow collectors. The type of steel structure varies according to conditions, the cantilever type being used on approach tracks to sidings, whilst in the sidings, bridge structures with cantilever construction for outside tracks are used. The majority of masts are made up of angle-irons suitably braced, but there are also a number of masts made up of old track-rails braced together. All structures are bonded to the running rails by means of a hard copper bond of No. 0·08 sq. in. section. Provision is made by means of air-break switches to section out the sidings where desirable.

Rolling Stock.

The passenger stock is arranged for multiple-unit working. Fig. 9 shows a six-coach train. The coaches are all of the saloon type with cross seats. In the first-class coaches the

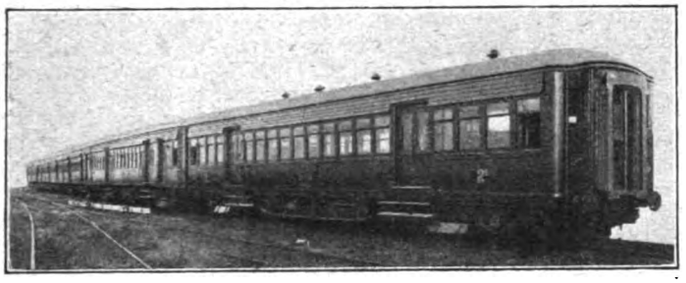

FIG. 9.—VIEW OF A SIX-COACH TRAIN.

seats on each side of the centre passage-way accommodate two passengers, whilst in the second-class coaches the seats on one side of the passage-way accommodate two passengers, and those on the other side three passengers. Each coach has a partition dividing the coach into smoking and non-smoking compartments, the former containing approximately two-thirds of the total seats.

The usual type of station platform in the Argentine is low, varying from 6 in. to 20 in. above rail level. On the stations on the present electrified section, however, the railway company have put up high-level platforms, which leave only 7 in. between the coach floor and the platform, thus doing away with the need for steps on the coaches. This facilitates the loading and unloading of coaches and simplifies the underframe design, it being unnecessary to set back the underframe members to provide space for steps. To allow for unloading of trains under emergency conditions away from a platform, three steps arranged vertically are provided at each door. These steps are exposed by lifting up a hinged chequered sill-plate 6 in. wide.

Driving Arrangements.

The motor-coaches are equipped with a driving cab at each end, whilst the trailers have a cab at one end only. The entrance to the cab is by a hinged door from the saloon. As the majority of the stations on the section have island platforms, the control gear is arranged on the right hand side of the coach, so that the motorman can receive signals from the guard standing on the platform. This section of the cab contains the master-controller and the driver's brake-valve, and on the partition behind the motorman the necessary control switches. The hand-wheel of the brake is also in this section, and is fitted at the right hand side of the driver under the side window at the main driving end of motor coaches and the driving end of trailer coaches; the left hand side of the cab contain the necessary lighting and fan switches.

Motor Bogie.

The motor-bogie frames (Fig. 10) are of pressed steel. The side frames are ½ in. thick with a depth of 1 ft. 9½ in. at the centre. The headstocks are pressed out of ⅜ in. plate, and are 6 in. deep in the middle. The corners between side frames and headstocks are strengthened by ½ in. gusset-plates rivetted to the underside. These gussets also form the brackets for supporting the ends of the axle-box springs.

The axle-boxes are of cast steel with gunmetal bearings lined with white metal. The boxes are cast with a wing bracket, to which the end of the collector-shoe beam is bolted.

The wheels are 3 ft. 6 in. diameter, pressed on to a 7¾ in. diameter seat. The solid gear-wheels are pressed on the axle. The motor journals are 6¾ in. diameter by 13 in. long, and the axle-box journals 5 in. diameter by 10 in. long.

The coaches are fitted with vacuum brakes. The motor coaches have one 24 in. cylinder per bogie, and the trailer coaches one 18 in. cylinder per bogie. The driver's brake valve in the cab works a small controller which varies the speed of the exhauster motors. In the braking and running positions the pumps run at half-speed, and in the release position at full speed. This speed control is by tapped fields in the motors. The pumps have a capacity of 125 c. ft. of free air per minute when running at full speed, and one pump working on the brake system of a motor and two trailer coaches can restore the vacuum to 20 in. after complete destruction in 12 sec.

Collector Shoes.

The collector shoes are designed to make contact on the underside of the top flange of the channel section conductor rail. They have two sets of springs—one a coil spring holding the skate in contact with the running face of the conductor rail, and the other a laminated spring pressing the lower portion of the shoe outwards from the coach, allowing for lateral movement of the shoes with respect to the conductor rail. In all, a total lateral movement of 5½ in. can take place between the shoe and the rail without the skate disengaging from the rail or binding so solidly on the web as to cause breakage. The total end movements expected are much less than this. Each motor-bogie has collector shoes on each side, and one bogie of each trailer coach.

Bus Lines.

A main cable and a 10-point control cable run through the length of the train connected between coaches by removable flexible jumper cables. All shoes are connected to the main bus line through copper strip fuses mounted in insulating boxes fixed to the shoe-beam over the collector shoe. Similar fuses are connected in the bus line at each end of each coach to facilitate the automatic isolation of faults on the bus line connections.

Traction Motors.

The motor coaches have two motor bogies, each fitted with two motors. The nominal one-hour rating of these motors is 220 h.p. each; with a four-coach train containing two motors and two trailers, an average acceleration on level tangent of 1·25 miles per hr. per sec. up to 22 miles per hr. is obtained, with an average accelerating current of 290 A per motor. With a six-coach train containing two motor coaches and four trailers an average acceleration on level tangent of 0·8 miles per hr. per sec. is obtained with a current per motor of about 270 A. The motors have solid-box frames. They are four-pole with commutating coils. The main-pole pieces are laminated and the commutating pole pieces solid. The coils are wound in flat copper strip, the commutating coils being wound edge-wise. The armature bearing bushes are not split. They are lined with white metal on the journal face, but not on the collars. The suspension bearings are split and are lined with white metal on journal face and collar. The armature and suspension bearings are lubricated by oil and waste.

The motors have parallel flow ventilation, a double fan on the pinion-end of the armature drawing air into the motor from the commutator-end in two streams, one through the

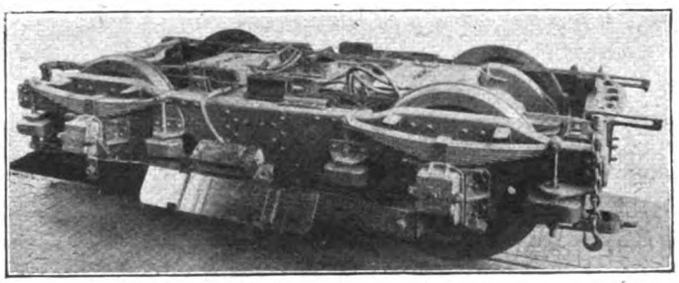

FIG. 10.—THE MOTOR-BOGIE FRAME.

armature and the other through the field. The motors of each bogie are permanently connected in parallel, the two pairs on a coach being connected in series or parallel as required.

Control Equipment.

All the equipment, except that for motor and auxiliary control is mounted underneath the coach. The contactors and reversers are in cases fitted with dustproof covers. The circuit breakers blow the arc out into the open air.

The circuit breaker has closing and tripping coils energised from any cab. The closing circuit is made through interlocks

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on the contactors, so that the breaker can only be closed if all contactors are out. It can be tripped at any time.

The reverser has two coils operating the rocking barrel. For throwing the reverser the corresponding coil is connected across the line with only a small resistance in series. After throwing, it is held in the desired position by the control coil being connected in series with two of the main contactor coils. Interlocks on the reversers make the necessary connections.

The 15 contactors are mounted in two boxes, one containing nine and the other six contactors. The majority of them are fitted with interlocks for making the necessary control connections.

Practically the whole of the insulation on the control apparatus is mica wrapped on steel bars. The arc chutes are of moulded material.

The motor resistances are of the cast-iron grid type mounted on cross-bars near the middle of the coach.

The control of the vacuum exhaust motors is effected through two contactors, one for full field and one for tapped field. These are mounted direct on the pump motor.

Automatic Acceleration.

The acceleration is automatic, each motor-coach being fitted with a controlling relay containing a series coil and two control coils. The feed to the control circuits in the various steps is made alternately through the two relay control coils. When energised these lift plungers and contacts in circuit with the control for the succeeding step. Once a plunger is lifted it is retained by the current in the main coil,

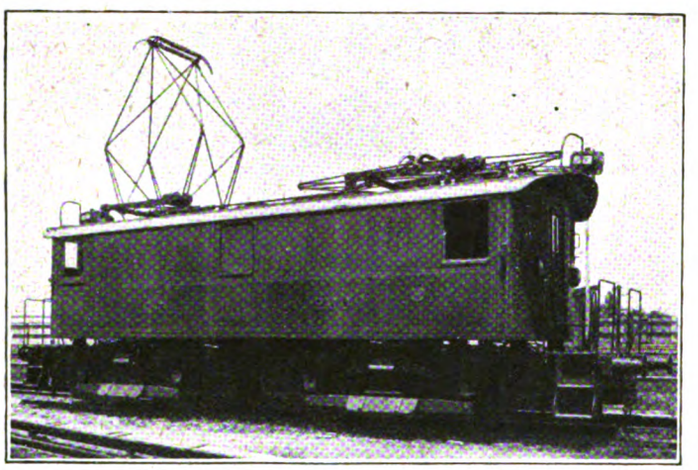

FIG. 11.—AN ELECTRIC FREIGHT LOCOMOTIVE

if above the value for which the relay is set. This main coil carries the current of one motor. The rate of operation, therefore, depends on the current in the motors, and cannot be increased by the driver. At the entrance to Plaza Once station there is a section of 1 in 26 grade. A six-coach train with two motor coaches will accelerate on this grade at a reasonable rate with the relays at their normal setting. To provide for the possibility of a still lower ratio of motors to trailers, however—a condition only possible in the event of a faulty equipment—means are provided on each motor coach for readily coarsening the relay setting. This is effected by an additional control coil on the relay which, when energised, lifts a plunger and increases the reluctance of the main coil magnetic circuit, and so allows the relay to operate more quickly. This is purely an emergency device, and the push-button energising the coil is placed near the relay on the opposite side of the cab to the master-controller, so that the motorman himself cannot operate it if he is operating the controller. He must call the guard of the train to close the push-button if he wishes to accelerate the action of the relay.

The Master Controller.

The master controller has a separate reversing barrel. The main and reversing barrels are locked in the usual way. If the main handle is released with the reversing handle in either forward or reverse positions, the control main-feed is broken and a pilot valve opened on the controller which operates an emergency valve and opens the train pipe to atmosphere.

The whole of the auxiliaries on each coach are supplied through a two-way auxiliary switch and fuse. On one side this switch connects the auxiliary circuits to the main bus line, and on the other side to a special socket under the switch. In the car-shed this socket can be supplied from a plug and flexible cable, so that all auxiliaries can be operated without making alive the main circuits.

Electric Locomotives.

For the handling of freight trains to and from the Port through the tunnel from Once, two electric locomotives are provided (Fig. 11). They are of the 0-4-4-0 type, consisting of two articulated four-wheel bogies carrying the cab on four spring-loaded sliding seats per bogie. The draw-gear and buffers are mounted on the bogie frame.

Equipment.

The motors are of the box-frame type, fitted with commutating poles. A blower is supplied for supplying air to the four motors.

The equipments are controlled by contactors operated by compressed air through electrically controlled valves. The compressed air supply is at 60 lb. pressure supplied through a reducing valve from the main air system. The control current for the electrically-operated valves is at 100 V pressure, obtained from tappings on a control resistance connected between the 100 V line and earth. Line switches similar to the other contactors, but provided with overload relay contacts in the supply to the control valves take care of overloads or faults. The relays for these line switches can be reset electrically, but only when the control main switch is opened. For emergency conditions, hand resetting for these relays is also provided.

Two reversers are fitted for control of direction. They are operated in the same way as the contactors. Cut-out switches are provided for cutting out defective motors, one pair at a time. These switches also have a control blade to prevent the equipments being worked up to full parallel if either pair of motors is cut out.

The reversers, contactors, and resistances are all mounted in a frame in the body of the cab. The reversers and control resistances are on the floor of the cab with the contactors and motor cut-out switches mounted above them, and the main resistance above that. Suitable inspection doors are provided for obtaining access to the various parts.

The master controller has main and reverse barrels, and is locked when the reverser key is removed. There are 10 steps in series and nine in parallel.

Brakes.

The locomotives are fitted with straight air brakes with emergency pipe. Air is supplied from a compressor with a capacity of 17½ cub.ft. of free air per minute at normal temperature and pressure compressed to 90 lb. per sq. in. A governor cuts in the compressor motor at a pressure of 70 lb. per sq. in., and cuts it out at 90 lb.

Pantographs.

There are two pantographs on the roof of each locomotive, controlled by electrically-operated air-valves. The collectors are normally held up by the action of springs, and are forced down by compressed air admitted to two cylinders. When down they are latched. To raise them the latch is released by admitting air to a smaller cylinder and the pantograph springs raise the trolley. The control of the pantographs is from a two-way push button switch at each end. The operating valves are supplied from a battery of dry cells. A hand-pump is provided to release the latches of the pantographs if it is desired to raise them when no compressed air is available. Suitable cut-out valves are fitted to allow of either pantograph being cut out of action if desired. The total range of the pantograph is 9 ft.

The Electronic Theory of Valency.

A general discussion on "The Electronic Theory of Valency" is being arranged by the Faraday Society. It will be held at Cambridge on July 13th and 14th. Prof. G. N. Lewis will open the proceedings with a general introductory address, and he will probably be followed by Mr. R. H. Fowler, who will contribute a paper intended to open discussion on the physical and inorganic side of the subject. Among those expected to speak are Sir J. J. Thomson, who will be in the chair, Sir Ernest Rutherford, Sir Wm. Bragg, and Prof. W. L. Bragg. The Saturday morning session will be devoted chiefly to applications of the theory in organic chemistry. Sir Robert Robertson, President of the Society, will preside, and opening papers will be given by Prof. T. M. Lowry, and Dr. N. V. Sidgwick. Particulars may be had from the Secretary of the Faraday Society, 10, Essex Street, London, W.C.2, to whom applications should be made at once.

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The Institution of Electrical Engineers.

Annual General Meeting: Silvanus Thompson Presentations.

The annual general meeting of the Institution of Electrical Engineers was held on Thursday, May 31st. There was a larger attendance than is usually the case when there is no likelihood of a controversial matter arising, owing to the presentation of a portrait, a bust, and the library of the late Prof. Silvanus P. Thompson to the Institution.

After the President (Mr. F. Gill) had announced the order of the proceedings,

Mrs. THOMPSON came to the Council table and said she had much pleasure in presenting an oil painting of the late Prof. Thompson to the Institution. The painting showed him when he was about forty years of age, and was painted in the year in which he was elected a Fellow of the Royal Society. At that time, said Mrs. Thompson, his greatest contributions to electrical science were being made; and his work on the dynamo electric machine and the electromagnet was just beginning to spread. It was really at the time of his greatest activity.

Mr. W. M. MORDEY followed with an account of the manner in which Prof. Thompson's wonderful library was acquired by members of the Institution and others, and was not an official act on the part of the Council of the Institution. It was thought, he said, that the best memorial to the memory of Prof. Thompson and of his work would be to have his library in the Institution, and the consequence was that a committee was formed which contained representatives of all the leading scientific societies, including the Royal Society. Funds were collected and the work was very much encouraged by the decision of the Council of the Institution to allocate to a memorial of Thompson such a sum as had previously been devoted to the Kelvin Memorial. That sum was devoted to the object which the Committee had in view. So quickly did the necessary funds come in that it was possible in February, 1917—Prof. Thompson died in 1916—to hand the library temporarily to the Institution. A feature of the scheme was the manner in which manufacturing firms contributed to the funds, thus marking their sense of the practical value of Thompson's work. There was also a substantial contribution from the old students of Finsbury. The Trustees of the Fund were Mr. Kingsbury, Mr. Campbell Swintón, Mr. Sparks and himself. At the present time the Library was housed at one end of the main library of the Institution, and was a perpetual memorial to one of their most esteemed and honoured members and past-presidents.

Mr. J. E. RAWORTH then presented a bust of Prof. Thompson on behalf of the Finsbury Technical College Old Students' Association. He explained that some of the funds collected for this purpose were allocated towards the purchase of the Library, and the remainder devoted to providing a bust which was executed by Mr. Gilbert Bayes, a colleague of Prof. Thompson in his early days at Finsbury and a great friend of his. He hoped the Institution would accept the bust in the spirit in which it was offered.

The President Returns Thanks.

Each of the three speakers was cordially received and when the applause had died down,

The PRESIDENT said: "The Institution of Electrical Engineers is deeply grateful for these gifts which you have so generously made to-day, and is grateful not only because of their intrinsic and artistic merits, not only because they remind us of one who, while he was with us, was one of our most esteemed and loved members and became one of our honoured past-presidents, but also because you have chosen to link this Institution rather than some other Institution with these gifts and so to link us with the association of his memory. These memorials will constantly remind us of one who, out of a singularly gifted mind, served his fellow-men without stint faithfully, and as one who had learned that the labourer should not look for any other reward save knowing that he had accomplished a duty. On behalf of the Institution of Electrical Engineers I accept these gifts with gratitude. The Institution will cherish and take care of them to the lasting memory of him in connection with whom they are presented."

Continuing, the President said that by a coincidence there was present that evening Prof. Elihu Thomson from the United States, and it was felt that the members would be right in censuring the Council if Prof. Thomson was not presented to them and asked to say a few words.

Professor Elihu Thomson's Tribute.

Prof. ELIHU THOMSON, who received a very warm welcome, said it was quite a coincidence that he happened to be in London at this time in connection with an urgent call, and he felt fortunate in being present on this occasion, which meant so much to him as well as to other men who were early in the electrical field, and who knew the contributions made to the literature and in other ways to the electrical industry and to electrical science by Prof. Silvanus Thompson. There was scarcely any man who was closer to himself in the art than Prof. Thompson. They were separated by many miles, but they were in constant communication on important matters, and the one thing which drew him more than any other to Prof. Thompson was that he was such a versatile man. Prof. Silvanus Thompson not only succeeded in work that was of a purely electrical nature, but he was optician, musician and artist. In his own feeble way he had followed in Prof. Thompson's footsteps, and he remembered an occasion when Prof. Silvanus Thompson visited his house in America when he showed him an effort of his own in oil painting. Prof. Silvanus Thompson said, "Thomson, keep it up; that is all right—keep it up." Unfortunately he had not had time to do it. The last time he met Prof. Thompson was at the meeting of the International Electrotechnical Commission in Turin in 1911, and he also on that occasion had the pleasure of meeting his charming wife, Mrs. Thompson. It never occurred to him that Prof. Thompson would be called away so soon, but he could understand the feelings that must have come over him on the outbreak of the great war. He was a man of great sensitiveness of temperament, and there was no doubt that many of the things that happened were crushing to him. One of the letters he received from Prof. Thompson at the opening of the war was pathetic. He would like to add one word with regard to his writings. He felt that they were a treasure to every student of electricity, and he also knew that Prof. Thompson's little manual on elementary electricity and magnetism was still the best that could be recommended for anybody beginning the study of electricity. There was another reason why he felt he could congratulate himself on this occasion, and that was that it was the birthday of his dear old friend Col. Crompton, who was seventy-eight years of age and still going strong. In conclusion, he thanked them for this opportunity of saying a few words in commendation of the most excellent character and excellent abilities of Silvanus P. Thompson.

The Reduced Subscriptions.

The business of the annual general meeting was then proceeded with. In presenting the annual report of the Council (summarised below), the PRESIDENT immediately announced that the Council had decided to reduce the subscriptions, following out the resolution passed at the time the subscriptions were raised to the effect that they would be reduced as soon as the Council saw its way to do so. There would be a reduction of 10s. a year for members and associate members, 5s. a year for graduates, but no reduction for students, as there had been no increase, and no reduction was proposed for Associates. These reductions represented a sum of £3 550, although that was an estimate based upon a certain increase in the membership during the coming year.

Mr. F. W. PURSE (West Ham) said that this announcement relieved him from making some observations that he had intended to make upon the accounts. In place of that, he would congratulate the Council on going as far as he himself would have gone had he been in charge of the Institution funds.

Mr. W. R. COOPER, as the author of the resolution that the Council should reduce the subscriptions as soon as it was able, also expressed his appreciation of the reductions that had been made.

Mr. W. CASH expressed the hope that the Council would not feel bound to continue to make reductions in the subscriptions, and so hinder the work which the Institution could do.

Prof. PARKER SMITH urged that it would be in the general interest to spend more money in some directions, and particularly to distribute both sections of "Science Abstracts" free of charge to all who wanted them. He made this suggestion on the basis that one of the chief functions of the Institution was the dissemination of knowledge. That work of

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disseminating knowledge should not stop at distributing "Science Abstracts" in the manner he had suggested, but should also take the form of improving the "Journal" in every way, and both these meant a greater expenditure, which, however, he felt could be fully justified.

Poor Attendances at Meetings.

The PRESIDENT then went through the various items in the Council's report, the principal comment he had to make being a complaint as to the poor attendances at some of the London meetings. He made an earnest appeal to the members to remedy this state of things which, he said, could not be cured by the Council. Among the other points briefly referred to was the work of the Wiring Rules Committee, the voluntary registration of electrical contractors, the prospects of good work being done by the Engineering Joint Council, and the fact that no fewer than 225 meetings were held during the year, not including committee meetings. Finally, reference was made to the increasing responsibility which was being imposed upon the Institution, and the need for everyone to help, so that the Institution was in a position to take up this increased responsibility worthily.

Mr. ROGER SMITH seconded the adoption of the report, which was agreed to without discussion.

Sir JAMES DEVONSHIRE then presented the accounts, and said he did so with "that Kruschen feeling," not because it would be the last financial statement he would present, but because he had been able to escape his annual castigation at the hands of Mr. Purse! The surplus revenue, after placing £3 000 to reserve, was £862, compared with £639 in the previous year, when, however, £4 000 was placed to reserve.

There were the usual votes of thanks and the proceedings were brought to a close with the announcement of the following award of premiums for papers read during the session 1922–23 or accepted for publication: The Institution premium to the late Dr. G. Kapp; Ayrton premium to Mr. F. Creedy; Fahie premium to Dr. H. W. Nichols; John Hopkinson premium to Mr. J. Rosen; Kelvin premium to Mr. S. W. Melson and Mr. H. C. Booth; Paris premium to Mr. J. Caldwell; extra premiums to Mr. L. Breach and Mr. H. Midgley, Dr. F. T. Chapman, Mr. A. T. Dover, and Mr. P. J. Robinson; wireless premiums to Dr. N. W. McLachlan, Mr. E. B. Moullin, Prof. C. L. Fortescue and Mr. J. Hollingworth.

The Annual Report.

The report begins by putting on record the Council's gratification at the continued progress of the Institution. The process of transferring to the Chartered Institution the property of the old Institution including the trusts in connection therewith has proved more protracted than had been anticipated, chiefly owing to certain provisions in some of the trust deeds necessitating, on the dissolution of the old Institution, steps being taken to ensure that these trusts and the benefits under them should pass to the Chartered Institution. For that reason the final winding-up must necessarily be postponed a short time longer until the whole of these trusts and benefits have been transferred to the new Institution.

Growth of Membership.

During the year ended March 31st, 1923, 1 018 members were elected to the Institution, of whom 692 were students, while 28 were reinstated. During the year 48 members died, 129 resigned, and the membership of 233 lapsed, so that the net increase during the year was 636, and the total membership of the Institution on April 1st, 1923, was 10 911.

The Council have noticed with satisfaction the practice of some employers of stipulating corporate membership of the Institution as a qualification for vacant positions, and urge its adoption by all employers.

Meetings, Papers and Attendances.

The total number of meetings held during the year was 369. These included 17 ordinary meetings, eight wireless sectional meetings, eight informal meetings and 19 Council meetings, 116 in local centres, while the various students' sections held 76, and there were 125 committee meetings.

The Council gladly referred to the generous devotion by members of the Institution of their time and expert knowledge to the work of its various committees.

The discussions on the papers read were consistently maintained at a high level and were more spontaneous than in the past. The Council tender the best thanks of the Institution to those who placed their knowledge and experience at the disposal of their fellow-members by reading papers or taking part in the discussions.

The fact that the same paper is read at several places appears to react unfavourably on the attendance at particular meetings, a result which, in the case of highly technical papers, may need consideration in the future.

Local Centres.

During the Session the President paid visits to the Centres at Birmingham, Bristol, Dublin, Glasgow, Leeds, Manchester and Newcastle-on-Tyne, and to the Sub-Centres at Liverpool, Loughborough, Middlesbrough and Sheffield. The Council have decided to supply technical books to the value of £50 to any Centre wishing to set up a technical library, provided that suitable accommodation is available and that each collection is maintained and added to locally.

Informal meetings during the session maintained their interest, and though the average attendance was below that of last year, the subjects selected were keenly debated. On the score of assisting in the training of speakers, these meetings have undoubtedly well served their purpose this Session, and a number of new speakers have contributed to the discussions.

Scholarships.

The number of students on the register has reached a record total of 2 869, representing 26 per cent. of the total membership.

The following scholarships have been awarded by the Council: David Hughes Scholarship to Mr. W. H. M. Hellier, a Salomons Scholarship to Mr. A. H. Maggs, and a Paul Scholarship to Mr. C. A. Wilck. A grant of £100 for educational purposes has been made by the Council under the provisions of the Trust Deed to Mr. R. H. Holmes.

The Council have arranged for a complete set of enlarged photographs to be made of the past presidents of the Institution. These, suitably framed, will be hung in the Institution's rooms as soon as the collection is complete.

The Library and Museum.

During the year 235 books and pamphlets have been presented to the Reference Library by members and others. A marked increase in attendance is recorded, the total number for the year being 2 526, as against the previous highest yearly total of 1 651 in 1915-16. The Council have pleasure in recording a continued increase in the circulation of books from the Lending Library. During the year 2 213 were issued to 814 borrowers, the corresponding numbers for the previous year being 1 450 and 564 respectively.

After carefully considering the question of exhibiting the historical apparatus, particularly the larger apparatus and heavy machinery, the Council decided, in view of the limited space available in the Institution Building for this purpose, to offer to loan the collection to the Science Museum, South Kensington. The offer has been accepted and a considerable portion of the historical objects has now been transferred to the Science Museum. By exhibiting the apparatus in a public museum the Council feel that it will receive wider publicity, especially taking into consideration that a considerable number of the transferred objects would otherwise have had to remain stored in the basement of the Institution for an indefinite period. In view of this arrangement the Council can in future accept apparatus only on the understanding that it may be transferred on loan to the Science Museum.

During the past year there has been a gradual increase in the number of applicants for posts, the total being 130 as against 120 last year. The Council earnestly hope that members who are in a position to assist will not fail to make use of the register.

The "Journal" and "Science Abstracts."

The number of pages in the 1922 volume of the "Journal" was 1 002, as compared with 852 in 1921. The net cost of printing and publishing the "Journal" in 1922 was £4 604, as compared with £4 936 in 1921. The Council felt that it was in the best interests of the Institution to revert to the practice which obtained until 1913 of publishing advertisements in the "Journal."

The Physics volume of "Science Abstracts" for 1922 contained 104 more pages than that for 1921, and the Electrical Engineering volume 8 more pages. The cost of contribution of the Institution towards the cost of publication in 1922 was £1 085, as compared with £978 in 1921. This increase was rendered necessary by the large amount of belated material

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which came from the Continent after the War. The Committee of Management have taken steps to increase the revenue of " Science Abstracts " so that the burden falling on the Institution should be materially less in future.

Committee Work.

Reference is made to the work of the various committees of the Institution, including those of wiring rules, model conditions for contracts, British electrical proving house, voluntary registration of electrical contractors, and electricity regulations, and a notification is given that a committee on electricity in agriculture has been appointed.

The Council have authorised the Committee of the Irish Centre to appoint on behalf of the Irish Free State a committee to advise the Irish Government on matters concerning electrical engineering.

Educational Certificates.

It is expected that the scheme for the issue of certificates and diplomas to students who have passed certain examinations under conditions approved by the Board of Education and the Institution will come into operation for the educational session of 1923-24.

The Institution has increased its annual subscription to the Electrical Research Association from £200 to £300.

The Committee of Management of the Benevolent Fund report that on December 31st, 1922, the capital account of the Fund stood at £9 969 11s. 3d., and the accumulated income at £1 463 1s. 3d. The donations and subscriptions to the Fund in 1921 amounted to £2 399 13s. 4d. In the course of the year 40 grants were made to 16 persons, amounting to a total of £776 5s. With a view to increasing subscriptions to the Fund, the Committee have appointed a Local Honorary Treasurer of the Fund for each Local Centre of the Institution, and also for the Sheffield Sub-Centre.

In putting forward the accounts the Council state that after making provision for contingencies, as in the previous year, there is a margin to the good on the Revenue Account for 1922 of £862 2s. 8d. This amount, which has been carried to the credit of the General Fund, compares with £639 2s. 10d. in 1921, an increase of £222 19s. 10d. Mortgages now stand at £20 338 6s. 5d., as against £24 331 19s. 11d. in 1921. The Life Compositions Fund, which now stands at £5 684 18s. 3d., has been transferred to the General Fund of the Institution.

The surplus of assets over liabilities is now £114 399 2s. 1d., as against £108 939 7s. 11d. in 1921.

The Institution Summer Meeting.

Illustrations of the Applications of Electricity to Staple British Trades.

Monday, June 4th.

The annual summer meeting of the INSTITUTION OF ELECTRICAL ENGINEERS opens at Manchester to-morrow, and will continue to the end of the week. Visits will be paid to Liverpool and Llandudno, the latter giving an opportunity for the hydro-electric developments in North Wales to be inspected. Tours round works and power stations form a feature of the meeting, while lavish hospitality is being dispensed by the municipal and university authorities. Nearly five hundred members and ladies are attending, some for a part of the meeting only, and the only thing wanting to ensure the complete success of the arrangements is the weather, for particularly bad samples of which Manchester is of course renowned. The President and Mrs. Gill and numerous members of the Council and of the Committee of the North-Western centre have already arrived, but we learn with regret that owing to sudden illness Mr. C. H. Wordingham will be unable to be present. This evening there was no formal function, but the lounges of the Midland and the other hotels in the city had assumed a distinct electrical tinge at an early hour.

Tuesday, June 5th.

A start on the programme proper was made this morning at the early hour of 9 a.m., in cold but dry weather, when motor coaches were in readiness to take visitors to see either the rolling mill equipment of Richard Johnson and Nephew, and the engineering works of Mather and Platt, or the No. 2 Cotton Mills of the Dunlop Rubber Co. at Rochdale.

In connection with the development of Manchester as an engineering centre, the works of MATHER AND PLATT, which were established nearly 100 years ago, are of historical interest. The firm's first factory was opened in Salford, and was at first chiefly concerned with the manufacture of machinery for the textile industry.

The Park Works, which were the occasion of to-day's visit, were built in 1900, and consist of three bays, 376 ft. long, ten bays 550 ft. long, and four bays over 600 ft. long. These seventeen bays are all under one roof, without gallery or step, and with only one partition.

Pioneers in Electric Railway Work.

From the electrical point of view, the most interesting chapter in the firm's history began in the early 'eighties, when they undertook the manufacture of Edison-Hopkinson dynamos under the supervision of the late Dr. John Hopkinson. In electric railway work the firm can also claim to be pioneers, as in 1885 they supplied the electrical plant and equipment for the Bessbrook and Newry Railway, and in 1891, the complete electrical equipment for the City and South London Railway. As intimated in a recent issue of THE ELECTRICIAN, one of the original locomotives of the latter railway has obtained an honoured place in the South Kensington Museum, and a model of this and one of the earliest Mather-Reynolds turbine pumps were shown to visitors.

To-day, members were given an opportunity of seeing what the firm are now doing in their electrical department, and also of inspecting the more purely engineering departments which include the manufacture of hydraulic apparatus, textile machinery, chemical plant and fire-fighting appliances.

Special interest was taken in the 1 000 kW rotary converters on the test bed, a type of machine which the firm have not very long been manufacturing. The arrangement of the double commutator brush-gear struck us as being particularly rigid and good. A large number of pumps of various design and capacities were going through the shops, and it is worthy of note that Mather and Platt are one of the few firms who make both pumps and the motors for driving them. We also inspected a slow-speed direct current generator which is being manufactured for operation with a uniflow engine. Its output is 600 kW at 150 revs. per min. A slow-speed three-phase alternator for a works with a bad power factor was also passing through the shops.

An interesting feature of the works is the research laboratory, which considering the wide activities of the firm, has a scope which is as unusual as it is valuable.

A rather new departure for the firm which was exhibited in this department is the mass production of colloid solutions for dyes. This is effected by mechanical means, and the results are said to be stable. The product can be filtered through a 300 mesh without any of the colloidal matter being retained.

A Modern Electrically Driven Rolling Mill.

A visit was subsequently paid to the Bradford Ironworks of RICHARD JOHNSON AND NEPHEW, to inspect the electrically driven, continuous wire rod rolling mill which was built to the company's specification by the English Electric Co. for dealing with large outputs of wire-rod mainly of No. 5 and No. 6 gauge. The mill consists of three sections—one roughing mill and two finishing mills. The roughing mill contains eleven sets of rolls of 12 in. diameter, and the two finishing mills contain seven sets of rolls, also of 12 in. diameter. The roughing train is driven by one 2 750 H.P. motor, which is capable of giving 100 per cent. overload for 30 secs. The finishing trains are each driven by one 750 H.P. motor with the same overload capacity. Each mill is provided with a barring motor and reducing gear, so that the mill can be driven at 10 per cent. of the top speed. The motors are supplied with three-phase current at 6 600 V and 50 cycles from the mains of the Manchester Corporation. The main motors are controlled by push buttons which actuate oil immersed solenoid operated switches which are so arranged that the switch can only be closed when the starter is in the open position. The starters are of the liquid type, and are operated by a small motor which is actuated by a relay through the potential transformer of the e.h.t. breaker. An automatic brake is provided on the roughing mill motor which is capable of pulling up a train in 45 secs. The mill can roll a 2-in. billet 28 ft. long weighing 364 lb. to a

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No. 6 rod in a minute, and can finish two such rods at the same time. Its operation is automatic throughout.

The works are equipped with an automatic telephone exchange.

Richard Johnson and Nephew have the distinction of being the first firm to adopt the continuous system of galvanising, while as long ago as 1884 they established a great reputation for iron telegraph wire. The works at present are capable of dealing with 1 500 tons of finished product per week in iron and steel, and about 200 tons per week of electrolytic copper. They are also engaged in the manufacture of barbed wire.

Cotton for Tyre Making.

The second party who visited the DUNLOP RUBBER CO.'S No. 2 Cotton Mills at Rochdale, had an interesting time in that they were able to examine the various processes through which cotton passes in its progress from the raw material to the finished product necessary for tyre making.

The original spinning and weaving sections of the mill began operations in 1915, and during recent years extensions have been made. These mills having been described in THE ELECTRICIAN of February 4th, 1921 and April 21st, 1922, we need only remind our readers that they are electrically driven throughout, power being obtained from the Rochdale Corporation at 10 000 V. The operating voltage in the mill is 400 V, and there are two transformer sub-stations in suitable positions, the larger one with an ultimate capacity of 10 000 kVA. This sub-station at present forms a connecting link between the systems of the Lancashire Power Co., and the Rochdale Corporation.

The total power of the motors installed amounts to 14 000 H.P., of which approximately 9 000 H.P. are in the new spinning mill.

Special attention may be called to the arrangement of the distributing cables in the various flats. This is carried out on the most modern lines, particular care having been taken to make the best arrangements for the runs during the erection of the mill. The mill may be taken as a good example of what can be done for the textile industry by the use of electrical equipment, and it is well to notice that it is an electric mill, and not a steam mill converted to electricity.

At the conclusion of these visits some of us made an unpremeditated tour through the slums of Manchester, and the whole party were entertained to lunch by the Manchester Corporation. The Lord Mayor welcomed the visitors, and Mr. Frank Gill briefly replied.

Batteries and Power Stations.

In the afternoon those attending the meeting were again divided into two parties, one of which proceeded to Clifton Junction to visit the works of the PILKINGTON TILE AND POTTERY CO. and the CHLORIDE ELECTRICAL STORAGE CO., and the generating station of the LONDON, MIDLAND AND SCOTTISH RAILWAY, while the second went to Radcliffe to see the generating station of the LANCASHIRE ELECTRIC POWER CO.

Pilkington's Tile and Pottery Co. are noted for the production of the well-known " Royal Lancastrian Pottery," " Royal Lancastrian Ware " and " Royal Lancastrian Lustre Pottery." The works themselves are of a non-electrical character.

At the works of the CHLORIDE ELECTRICAL STORAGE CO. visitors were able to see the manufacture of this well-known firm's products, including Chloride and Plantide batteries for central stations and various types of Exide batteries for motor-car and other work. Details of these works and of the processes carried out therein were given in THE ELECTRICIAN of February 27th, 1920, and need not therefore be described here, except to say that they are examples of all that is most modern in organisation and production methods.

The Clifton Junction generating station of the LONDON, MIDLAND AND SCOTTISH RAILWAY CO. supplies energy for the Manchester and Bury electrified lines, which were opened for general service in April, 1916. Its general details and the equipment of the line itself were dealt with in THE ELECTRICIAN on January 14th, 1916, and subsequent issues.

An interesting feature of the power station is that it is 37 ft. below the level of the main line, and coal wagons can thus be run directly over the tops of the bunkers, obviating the necessity of installing coal handling plant.

The boiler house contains four Babcock and Wilcox water-tube boilers each with an evaporation capacity of 32 000 lb. of water per hour, the steam pressure being 200 lb. per sq. in., and the superheat, 700 deg. F. The turbine room contains two 5 000 kW turbo-alternators, and one 500 kW geared turbo-alternator. The generating voltage is 6 600 V at 25 cycles, the speed of the sets being 1 500 revs. per min. The 500 kW set generates power at 440 V and 25 cycles, and is used for supplying auxiliaries in the sub-stations.

The switch-gear is of the solenoid remote control type, and was manufactured by the British Thomson-Houston Co. It is housed in a separate building. Current is supplied from the generating station for operating the line to two sub-stations at Radcliffe and Victoria railway station, Manchester, respectively. Transmission is by means of overhead conductors in the open country, and by three core armoured and lead-covered cables on short stumps, and brackets in congested areas. Each sub-station is equipped with four 1 000 kW rotary converters, and at Radcliffe there is an 800 Ah battery, and at Victoria a 500 Ah battery.

The Radcliffe Generating Station.

The Radcliffe generating station of the LANCASHIRE ELECTRIC POWER CO., which was started some seventeen years ago, is now supplying approximately 100 000 000 kW hours per annum, so that it ranks among the ten largest electricity undertakings in the country. The total plant capacity is 42 375 kW, and the maximum load approximately 35 000 kW. The original generators installed were of the Curtis type with a capacity of 1 500 kW each. Since then, ten other generating sets have been added, including two with a capacity of 10 000 kW. These are all of the horizontal type, and were manufactured by the British Thomson-Houston Co.

Auxiliary Arrangements.

An interesting feature is that the auxiliaries on the two larger sets are divided into two portions, either portion being capable of maintaining a normal vacuum when the generator is doing 60 per cent. of its output. It may be also mentioned that the main generators are wound for 11 000 V, and deliver current direct to the main busbars. These busbars are divided into two sections which are interconnected by reactances, and are protected by electrolytic lightning arresters. Two group feeders are coupled by isolating switches to each section of the generator busbars. Each group supplies six feeders, so that there are 24 outgoing feeders in all. Each consumer on the system is provided with an alternative supply.

The boiler plant is designed for a working pressure of 160 lb. per sq. in., with a superheat of 150 deg. F. In spite of this low pressure and temperature, the results obtained are excellent.

Those in the first party were entertained to tea by the Chloride Electrical Storage Co., and those in the second party by the Lancashire Electrical Power Co.

On the return journey a detour was made past the site of the new generating station of the SALFORD CORPORATION at Agecroft. This station will have an initial capacity of 50 000 kW. It is being erected on a site of 65 acres on the banks of the Irwell.

In the evening the visitors were received by the Lord Mayor and Lady Mayoress of Manchester in the Town Hall, when a dance took place.

Wednesday, June 6th.

This morning visitors were taken to see the new Barton generating station of the Manchester Corporation by way of the Manchester Ship Canal, so as to give them an opportunity of viewing the swing bridges, locks and other engineering features of this interesting means of connection between Manchester and the sea.

A good deal of electrically operated apparatus is used in connection with the operation of the canal, including shear legs of 150 tons capacity, employed for lifting and replacing the tops and masts and funnels of ships, so that those not fitted with telescopic masts can pass under the swing bridges. The various wharves and warehouses of the Company are exceptionally well equipped with cranes, 130 of which are electrically driven.

The New Barton Station.

But the *pièce de résistance* of the morning—and, indeed, of the visit—was the new BARTON power station of the MANCHESTER CORPORATION, which was next visited. The site of this station, which covers 14¼ acres, is in Trafford Park, on the south side of the Bridgewater Canal, and in close proximity to the Manchester Ship Canal. The supply of fuel, by rail or by water, is therefore assured under satisfactory conditions. Within the limits available, the condensing water will be drawn from the Ship Canal, with the sewage and sub-soil water (in the form of

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a purified effluent) which passes down the main outfall sewer to the Davyhulme works of the Corporation as an alternative, or additional, source of supply.

The whole site is capable of ultimately accommodating 150 000 kW of plant, but certain limiting factors may preclude development to this figure.

Details of Buildings.

For the rail-borne coal supply to the station a double-track railway bridge has been constructed of about 68 ft. span. The buildings generally are of steel frame construction, the walls between being of brick, and the floors of concrete. The roofs are generally of girder construction with the necessary lanterns for lighting and ventilation. The roofs are covered with 3½ in. flat reinforced concrete slabs covered with asphalte.

The turbine house is 243 ft. long, with a width between walls of 65 ft. The height from floor to crane rail is 33 ft., and the height from floor to underside of roof principals 46 ft. The floor of the basement containing the circulating plant is 25 ft. 6 in. below the turbine house floor.

Turbo-Alternator Features.

The turbine house will contain three 27 500 kW turbo-alternators (maximum continuous rating), with a maximum output of 31 250 kW for short periods. These were manufactured by the Metropolitan-Vickers Electrical Co., the condensing plant being built by Richardsons, Westgarth and Co. Power for the station auxiliaries is furnished—in part—by three 1 000 kW, 400 V, "house-service," turbo alternators, and these, together with the whole of the main and auxiliary switchgear, have been supplied by the British Thomson-Houston Co. The operating steam pressure, temperature and speed of the main units are 350 lb., 700 deg. F., and 1 500 revs. per min. respectively, the vacuum being 29·1 in. at full load, with a 30 in. barometer.

The Switch House.

The switch house is about 215 ft. long by 52 ft. 6 in. wide, and a height from ground floor to underside of roof of 61 ft. 9 in. It is divided into three floors. The generators are connected directly to their transformers, and all switching is done on the 33 000 V side without interposing any switchgear between the 6 600 and 33 000 V circuits.

Circulating Water.

The circulating water pumps are contained in a basement 45 ft. deep below the turbine house floor. This floor is about 9 ft. 6 in. below the top water level of the Manchester Ship Canal, so that the pumps are constantly flooded. Six electrically driven pumps are provided—i.e., two for each main condenser. The circulating water for condensing purposes is drawn from and returned to the Manchester Ship Canal through circular culverts, each 9 ft. 6 in. diameter.

The inlet chamber is constructed of concrete, the bottom being 26 ft. 6 in. below the water level of the Ship Canal and about 50 ft. below ground level. The water is drawn through three canals, each 7 ft. 2 in. wide, and each fitted with an inclined grid screen, a "Brackett" travelling band screen and the necessary penstocks for shutting off the water if required.

The outlet chamber is a closed chamber 100 ft. long by 21 ft. wide, the bottom being 15 ft. below the water level of the Ship Canal. A midrib or weir wall extends the whole length of the chamber over which the water passes previous to returning to the canal, the discharge being made by ten openings at the bottom of the outer wall. The wall serves to distribute the flow along the whole length of the chamber, and also serves as a measuring weir.

Pumping Plant.

With the exception of three steam-driven "Weir" boiler-feed pumps, the whole of the various pumping plant services have been provided by Mather and Platt.

The voltage of generation is 6 600 V, which will be stepped up to 33 000 V, and at this pressure three-phase alternating current will be transmitted into the Manchester area of supply. The whole of the transforming plant at the station has been supplied by the Metropolitan-Vickers Electrical Co. The main "step-up" three-phase transformers for each generator are two in number, and of 19 500 kVA capacity each. The transformers are of the oil-immersed forced cooled type, each being provided with its own oil cooler, all the coolers being piped up on a common oil ring, with one spare cooler. The auxiliary transformers are three in number of 1 250 kVA each, and supply, in part, the station power requirements at 400 V stepped down from the 33 000 V busbars.

Boiler House Arrangements.

The boiler house is 314 ft. long by 87 ft. wide, with a total height of 86 ft.

The coal bunkers (to contain 36 hours' supply), which are of reinforced concrete, are carried at the level of the fan floor, the level of the roof being about 94 ft. above ground-floor level. Steam is supplied from nine Babcock and Wilcox water-tube boilers, of the double-fired marine type. The most efficient rating is 100 000 lb. per hour actual evaporation, but each boiler is capable of maintaining an actual evaporation of 120 000 lb. per hour when supplied with fuel having a calorific value of not less than 10 500 B.Th.U. Each boiler, with its complementary chain-grate stokers, superheater, economiser air heater, chimney and induced and forced draught fans, is a complete unit in itself.

The ash basement of the boiler house is at ground level, permitting standard-gauge-railway wagons or road transport wagons to be fed directly from the ash discharge hoppers of the respective boilers, thus suction ash plants or ash conveyors are dispensed with.

Coaling Dock.

For the purpose of dealing with canal-borne coal a dock and lay-by is being constructed, the dock being 320 ft. long by 50 ft. wide, and the lay-by being 250 ft. long by 50 ft. wide. The dock walls are constructed of mass concrete. Coal is unloaded by means of two overhead travelling cranes.

To connect these dock works with the Bridgewater Canal it has been necessary to raise the towpath to provide headroom for the necessary bridge, and the Corporation has been compelled by Act of Parliament to provide, in addition, a footpath connecting the new road with Barton Bridge.

The coal unloading viaduct receives the coal from the double line of way, which passes over the new bridge over the Bridgewater canal, and is provided with three hoppers into which the coal is discharged from the wagons by electrically operated end tippers.

Coal Conveying Plant.

The fuel thus brought by rail is delivered from the hoppers to a system of bucket conveyors, and is thereby transferred to the boiler house bunkers, or into storage on the land. Alternatively, the same conveyors are used for withdrawing coal from the silo storage. The coal-unloading plant has been supplied—for the most part—by W. J. Jenkins and Co.

A storage capacity of some 25 000 tons is provided, equivalent to approximately seven weeks' consumption, with all three main generating units in operation. Coal received by rail is weighed in the trucks before unloading; coal received by canal is weighed by two automatic machines fed by grabs or boxes; coal taken from storage to the boiler bunkers is also weighed by automatic machines.

Buildings to serve as workshops and stores have been provided for use during the construction of the plant, and also for serving the requirements of the station when in operation.

The Barton station has been designed, and the construction supervised, by the engineering staff of the Manchester Electricity Department.

An Interesting Outdoor Sub-station.

Another feature of interest in the Electricity Department which was available for inspection by visitors was the High Street sub-station, which is the first complete example of a large 33 000 V outdoor sub-station in this country. It has been designed, as nearly as possible, on the "straight-through" principle—the 33 000 V and 6 600 V feeders being on opposite sides of the station.

All the oil switches, which were supplied by the British Thomson-Houston Co., have a breaking capacity of 500 000 kVA, and are of the remote electrically controlled type, operated by single phase 240 V motors.

Two 50 Ah 60 cell batteries, by the Chloride Electrical Storage Co., supply current for the opening circuits, and for a few emergency lights.

The arrangement of the 33 000 V switchgear is such that the duplicate busbars and isolating switches are mounted above a central gangway, mechanical operating gear being provided for the isolated switches. The busbars and conductors are constructed from 1¼ in. diameter copper tube, and coned couplings are employed for all joints and connections, thus

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maintaining a circular outline to reduce the corona discharge to a minimum.

The oil switches are of the tank type, with compound-filled bushings and explosion chamber contacts. These chambers consist of an inverted steel cup, lined with insulating material and fitted over the contacts. Their function is to minimise the stress in the main tank sides and to assist in rapidly extinguishing the arc when the switch opens. Non-corrodible bearing pins are used throughout, and all iron and steel exposed to the weather are galvanised or sherardised wherever possible. Lightning arresters of the oxide-film type, with sphere gaps, are used for each transformer group.

The 6 600 V switchgear is of the concrete cubicle type, the oil switches being of the makers' " H " pattern, having two separate steel tanks per phase. There is a special arrangement of auxiliary busbars, designed so that any feeder can be kept in service, whilst its switchgear is " dead " for cleaning or other purposes.

Transformer Details.

There are three 8 500 kVA, 33 000 to 6 600 V groups, each comprising three single phase, outdoor, oil-immersed, self-cooled transformers, manufactured by the Metropolitan-Vickers Electrical Co. Each transformer is fitted with a conservator tank, chloride breather, and a distance electrical thermometer, the indicators being mounted in the control room. Two 125 kVA, 6 600 to 420 V, three-phase, oil-immersed, self-cooled transformers supply current for the oil-switch-closing circuits, battery charging, motor generators, station lighting, and for local distribution.

A 428 kVA, oil-immersed, self-cooled, induction type voltage regulator set, having a pressure range of from 6 270 to 6 930 V, is used in conjunction with each main transformer group. This set was supplied by the Oerlikon Co. The regulators are non-automatic, but are fitted with remote electrically controlled, three-phase, 420 V operating motors. Double units are used to correct phase displacement.

Position of the Manchester Electricity Department.

It should be added that the Manchester Corporation's Electricity undertaking is the largest municipally owned undertaking in the country, the connections at December 31st, 1922, amounting to 212 744 kW. Supply was commenced in 1893 from the Dickinson Street station, which is now used as a sub-station, the system being five-wire at 100 V. Bloom Street station, which is adjacent to Dickinson Street, was opened in 1901, while in 1902 the development of the undertaking made the opening of a third station at Stuart Street necessary. This station, which has the largest installed capacity—106 750 kW—of any station in the country, is now fully loaded, and as long ago as 1913 it was decided to erect the station at Barton which we have just described. Putting this last station into operation has, of course, been delayed by the war, and work on it was not commenced until 1920.

Supply is given at 400 to 500 V to 26 public sub-stations, while there are some 132 sub-stations on the premises of larger consumers. The present transmission voltage is 6 600 V, but this is being raised to 33 000 V, and five sub-stations, which will convert this voltage to 6 600 V, are now being constructed. The area of supply is 43 square miles, with a population of 850 000, and the mains laid amount to 549 miles.

At the conclusion of the visit to Barton the party left for the Metropolitan Vickers Electrical Co.'s works at Trafford Park, where they were entertained to lunch.

Electrical Production at Trafford Park.

After lunch the works of the Metropolitan-Vickers Electrical Co. and of the Lancashire Dynamo and Motor Co. were open to inspection.

The Metropolitan-Vickers Electrical Co. was founded in 1901 by the late George Westinghouse, under the title of the British Westinghouse Electrical and Manufacturing Co. In 1917 it was acquired by the Metropolitan Carriage Wagon and Finance Co., which in its turn was acquired by Vickers, Ltd. At the time of their formation the works were the largest of their kind in the country, and they still occupy a proud position in point of size, covering 130 acres, with an effective floor space of 1 500 000 sq. ft., and employing 9 000 people. They were originally designed for the manufacture of slow-speed alternators for direct coupling to reciprocating engines, but they now have under construction 14 turbo-alternators of capacities varying from 5 000 to 25 000 kW. Other manufactures with which they have always been connected are railway and tramway apparatus, motors and controllers, transformers and switchgear. But the development in design and production that has taken place in twenty years has profoundly modified the shop equipment.

Having seen a Metropolitan-Vickers turbo-alternator in a finished state in the morning, visitors in the afternoon had an opportunity of learning something about its design and manufacture. These turbines are of the impulse type, and by a recent development in the blading at the exhaust end of the turbine, the Company are now designing and making machines in one cylinder, having normal full load capacities in the neighbourhood of 15 000 kW, of such small mean diameter that they can be run at a speed of 3 000 revs. per min., and even at this speed the stresses in the material are less than in the older type. The first of these machines installed for the Liverpool Corporation established a record, giving the largest output at the highest speed of any single cylinder turbine in the country.

Since the date of the first Liverpool installation, a duplicate set has been supplied and set to work, and 16 others for different undertakings, all having a speed of 3 000 revs. per min. and capacities varying from 10 000 to 12 000 kW are either installed or on order.

New Metropolitan-Vickers Developments.

For ventilating large turbo-generators a special system has been adopted by the Company. The continual flow of fresh air through the machine, even when this is filtered, tends to deposit a large amount of dirt in the windings which has to be cleaned out from time to time. In the system adopted the same air is used over and over again, but is passed through a cooler in the course of its flow. By this means the constant deposition of dust and dirt, and the risk of lowering the insulation resistance when wet air filters are employed, are avoided.

Another development is the internal feed water heater in which steam is drawn from the turbine cylinder at a point or points below atmospheric pressure for feed water heating. The overall thermal efficiency of the plant may be increased by as much as 5 per cent. when this apparatus is fitted, and the size of the condenser can be reduced. When it is considered how very small have been the gains in thermal efficiency by improved design during the last 20 years, a step of this magnitude is of a striking character.

On the traction side the company has recently supplied 78 electric locomotives for the South African Railways, and other similar equipment has gone to the London Underground Railways, to Japan, Holland and Western Australia.

In the transformer department equal progress is evident, six 19 500 kVA three-phase transformers having been supplied to the Barton station, and nine 1 500 kVA 11 000 V transformers to New Zealand. Testing transformers up to 300 000 V have been built, and one for 500 000 V is under construction for the company's new H.T. research laboratory.

Research and education are in fact definite parts of the company's activities. The education department provides instruction for a number of boys during working hours with the idea of recruiting a high-grade personnel. The research department deals in the same way with material.

Organised Production.

At the works of the Lancashire Dynamo and Motor Co. a great point is made of organised production.

Large batches of the main components for the varying types of machines are passed through the machine shops at a time, and on completion of the various operations these parts are placed in the finished part stores. The comprehensive use of jigs and fixtures ensures that any one part is an exact duplicate of and interchangeable with any other corresponding part. When, therefore, an order is issued to the works for a number or even a single machine of a given type, it becomes an easy matter to withdraw standard parts from the stores for assembly, and supply special electrical windings, etc., as called for on the works order.

The winding shop is of special interest, as here the greatest care is required in order so secure an entirely reliable machine, and the reputation of " Lancashire " machines is attributed very largely to the continual insistence to the workman that every job must be thoroughly well done. The exceptional amount of mica insulation inserted in the armature and stator slots is worthy of note, the manner in which each piece of slot insulation is carried out well beyond the end of the slot—both very important points when considering the eventual life of the machine.

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In the manufacture of alternating current motors the methods adopted of winding two or more stator coils with one continuous length of wire, and of avoiding joints on rotor coils are noteworthy, as soldered joints are a frequent cause of breakdowns on all motors. Special machines that apply pressure and heat during the process of wrapping the insulation around each individual coil of high tension machines are installed, also a complete impregnating plant for treating either individual coils or the completed windings. In the fitting shop all classes of machines undergo assembly. After assembly the machines are delivered to the test bed, where they undergo very stringent tests, after which the machines pass to the inspecting, painting and finishing department. Here they are carefully checked against the customers' requirements, all loose parts are collected together and prepared for despatch.

An Outdoor Sub-station.

During the course of the day there were opportunities for inspecting the Murray multiplex telegraph equipment at the "Manchester Guardian" offices and the laboratories of the Manchester University, as well as other buildings of interest in the city.

In the evening a reception was held at the Manchester University, when the guests were received by the Vice-Chancellor (Sir Henry Miers).

(*To be concluded.*)

Parliamentary Intelligence.

Private Bills.

On June 1st, the LONDON ELECTRIC RAILWAY BILL was read the third time and passed. The WIMBLEDON AND SUTTON RAILWAY BILL and the POTTERIES and NORTH STAFFORDSHIRE TRAMWAYS and LIGHT RAILWAYS BILL were considered, as amended, and are to be read the third time. The TRAMWAYS PROVISIONAL ORDERS BILL was read a second time and committed.

The Imperial Wireless Chain.

On Tuesday, Sir L. WORTHINGTON-EVANS, in reply to Sir H. BRITTAIN, said the conditions of the licences for which the Marconi Co. had applied to conduct wireless telegraph services with the Dominions, Colonies, and foreign countries were being discussed with the company, and no time would be lost, so far as the Post Office was concerned, in arriving at a settlement. Meanwhile the manufacture of plant for the proposed Government station was being proceeded with, and orders for the rest of the plant would be placed as quickly as possible.

Sir H. BRITTAIN asked if the right hon. gentleman could not hold out some hope that in the near future this country would be put approximately on the same basis as France and the United States.

Sir L. WORTHINGTON-EVANS replied that as far as the Post Office was concerned there would be no avoidable delay.

Two Strikes.

London Tube and Bristol Trams Affected.

In consequence of the decision of the contractors to reduce wages by 1d. per hour, several hundred men employed on the reconstruction of the City and South London Tube Railway went on strike on Friday last. At a meeting held later, the men affirmed their intention not to accept the reduction.

On Tuesday, at Bristol, there was a strike of tramway men, who were stated to be dissatisfied with certain working conditions. Many protests were made against the stopping of the public service in these days of industrial councils. A few tramcars were run by the company's inspectors and others. The company decided that men not resuming duty on Wednesday would be deemed to have left the service.

British Empire Exhibition.

Science and Scientific Instruments.

The British Empire Exhibition News Service announces that special efforts are being made by the Exhibition authorities to have all branches of science adequately represented at Wembley next year, not only in the organised exhibits, but by means of conferences and discussions on scientific subjects. The outstanding purpose of the Exhibition is stated to be educational. Scientific instruments will form a notable feature and the latest inventions and the most up-to-date tools will be brought to the notice of a wide public, so creating new opportunities for the development of trade.

Some figures issued by the AMERICAN BUREAU OF LABOUR STATISTICS show that while in the United States fuel and light cost 86·2 per cent. more in March 1923, than in December 1914, the cost of electricity is 2·4 per cent. less now than it was then. This decrease has been progressive except in the quarter ending December 1920, when there was a slight rise.

All-Electric Flats.

Thousands Visit Glasgow Exhibition.

The housing shortage has been felt in Glasgow no less than in other parts of the country, and it has been found expedient to convert large houses into flats to meet the current need. In one such case the Corporation Electricity Department took the opportunity of fitting out the flats on "all-electric" lines, and throwing them open to the public for inspection, with gratifying results.

A large house at 12, Crown Terrace, was converted into four self-contained flats, in which, by the introduction of latest electrical cooking, heating and labour-saving devices, household work has been reduced to a minimum. Heating is effected by "Magicoal" electric fires, the handsome installation in the dining-room being shown in

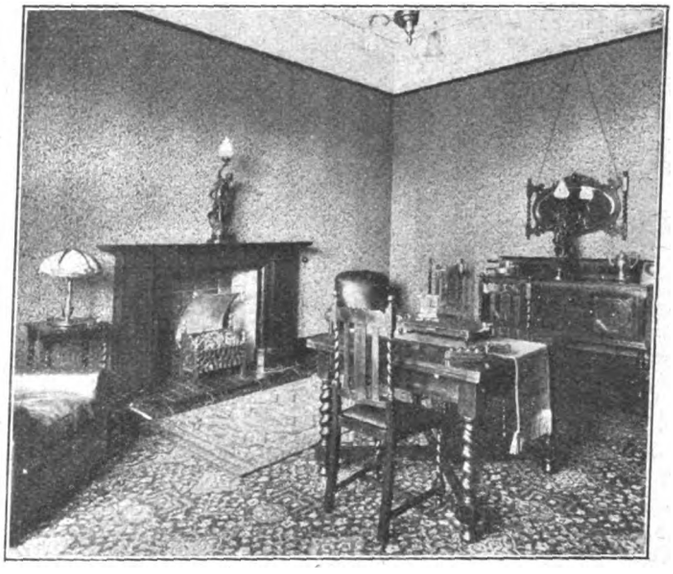

FIG. 1.—THE DINING ROOM.

Fig. 1. An explanatory booklet given to visitors points out that the working cost of these fires is from 1d. to 2d. per hour, according to size. The kitchenette (Fig. 2) contains a modern electric cooker and an electric hot water tank. Electric light is, of course, fitted throughout.

A good, if somewhat long, slogan appears on the cover and title page of the booklet, "The measure in which your house is electrified largely determines the degree of comfort and convenience which you will enjoy." The flats were open for inspection from

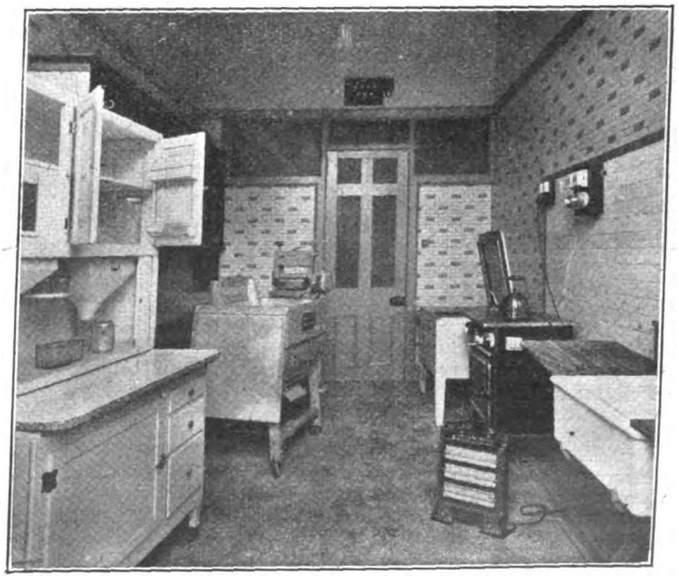

FIG. 2.—THE ALL-ELECTRIC KITCHEN.

May 15th to 26th, between the hours of 11 a.m. and 9 p.m. Mr. R. B. Mitchell, Corporation electrical engineer, informs us that the attendance was about 1,000 per day, and the business resulting to his department should be considerable. Care has been taken to counteract the impression that these "all-electric" flats are expensive to run. At Glasgow a special tariff is available for complete electric service, at a low rate per kWh for all current consumed for any purpose.

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A New Vogue in Lighting Equipment.

As a preface to these notes some comment on the reason why they are published at this time of the year is necessary. It is appreciated that the " lighting season " is finished, and that it will not open again until (say) August or September next. But very subtly and without any bold announcement or teaching, a new vogue in lighting equipment is stealing on us. A new type of fitting is now just on the verge of popularity, and though it is very hard to find a descriptive name for it, the term " enclosed globe pendants " may be used.

Semi-Indirect Fittings and Price Cutting.

If ever, in the distant future, a writer sits down to write a history of the electrical industry, and attempts to analyse the fads and fancies, the fashions and the vogues in electrical fittings particularly, he will surely comment with amazement on the prostitution of the

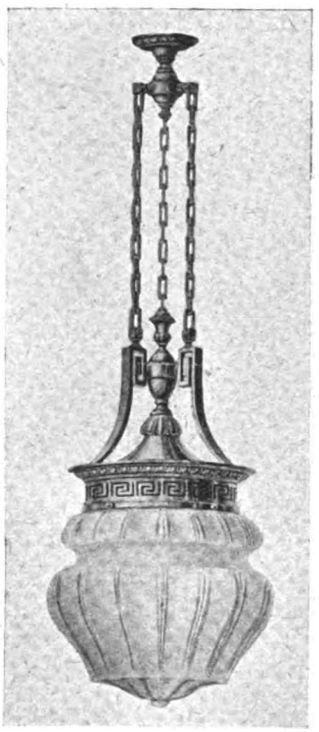

FIG. 1.—UNDERWOOD.

" semi-indirect " lighting idea by the electrical men of to-day, and the fallacies that surround it. For surely none will deny that the " semi-indirect " fitting has been broken on the wheel of the conventional and commonplace. It is used as a lighting unit for every requirement without any regard to period atmosphere, surroundings or other factors, and—a fact to be still more deplored—it is installed without any regard to the real lighting requirements or the light required in the terms of foot candles as proved by scientific illumination. Still more to be deplored, or certainly as much, is the fact that this fitting has become an excuse to cut prices to a point bordering on insanity. The price-cutting started from the source of the supply of the fittings, and as a result " semi-indirect fittings " are mere bits of brass scamped in weight of metal and finish, and in the most impossible designs (save the mark !) it is possible to imagine. It is only necessary to review a few catalogues of fittings makers and wholesalers to prove how barren of thought designers have become. All the fittings are as like as Tweedledum and Tweedledee. The glass used in these fittings must also be commented on. Opal and heavy-pressed glass (both white) are invariably used. Is there no other glass to be obtained ? " Yes," says the despiser of scientific illumination, " but white opal and heavy-pressed glass is so efficient." How true it is that our arguments are a matter of expediency in relation to our profits ! How soon we forget the gospel of the " electrical idea."

A Sigh of Relief.

It is with relief, therefore, that one sees this new vogue in lighting equipment growing apace. Relief rather more from the æsthetic point of view than any other. No attempt is being made to sidetrack the " scientific illumination " thesis on which lighting equipment business must be built up, and this is purposely left to more able minds to deal with. Also it must be made clear that these few notes must not be construed as a diatribe against the principle of semi-indirect lighting as such. It is pleaded, however, that more thought and originality are necessary in using these units, and to keep alive the electrical idea with ".something different." It is an omen for electrical men that the gas industry is rapidly taking up semi-indirect fittings, and as they have caught us up we must again forge ahead.

The number of makers of the enclosed globe or bowl type fitting is limited at the moment but the choice is none the less wide. In these columns will be found several illustrations of such fittings. Before any comments on the characteristics of these particular units are made a few cardinal points for guidance in selection are submitted. This will apply more particularly to the glass, but for the metal part of the complete unit let us try and get away from the hackneyed Georgian, Adam or any other period. For the sake of something different, let us have a frankly " modern " period. Let our fittings designers remember that one of the many criticisms that apply to-day to fittings is that they are merely " bits of brass " to provide a suspension for lamps. A " modern " period can be achieved without any sacrifice of artistic detail. All fittings makers should, therefore, alter their practice with regard to finish. Every fitting, whether it be modest or otherwise in price, and without regard to design, is finished in polished brass. Those who sigh for standardisation of everything electrical have the consolation of knowing that so far as the finish of fittings is concerned, " polished brass " is the " Admiral's walk " of the majority of fittings makers. Again something different is demanded, and standardisation must for once in a while be forgotten.

Some Thoughts on Glass.

Dealing now with the question of glass it must be kept in mind that there are at least two distinct fields of lighting to be catered for. Certainly for the purpose of these notes the requirements can be put under two headings—(*a*) domestic lighting, (*b*) commercial (including industrial) lighting, and it is in both fields that the new unit will find a ready demand. For the domestic field the design of the metal part of the complete unit is not made complete by a random choice of glass. Generally speaking, while efficiency is important in domestic lighting, it is considered secondary to artistic effect. Several manufacturers offer a range of globes or " enclosed unit " glassware, carrying out this ideal—viz., delicacy of design and harmony of colour with efficiency. Although these new units have come into being comparatively recently, it is necessary to point out a mistake into which several have fallen. The practice of installing a unit with a small diameter globe and using a large capacity gasfilled lamp is meant. Several of the manufacturers publish data showing the correct lamp to be used, but it is as well to remember that it is not possible to squeeze a quart into a pint pot. The effect of putting a high-capacity lamp into a small globe is to make a glaring unit which is no recommendation for better lighting, and

FIG. 2.—WESTERN ELECTRIC CO. B.A.G. DIFFUSER.

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in the case of domestic globes the surface brightness will mean the loss of the artistic appearance and decoration of the globe. For commercial lighting efficiency takes precedence of decorative effect, but withal artistic detail, both in the glass and the metal-work, need not be entirely forsaken.

The Question of Ventilation.

A brief comment may be made on the question of ventilation of these totally enclosed units. Several makers are providing ventilation holes in the metalwork, taking care that the fitting remains

FIG. 3.—B.T.-H.

dustproof. In other units no ventilation holes are provided, it having proved that such ventilation is not necessary because of the large radiating surface provided.

FIG. 4.—G.E.C.

A Few Illustrations.

It must not be assumed that the few illustrations which these columns will accommodate represent the limit of the range manufacturers have to offer. Obviously this is not so. Already, in spite of the fact that there are but comparatively few manufacturers who are offering these fittings, the choice is a wide one. Fig. 1 is a fitting which, described in popular language, is very handsome. There is, however, a modern tendency to assume a different meaning when one describes a fitting as handsome: but I shall make no bones of calling this fitting handsome. It is marketed by UNDERWOOD and the glassware shown is "Moonstone." Underwoods have many particularly appealing fittings to offer. Fig. 3 is one selected from the many designs to be seen in the various local showrooms of the BRITISH THOMSON-HOUSTON CO. The simple nature of the design of the metalwork is pleasing when fitted to the distinctive shape glass shown in the illustration. This shape is *particularly distinctive* because it does depart from the spherical or pine shapes which all "enclosed units" seem to adopt. The artistry of the design done in grey on a satin glass is a triumph of the designer, and the glassmaker. Fig. 4 is a fitting taken from the recent catalogue of the GENERAL ELECTRIC CO. In this design the glass takes the shape of the more conventional ball or sphere. The ribbings of the "Equiluxo" glass are chaste, and the fitting as a whole is one which will suit many situations.

Fig. 2 is an enclosed unit marketed by the WESTERN ELECTRIC CO. Here, again, the whole note of the design is originality. Further, the glass is made up, so to speak, on the two-piece principle. The top member is made in two-ply diffusing glass, and the bottom member has been so designed as to perform the function of a diffusing glass.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

RADIOPHONES, LTD. (manufacturers of Listoleon instruments) announce that they have published a descriptive booklet describing the Listoleon de Luxe Cabinet.

"Experience" is the keystone on which apparatus is manufactured by RADIO INSTRUMENTS, LTD. The small folder describing a high-frequency panel with variable intervalve reaction will interest both engineers and wireless retailers.

We tender the advice to all readers of "The Electrician" (who are interested in such instruments) to apply to KELVIN, BOTTOMLEY AND BAIRD for a copy of the pamphlet which they have just issued describing the Econometer Portable Co_2 Tester.

Telephone engineers who actively follow every development in their art, are invited to apply for a copy of booklet entitled "Notes on Telephone Economy and Efficiency" which has just been published by the RELAY AUTOMATIC TELEPHONE CO.

C. F. ELWELL, LTD., have recently published a list of wireless apparatus and accessories. From even a superficial study of the list it is obvious that the manufacturers intend that "Aristophone" apparatus shall keep in the front ranks of quality apparatus.

MARCONI'S WIRELESS TELEGRAPH CO. have kindly sent us copies of two pamphlets (*a*) L/2003, entitled "Marconi Y Series of Portable and Semi-Portable Telephone Telegraph Stations," (*b*) No. 210, entitled "500 W Portable and Semi-Portable Station Type Y.C.5."

THE BRITISH THOMSON-HOUSTON CO. have recently circularised to all on their mailing list two new publications: (1) price list No. 5 116 describing a.c. hand operated oil-immersed starting rheostats, and (2) descriptive list No. 4 154C on ironclad oil-break switchgear.

ROGERS FOSTER AND HOWELL have just published a comprehensive list describing their range of wireless sets. The manufacturers lay particular stress on the new reaction sets, and we hope to be able to describe them more fully in our "Merchandise to Sell and Profit by" columns at an early date.

Engineers who cater for power jobs for the printing and allied trades will not need prompting to secure a copy of the illustrated brochure just published by the SWEDISH GENERAL ELECTRIC CO. It is entitled "Electrical Equipments for Printing and Allied Trades" and is a mine of information on the subject.

The BRITISH THOMSON-HOUSTON CO. have recently published new lists—(*a*) price supplement No. 2147B of 50 cycle induction motors; (*b*) price list No. 5115C of a.c. hand-operated starting and regulating rheostats; (*c*) list No. 4612 is a descriptive list of moulded compounds. Readers of THE ELECTRICIAN who are not on the B. T.-H. mailing list and consequently have not received these lists are invited to inquire for copies.

There are many critics of the publicity matter issued by electrical manufacturers in this country. They are now confounded by the issue of several excellent lists by METROPOLITAN-VICKERS ELECTRICAL CO., LTD. These are as follows:—(*a*) Section C on porcelain cleats and insulators, (*b*) section H covers a wide range of industrial and street lighting lanterns and fittings, (*c*) section M is a most exhaustive list on the whole range of "Cosmos" cooking and heating appliances, (*d*) section B quotes in detail description and prices of wiring accessories.

Many buyers of resistance wires for electric fires and the like are reproached for buying foreign-made material. They have pleaded in defence that it is not done so much on price, but on the fact that English makers do not present their proposition in the concise tabulated form which is particularly the practice of American manufacturers of resistance wires. They have now lost their ground for this plea. HENRY WIGGIN AND CO., the manufacturers of the "Snake" brand of resistance wires and tapes, have just published a small book giving every information on resistance wires for many purposes. This book should be in constant use in every designer's and buyer's office.

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Institution of Electrical Engineers.

Nominations for Election to the Council.

The following have been nominated by the Council of the Institution of Electrical Engineers for the vacancies which will occur in the offices of President, Vice-Presidents, Honorary Treasurer, and Ordinary Members of Council on September 30th 1923 :—

PRESIDENT, Mr. A. Russell, M.A., D.Sc., Principal, Faraday House Electrical Engineering College, Faraday House, Southampton Row, London, W.C.1.

VICE-PRESIDENT, Sir James Devonshire, K.B.E., Director, Underground Electric Railways Co. of London, Ltd., Electric Railway House, Westminster, S.W.1.

HONORARY TREASURER, Mr. P. D. Tuckett, Chairman, Edmundson's Electricity Corporation, Ltd., Broad Sanctuary Chambers, Westminster, S.W.1.

ORDINARY MEMBERS OF COUNCIL :—*Members*, *Capt. J. M. Donaldson, M.C., Chief Engineer, North Metropolitan Electric Power Supply Co., Manor House Offices, Finsbury Park, London, N.4.; Mr. G. W. Partridge, Managing Director and Chief Engineer, London Electric Supply Corporation, Ltd., 25A, Cockspur Street, London, S.W.1; *Col. T. F. Purves, O.B.E., Engineer-in-Chief, General Post Office, London, E.C.1; *Mr. P. Rosling, General Manager, W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London Wall, E.C.2; Prof. W. M. Thornton, O.B.E., D.Sc., Professor of Electrical Engineering, Armstrong College, Newcastle-on-Tyne. *Associate Member*, *Mr. S. W. Melsom, Principal Assistant, Electricity Department, National Physical Laboratory, Teddington.

Members whose names are marked * have not served on the Council previously in any capacity.

It is competent for Members (M.I.E.E.) and Associate Members subject to the conditions laid down in Bye-Law 50 to nominate other qualified persons to fill the above vacancies. The requisite qualifications and procedure are set out in Bye-Laws 44–51 of the Bye-Laws of the Institution.

I.E.E. Western Centre.

Annual Meeting at Plymouth.

The annual meeting of the INSTITUTION OF ELECTRICAL ENGINEERS, WESTERN CENTRE, was held at Plymouth on Saturday. In the morning, by permission of the Admiral Superintendent, the party went over Devonport Dockyard and were shown over H.M.S. "Hood." In the afternoon they went by motor bus over the moors to Yelverton and Princetown, where tea was taken. The party returned to the Royal Hotel to dinner.

Mr. F. TREMAIN presided, and the toast of the Institution of Electrical Engineers was proposed by the Mayor of Plymouth (Mr. SOLOMON STEPHENS).

Responding, the chairman said he had been very much struck, on returning to Plymouth by its development. One thing that deeply impressed them as engineers was the waterworks at Barrator. A great water power was held in this huge storage. It would serve to light the whole town and some of the neighbouring towns as well. But if Plymouth could not develop its electrical energy it did develop other energies of a potent character and the town, he was sure, had a great future.

Responding to the toast of his health, Mr. P. A. YAPP, chief assistant electrical engineer, Devonport Dockyard, spoke of the visit of the Institution to H.M.S. "Hood." The "Hood," he said, embodied some of the lessons of Jutland, but not all. England had scrapped some of her newest ships. Other countries had ships which embodied all the lessons of Jutland. Were we in Great Britain to let slip the legacy of our forefathers ? He did not think so. That lesson came largely from the West Country, and he hoped we should never forget in England what a factor the British Navy had been in the past and must be in the future.

On Sunday the party enjoyed a river trip to Calstock.

I.E.E. South Midland Centre.

Summer Visit to Cannock Chase Collieries.

Some 150 members of the SOUTH MIDLAND CENTRE of the INSTITUTION OF ELECTRICAL ENGINEERS participated, on May 30th, in a visit to the Cannock Chase Collieries, by courtesy of the general manager, Mr. S. F. Sopwith, the arrangements being made by Mr. C. Jones. The visitors were taken down No. 9 pit, where they saw hand and machine mining in progress, and inspected the system of underground haulage, gears, sub-stations, etc. Subsequently they were shown the screening operations of coal, and inspected the Colliery Co.'s overhead transmission system and village lighting scheme by overhead lines. Arrangements were also made for the inspection of the underground conveyors, static condensers and other special mining electrical apparatus.

Luncheon was taken at the Company's power station by invitation of Mr. Sopwith. The visit was greatly enjoyed, and the universal impression was that the electrification scheme of the Cannock Chase Colliery group ranks second to none in the country.

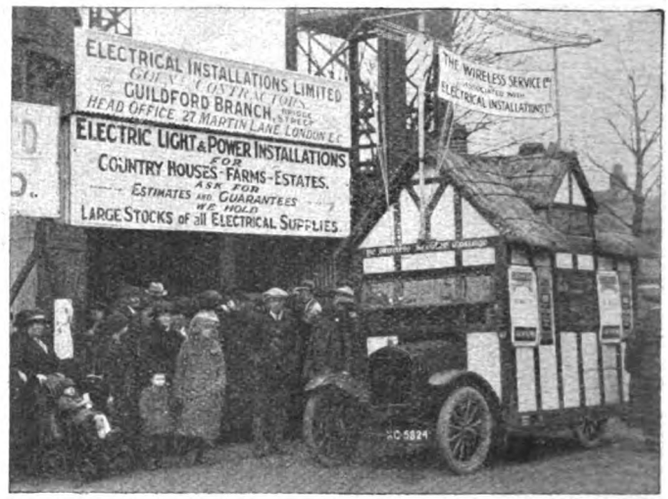
An order has been made for the RESTORATION OF PATENT No. 6 492 of 1912, granted to Riccardo Girardelli for "Electric motor for transmitting angular movements with an auxiliary motor which controls the successive displacements for it."

Portable Wireless Publicity.

A Novel Aid to Salesmanship.

There is no more effective method of publicity for wireless broadcasting receivers than actual demonstrations with the sets, and wireless dealers throughout the country, keenly alive to this fact, are arranging suitable demonstrations whenever an opportunity offers.

Unfortunately, in many more remote and scattered regions it is difficult to obtain suitable premises for these demonstrations, but WIRELESS SERVICE (in association with Electrical Installations, Ltd.) have equipped the novel wireless demonstration van shown in the accompanying illustration. The van consists of a touring


ELECTRICAL INSTALLATIONS LIMITED
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ELECTRIC LIGHT & POWER INSTALLATIONS
FOR
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ESTIMATES AND GUARANTEES
LARGE STOCKS of all ELECTRICAL SUPPLIES
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G.E.C. WIRELESS DEMONSTRATION VAN USED BY WIRELESS SERVICE LTD.

motor-car, the body of which has been camouflaged to look like a small country cottage. A short but efficient aerial is erected on the roof, and the interior is equipped with a "Gecophone" two valve receiving set and full equipment of loud speaker, etc.

Some successful business tours in the country districts within 100 miles of London have been made, and the demonstration van has visited several market towns and given concerts in the market place.

The illustration shows a concert in progress at Guildford market, the pitch chosen being in front of the permanent stand of Electrical Installations, Ltd., in the Market Place.

B.E.A. Annual Meeting.

Mr. E. W. Petter Elected President.

The eleventh annual general meeting of the BRITISH ENGINEERS' ASSOCIATION was held at the Hotel Victoria, London, on May 31st. Mr. E. W. Petter was unanimously elected president in succession to Mr. Nevile G. Gwynne, who had occupied that position for the past two years. Notwithstanding the effects of the recent industrial depression the Council was able to present a satisfactory report on the work of the Association during the past year together with accounts disclosing a sound financial position.

With regard to the organisation by the Association of the ship-building, marine, mechanical and general engineering section of the British Empire Exhibition it was reported that already over 75 per cent. of the space had been sold and allotted through the Association, so that the success of this section might be regarded as assured.

The meeting closed with a hearty vote of thanks to the retiring president. Mr. H. J. Ward was elected chairman of the executive committee in the place of Mr. Petter. The following new members were elected to the Council: Engineer Vice-Admiral Sir George Goodwin, Lt.-Col. W. C. Symon, Mr. David C. Lycett Green, and Mr. Wilfrid Lancaster.

E.C.A. President in Ireland.

Mr. H. Marryat, president of the ELECTRICAL CONTRACTORS' ASSOCIATION, has just returned from visiting the contractors in Ireland, where he was enthusiastically welcomed both in Belfast and Dublin. In Belfast particularly he finds the contractors to be well together and on the best of terms with each other, with Mr. Johnstone Wright, city electrical engineer, and the local supply houses.

A lunch was arranged in the city at which Mr. Johnstone Wright and Mr. Marryat were guests. The majority of the local contractors were present, and it was evident from the speeches made that the utmost goodwill existed between all parties.

At Dublin the contractors have formed their own local association, only a few members of which belong to the E.C.A. This position has arisen owing, to some extent, to the local workmen's organisation having broken away from the E.T.U. It is expected, however, that some arrangement will be made to enable the Dublin contractors to join or affiliate with the E.C.A.

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Electricity Supply.

Extensions and Developments.

Mains extensions are proposed at CARDIFF at a cost of about £10 000.

MALVERN Urban Council has applied to the Commissioners for a loan of £3 000 for cables, transformers, meters, etc.

New plant, consisting of two 105 kW generators and two 250 H.P. Diesel engines, was brought into use at SHREWSBURY last week.

YORK Electricity Committee proposes to make arrangements for the formal opening of the hydro-electric works at Linton in July.

CARNARVON Town Council has approved the draft agreement with the North Wales Power Co. for a supply of electricity in bulk.

New generating plant, consisting of a boiler and Curtis-Ratteau turbine, was inaugurated at PERTH Corporation electricity works last week.

FOLKESTONE Corporation is to take expert advice in connection with the proposal of the Folkestone Electricity Co. to change over from d.c. to a.c.

BATH Electric Lighting Committee recommends the installation of a 1 250 kW generator at a cost of £3 904, in place of the 1 500 kW rotary converter originally contemplated.

LANCASTER Electricity Committee have arranged terms with Morton Sundour Fabrics, Ltd., for a supply of electricity to their Caton Road works. The engineer was authorised to obtain an additional 150 kW rotary converter at a cost of £1 080.

PETERBOROUGH Town Council has decided to lay a new main along Lincoln Road, for supplying electricity to new waggon works at Walton, and the cost, with the erection of a sub-station, is estimated at £2 750. The charge for electricity for lighting purposes is to be reduced to 8d. per unit.

COVENTRY City Council has adopted the recommendation of the Electricity Committee that extensions be carried out at the Sandy Lane generating station, at an estimated cost (including £29 842 previously approved) of £44 188, and that application be made for sanction to a loan of that amount.

The Town Clerk of BURNLEY has reported that a scheme is on foot for the provision of a new capital electricity station in the district of Padiham, and Burnley Corporation had notified that they were willing to undertake the erection of such station. Lancashire Electric Power Co. had also notified that they were willing to undertake the scheme. The Electricity Committee of Burnley Corporation have decided to pay a special visit to the proposed site before coming to a final decision.

Alterations in Charges, Proposed and Actual.

EXETER Electricity Committee recommends that charges be reduced to within 50 per cent. of the pre-war charges. The rates proposed are: Lighting, 6d. per kWh; power and heating, 3d., 2½d., and 1½d. per kWh.

BARTON-ON-HUMBER Urban Council has decided to oppose the application of the Barton Electric Supply Co. for an order authorising the charge for electricity supplied to private consumers to be increased from 10d. to 1s. per kWh.

LEATHERHEAD and District Electricity Co., has applied to the Ministry of Transport for an order to continue the maximum charge of 1s. per kWh with minimum payments of 15s. for each winter quarter and 10s. for each summer quarter.

LEEDS Electricity Committee recommends that the charge for power be reduced from 30 per cent. to 20 per cent. over the 1916 charge, and that the charge for electricity for other purposes be reduced from 60 per cent. to 50 per cent. over the 1916 charge.

At WATERLOO-WITH-SEAFORTH the charges for electricity for lighting have been reduced from 70 per cent. above pre-war charges to 50 per cent., plus 1½d. per kWh; for shop lighting from 35 per cent. to 25 per cent.; and for power from 25 per cent. to 12½ per cent.

BARNSTAPLE Town Council has applied to the Commissioners for an order to maintain the maximum charge for electricity now existing under the Statutory Undertakings (Temporary Increase of Charges) Act, 1918. It has been decided to fix a minimum charge of 5s. for each summer quarter and 7s. 6d. for each winter quarter.

ABERTILLERY Urban Council has applied for the maximum charge of 9d. per kWh for electricity to be continued after the expiration of the order under the Temporary Increase of Charges Order, on August 31st. The Council is also considering the question of a fringe Order to enable electricity to be supplied in the outskirts of the town.

New electricity charges decided upon by BOLTON Corporation represent a reduction of a farthing per kWh for all purposes. The average rate for lighting will be 4¾d., instead of 5d. For domestic purposes the new rate is 1¾d., against 1·90d., and for industrial purposes the new rate is 2¾d., instead of 2·90d. up to 500 kWh per quarter, and 1½d. instead of 2d. over that consumption.

CHESTERFIELD Electricity Committee has adopted the following scale of charges:—Large power consumers, £6 per kVA per annum, plus ·4d. per kWh consumed; small power consumers, first 500 kWh per quarter, 2¼d. per kWh, next 500 kWh per quarter, 2d.; next 1 000, 1¾d.; next 3 000, 1½d.; all additional, 1¼d.; tramways, 1½d. per kWh; lighting consumers, 5¼d.; heating and cooking, 1½d.; public lighting, 3d., exclusive of maintenance.

ACCRINGTON Electricity Committee has adopted a revised scale of charges for electricity, to come into operation as from April 1st, representing a reduction of 20 per cent. For lighting purposes the flat rate of 8d. per kWh is reduced to 6d., and for heating and domestic purposes from 3d. to 1½d. To consumers supplied on rateable value basis the rate will be a fixed charge of 15 per cent. per annum on the rateable value of the house, plus a charge of 1½d. per kWh, as against 2½d. at present. Power charges are also reduced.

Tapping New Areas.

A public meeting at CLOGHER (Ireland) has appointed a committee to take expert opinion and report on the question of lighting the town with electricity.

HENLEY-ON-THAMES Town Council and the Rural District Council have approved the draft order of the Thames Valley Electric Supply Co. for the supply of electricity to their districts.

SHOEBURYNESS Urban Council has been informed that the Commanding Officer of the Royal Engineers was willing to meet a deputation from the Council on a question of an electricity supply for the district.

BILLINGHAM Urban Council has decided to offer no objection to the application by the Cleveland and South Durham Electric Powers Co. for a special order authorising them to supply electricity within the urban district.

GODSTONE Rural Council has received notice from W. O. Rooper and Co., of a proposal to apply to the Commissioners for an order sanctioning the erection of a generating station at Lingfield, and power to supply electricity in the district.

ILFORD Urban Council has decided to seek the consent of the Electricity Commissioners, the County of London Electricity Supply Co., and the Romford Rural Council, to give a supply of electricity to consumers in the vicinity of Chadwell Heath.

NEWMILL Urban District Council (West Riding of Yorkshire) is applying to the Commissioners for an order authorising the Council to purchase electricity in bulk and distribute it in the Newmill urban district. Any objections must be sent to the Secretary, Electricity Commission, Whitehall, London, by June 25th.

The NORTH SOMERSET ELECTRIC SUPPLY Co. has applied to the Electricity Commissioners for a special order authorising the company to generate and supply electricity in ASHBRIDGE and LONG ASHTON rural districts. Any objections must be sent to the Secretary, Electricity Commission, Whitehall, London, by July 3rd.

NEWARK-ON-TRENT Town Council has decided to ask the directors of the Gas Co. whether they are disposed to transfer the undertaking with a view to working it in conjunction with an electricity plant, if that should prove the best method of supplying the town. The Council has also decided to inquire from Nottingham Town Council and the Notts and Derby Power Co. on what terms they would supply electricity in bulk.

Personal Items.

We learn with pleasure that Mr. C. O. MILTON, electrical engineer at Maidenhead, has resumed his duties after his recent severe illness.

Mr. J. F. SHEA, engineer of ways and works in the Victorian Railways Department, has been appointed chief electrical engineer of the South Australian Railways.

Edinburgh Tramway Committee recommends that the salary of the tramways manager, Mr. R. STUART PILCHER, be increased by £300, in three yearly instalments of £100.

Mr. EDWARD WILSHAW, the recently appointed secretary of the Eastern Telegraph Co., has been elected Chairman of the City Branch of the Royal Society of St. George.

On his retirement from the managership of the Wallasey Corporation Tramways, Lieut.-Col. R. A. GREENE was presented with a silver salver. Mrs. Greene was presented with a gold watch.

Leek Urban District Council has decided to increase the salary of the Electrical Engineer, Mr. H. TULLOCH, from £450 to £500 per annum, and that of Mr. JOHNSON, his assistant, from £300 to £325.

Maidstone Town Council has fixed the salary of Mr. A. T. LAMBERT, manager of the Corporation tramways, at £600 per annum, with no bonus, and inclusive of other emoluments. The salary is to come up for revision in three years.

Sir WILLIAM BRAGG has been chosen by the managers of the Royal Institution to be Fullerian Professor of Chemistry in the Institution and Director of the Davy-Faraday Research Laboratory, in succession to the late Professor, Sir James Dewar.

The Lord Mayor of Sydney (N.S.W.) has recommended that the salary of Mr. H. R. FORBES MACKAY, engineer and manager of the electricity department, be increased to £2 500 per annum, and the Finance Committee have been asked to consider the matter.

Alderman W. WALKER has been re-elected chairman of the National Joint Council for the Electricity Supply Industry. He has been chairman since the formation of the Council in 1919, receiving the unanimous support of both employers and trade unionists on every occasion.

The following are among the honours conferred on the occasion of the King's birthday:—C.B. (Civil Division), Mr. WM. MCCLELLAND, director of electrical engineering at the Admiralty; C.M.G., Mr. J. H. BUTTERS, chief engineer and general manager, Tasmanian Hydro-Electric Department; Knighthoods, Mr. G. H. KNIBBS, director of the Australian Bureau of Science and Industry, and Mr. R. C. BARKER, director-in-chief, Indo-European Telegraph Department.

WILL.—The late Mr. SYDNEY GEDGE, a director and formerly chairman of W. T. Henley's Telegraph Works Co., who died on April 9th, left £18 450.

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Foreign Notes.

EUROPE.

Electricity in Poland.

The Commercial Secretary at Warsaw (Mr. R. Kimmins) refers in his report to the electrical industry which, he says, continued to develop satisfactorily during 1922. Telegraph and telephone apparatus, wireless equipment and valves, cables, electric lamps, dynamos and motors, switch gear and household accessories are now being made. The increase in the number of locally manufactured articles is in a great measure due to the depreciation of the Polish currency, which has rendered purchases abroad difficult. Most of the foreign electrical apparatus sold on the Polish market is of German and Austrian origin. A Dutch concern has opened a lamp factory near Warsaw.

THE NEAR EAST.

Boycott of the Rutenberg Concession.

The Cairo correspondent of the "Morning Post" learns that for the present there is little prospect of a settlement between the Jaffa Municipality and Mr. Rutenberg, who holds the much-discussed concession for the development of electric power throughout Palestine. Mr. Rutenberg has not yet utilised the water power or other natural resources of the country, but has erected a large power station at Telaviv, near Jaffa. Cables for conveying power have been laid throughout Telaviv and to the central square of Jaffa, but notwithstanding steady progress in the work the deadlock between the Municipality and the Jewish concessionaire is unsolved.

The population of Jaffa, almost exclusively Moslem or Christian, remain uncompromising in their attitude to what they regard as a purely political concession fastened upon the country by certain official Jewish influences. All the efforts of the Government to persuade the population to participate in the scheme have failed, as well as every endeavour to allay the suspicion that the concession is political. At a meeting of influential citizens of Jaffa it was resolved to oppose every effort by the Government to compel acceptance of the scheme. During the last few days the people of Jaffa have been wearing ribbons inscribed "Lamp-posts of Rutenberg are gallows of our race."

THE FAR EAST.

Manila Electric Corporation's 1922 Results.

The gross revenue of the Manila Electric Corporation for 1922 totalled $3 584 121, and the available income was $1 063 646. Four quarterly dividends amounting to $400 000 were paid, leaving $663 646, which was transferred to surplus. Electric department general earnings continue to increase, and while gross earnings decreased $39 959 as compared with 1921, caused by a decrease in commercial power sold of $91 660 due to business depression throughout the island and shutdown of several important oil mills, other electric earnings show increases. Railway gross earnings decreased $57 417 on account of the increase in first-class passengers carried.

Chinese Electrical Concern's Extension.

To provide for extension, the Wu Hsing City Electric Co. in Huchow, Chekiang, has increased its capital by issuing new shares to the amount of $70 000, which makes the total capital $120 000. The company was formerly known as the Wu Hsing City Electric Light Co., and its business was confined to the supplying of electric light to the city. With the increase of its capital it has adopted the present name and is undertaking the supply of electric power to the public. The company's request for registration has been granted by the Ministry of Communications. The Ministry has also granted registration and a business licence to the Jehol Telephone Co., a new concern.

LATIN AMERICA.

Hydro-Electric Scheme for Uruguay.

Deputies César Gutiérrez and Garcia Selgas are trying to secure the interest of the President of the Uruguayan Republic in their project for the utilisation of the waters of the Salto Grande waterfall for the generation of electrical power.

A Chilean Electric Railway Concession.

The Department of Overseas Trade is informed that a concession was recently granted for the construction of an electric railway from Santiago to some of its south-western suburbs. The concessionaire is a qualified engineer and informed Mr. Bateman, who was until recently H.M. Chargé d'Affaires at Santiago that he would be willing either to undertake the construction of the line in connection with a British firm or to sell the concession to a constructor who would undertake the whole business. The name of the concessionaire and full particulars of the scheme supplied by him can be obtained by British firms interested in the matter on application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1.

U.S.A.

Westinghouse Co.'s Strong Position.

The net income of the Westinghouse Electric and Manufacturing Co. for the year ending March 31st, 1923, was $12 263 485 as shown by the company's annual report. The dividend requirements were $6 033 428, so that over twice this amount was earned and more than six million dollars added to the surplus. Gross sales for the year were $125 000 000, which represents an increase of $25 000 000 over the sales of last year. The cash position of the company is a strong one, the current assets totalling over $106 000 000, and the current liabilities less than $17 000 000. The value of unfilled orders at the close of the year was $61 914 237, as compared with $50 740 696 at the close of the previous year.

A plant located at Sharon, near Pittsburg, Pa, was acquired during the year, and it is planned to concentrate the manufacture of transformers there. Two hundred dwelling houses, located near the company's South Philadelphia Works and formerly the property of the Emergency Fleet Corporation, were purchased and are being sold to employees.

Imperial Notes.

AUSTRALASIA.

New Tramcars for Brisbane.

It is proposed to obtain new and larger cars for the BRISBANE TRAMWAY TRUST'S system. The Chairman states that it is desired to have the cars made in Australia if possible.

Electric Supply in Newcastle.

The accounts of the Newcastle (N.S.W.) municipal electricity department for 1922 show revenue £107 026, against £100 238 in 1921, gross profit £14 562, an increase of £570, and a net surplus after providing for capital charges and depreciation, of £10 339.

The Mangahao (N.Z.) Scheme.

The New Zealand Minister of Public Works, Mr. J. G. Coates, has informed a deputation that the supply of electricity from the Mangahao works will probably be commenced by June, 1924. The question of reducing the charge to the local power boards from £10 to £8 for the first 200 kW cannot be entertained until the undertaking pays interest, sinking fund and depreciation.

Sydney Council's Profit for 1922.

Sydney Corporation's electricity undertaking made a profit of £141 353 for the year 1922, compared with a deficit of £23 748 on the preceding year. £35 000 has been allocated to relief of rates. £50 000 has been expended on the first portion of the distribution system in the St. George district, which is now completed and ready to take electricity from the Corporation's electricity department.

Sydney Suburban Railways and Tramways.

A deputation recently urged upon the New South Wales Railway Commissioners the desirability of the early electrification of the Kogarah-Sans Souci tramway. The Chief Commissioner (Mr. Fraser) said he had asked for the allocation of large sums to be spent before 1925 upon the conversion of the Illawarra line to electric working, and when the conversion of the line was completed the tramways joined to it would also have to be worked electrically.

Adelaide Tramways Trust.

The revenue of the Adelaide Tramways Trust for the half-year ended January 31st last was £303 624, and the operating costs were £211 614. After providing for reserves, interest and instalment of cost of construction, the half-year's surplus was £6 140, and the accumulated surplus £33 320. Extensive additions to the plant at the power station and converter stations will come into operation shortly, after which additional cars and new lines will be put into service.

CANADA.

B.C. Electric Railway Dividends.

The British Columbia Electric Railway Co, has declared dividends of 3½ per cent., free of tax, on both the preferred and deferred ordinary stocks, in respect of the year ending June 30th next.

Ontario Water Power.

In order to relieve the shortage of electric power, which is seriously crippling the mining industries of Northern Ontario, the Provincial Government of Quebec decided to sell at auction on April 25th a lease of the Des Quinze Rapids at the head waters of the Quinze River, which are stated to be capable of generating nearly 100 000 H.P. of electric energy. The upset price was to be an annual rental of 8 000 dollars, and the company securing the lease will be bound to develop at least 20 000 H.P. within four years. The Government has adopted the principle of charging a royalty of 50 cents per H.P. on all electricity exported from the province, which will apply in the case of this and all future leases, but not to leases of water powers previously granted. The Ka-ka-ka Falls on the Quinze River, says the "Engineer," are to be utilised by the Northern Ontario Light and Power Co., for the development of some 90 000 H.P.

INDIA.

The Shillong Hydro-Electric Project.

Plant is now being installed at Beadon Falls for the Shillong hydro-electric undertaking. The plant includes two Pelton water-wheel turbines.

Bombay Railways Electrification.

The work of electrifying the Bombay suburban lines from the Victoria Terminus to Kalyan on the Great Indian Peninsula Railway is expected to be completed by 1927.

Electric Supply in Karachi.

Karachi Electric Supply Corporation have now issued the whole of the capital of Rs. 1 700 000 (about £113 000). The plant in the generating station will now be doubled for the third time, and additional high-pressure supply is expected to be available within six months.

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Electric Traction.

Tramway Extensions and Developments.

ABERDEEN Tramways Committee have decided to replace the cables on the George Street route at a cost of £7 000.

LIVERPOOL Corporation is applying to the Minister of Transport for a Light Railway Order authorising the construction of new routes in the parish and city.

Strong opposition has been offered by the members of the City Corporation to the proposal to assent to the scheme of the LONDON County Council for extending the tramway along Farringdon Street to Ludgate Circus. The matter has been referred back.

The general manager of BOLTON tramways has reported that the Chorley Old Road extension is now complete and ready for use. Application has been made for sanction to the use of the line for passenger service, and the general manager has been instructed to inaugurate a service of cars as soon as that is received. The engineer has been instructed to obtain tenders for tram rails, etc., required for the proposed extension to Westhoughton.

BIRMINGHAM Tramways Committee have been approached by West Bromwich Corporation as to the question of the operation of their tramways by the Birmingham Tramways Department after March 31st, 1924, the date on which the existing lease of these tramways to the South Staffordshire Tramways (Lessee) Co. expires. The committee have expressed their willingness to undertake the operation of the West Bromwich tramways upon the basis of being paid the whole of their operating expenses, the receipts from the West Bromwich lines being paid over to the Corporation.

The Leeds Accident Enquiry.

On May 31st, Lieut.-Col. A. H. Mount, of the Ministry of Transport, resumed his inquiry into the recent tramcar disaster on the LEEDS Corporation system at Churwell. The driver of the car, G. W. Knight, was examined, part of his evidence being taken in private. He stated that he knew the route well, and that before taking the car out of the depot on the morning of the accident, he found everything apparently in order. When he last pulled up before the accident, he did so by means of the hand-brake, the track-brake being on all the time. In starting, he applied no power, but simply released the hand-brake. The car, he said, all at once gave "a sudden jump."

Subsequently Mr. A. A. Allen, Works Superintendent of the Leeds Tramways, who was recalled, gave evidence concerning his report on the examination and general maintenance of cars. In reply to Mr. Trenholme witness said he found the condition of affairs in connection with the hand-wheel brake at the front of the car was consistent with the evidence of the driver when he said it failed to operate.

Mr. Trenholme: Is that through some defect which you discovered in the mechanism of the hand-wheel brake? —It is due to a defect in the teeth of the ratchet.

That is at the end of the car, which would not be operating when making the journey from Chapeltown?—Yes, but it would be operating from Bruntcliffe to the scene of the accident.

Have you found the mechanism of the hand track-brake, through slackness of chain, bring about a liability to foul?—Yes.

Mr. Trenholme: Was there any partial flaw of the rear axle before the accident?—Mr. Allen: In my opinion there was a flaw in the keyway of the axle.

Have you formed any opinion when it took place?—Witness: It is difficult to say, but having examined the site, I am convinced that the axle was not fractured until at least when the car got on the double track.

That is before the impact with the wall?—Possibly.

The Inspector: In my opinion no one would be able to come to a definite conclusion on that point. I think Mr. Allen's conclusion that it broke coming round the curve is quite sound, but, on the other hand, it might have broken when the car swung round after the impact with the wall.

Mr. Greene: Where was the first indication to your mind that the axle might have broken before the impact with the wall?—Mr. Allen: Where the rear wheels left the track.

The inquiry was concluded.

Tram Driver's Death on Duty.

At Whitworth, near ROCHDALE, on Monday, a tram-driver named Smith, 32 years of age, driving a Rochdale Corporation car between Rochdale and Bacup, fell off the platform into the roadway while the car was passing through Whitworth. One or two of the passengers who chanced to notice the incident raised an alarm, and the conductor dashed through the car to the driver's platform and stopped the car. Smith was lying prostrate in the middle of the roadway, and a doctor was immediately summoned, but when he arrived Smith was dead.

Members of the BIRMINGHAM AND DISTRICT ELECTRIC CLUB are to visit the Rugby works of the British Thomson-Houston Co. on June 20th.

At a LIVERPOOL electricity sub-station on Saturday, an employee named Geo. Phillips was seriously burnt while inspecting a power board owing to his watch-chain coming into contact with a fuse and giving rise to an explosion.

Wireless News.

Successful Opera Transmission.

Congratulations are due to the British Broadcasting Co. for the excellent way in which the operas from Covent Garden, London, have been transmitted during the last few days. It would be interesting to know whether the box-office receipts have fallen off in consequence. We suggest that such a result is very unlikely, and that, on the contrary, listeners-in generally will be impelled to go to Covent Garden and hear the actual performances. The British National Opera Co. know that they have nothing to fear by giving the public a foretaste of the performances by means of wireless. Possibly some of the theatrical managers who so bitterly oppose broadcasting are not so confident.

The B.B.C., however, were not able to broadcast "La Boheme," owing to the refusal of Dame Melba to take part if such a proceeding was adopted. Her agent is reported to have said that they were influenced in the matter "purely by business considerations." Dame Melba, he added, realised that her value as a concert artiste would soon diminish if she were to be heard by 100 000 people at a time, instead of by two or three thousand.

B.B.C. Activities at Sheffield and Aberdeen.

Mr. F. Lloyd, president of the Sheffield and District Wireless Society, has been to London to urge forward the construction of the experimental wireless relay station for Sheffield. He was assured by Capt. Eckersley that the work of erection at Sheffield would start at once. The experiment is an interesting one, and has involved the B.B.C in a great deal of work.

Plans are also being pushed forward for the establishment of a broadcasting station at Aberdeen, and the company may be expected to take definite steps shortly.

Australian Wireless News.

The Australian Customs Department has issued a series of tariff decisions relating to duties on wireless apparatus. Fixed and variable condensers, crystal and electrolytic detectors, rheostats, inductance coils (honeycomb and coupled coils), intervalve transformers, valve sockets, and complete tuning sets will be charged 27½ per cent. under the British preferential tariff, 35 per cent. under the intermediate tariff, and 40 per cent. under the general tariff. Valves will be free under the British preferential tariff, 5 per cent. under the intermediate and 15 per cent. under the general tariff.

The Australian Conference on broadcasting has resulted in a decision to assist the immediate development of wireless throughout the Commonwealth, in order to enable news, weather and market reports and music to be distributed. A resolution was passed affirming the principle of the decentralisation of broadcasting services. Mr. Fisk, who framed the scheme, said the English scheme was inappropriate to Australia.

Profitable Hull Telephones.

The Only Municipal System.

In view of the profitable working of the HULL Corporation telephone undertaking—the only municipal system in the kingdom—for the year ending March 31st last, a special committee is considering the advisability of reducing the tariff. The gross profit for the year amounted to £33 442, and after paying interest and loan charges, the net profit was £14 296. The income for the year was £113 765, an increase over the previous year of £7 004, and the expenditure was £80 828. The reserve fund stands at £21 161. The net debt on the undertaking is now £185 468.

The amount of royalty tax paid to the Government during the year was £11 199, making a total from the commencement of the service of £85 230. During the year additional subscribers were joined to the automatic exchange to relieve the pressure on the Central, and to continue the relief it will be necessary at an early date to consider the extension of the automatic equipment. The extensions to the system planned and sanctioned by the committee in 1919, are nearing completion, and it will shortly be necessary to consider further extensions to meet the anticipated growth.

It is gratifying to note that the acting chairman of the Telephone Committee, in moving that a special committee should consider tariff reductions, said that he was opposed to the use of their profits for the relief of the rates; the proper parties to have relief were the telephone users.

South-East Lancashire Advisory Board.

The Engineering Advisory Committee.

The SOUTH-EAST LANCASHIRE ELECTRICITY ADVISORY BOARD has now become a statutory authority, Parliament having confirmed the Order constituting the Board. It may be noted that an Interim Board has been operating since October 17th, 1922, in all respects as though Parliament had approved the Order, and has taken offices at 17, Albert Square, Manchester. The following are the members of the Engineering Advisory Committee of the Interim Board:—Messrs. S. L. Pearce (Manchester), C. D. Taite (Lancashire Electric Power Co.), W. J. H. Wood (Bolton), S. J. Watson (Salford), F. L. Ogden (Oldham), R. Lomax (Stockport), R. Owen (Wigan), G. H. Fawcus (Altrincham Electric Supply Co.), and H. C. Busbridge (Swinton and Pendlebury).

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Companies' Reports, Dividends, etc.

HART ACCUMULATOR CO.—The net profit for 1922 was £49 990, plus £54 341 brought forward, making £104 331. A further dividend is recommended of 3 per cent., making 13 per cent., placing £50 000 to reserve and carrying forward £32 787.

The STOCK EXCHANGE COMMITTEE has granted official quotations to $10 481 800 capital stock of the American Telephone and Telegraph Co., 200 000 £1, fully paid, 6 per cent. cumulative preference shares of Hurst, Nelson and Co. and £45 000 5 per cent. first mortgage debenture stock of the Midland Electric Corporation for Power Distribution.

Supply and Lighting.

LEWES AND DISTRICT ELECTRIC SUPPLY CO.—The net profit for 1922, after providing for administration and general expenses and other items, including debenture interest and provision of £2 500 for renewals, was £2 597, plus £1 574 brought forward, making £4 171. The directors recommend placing to reserve £819, dividend on ordinary shares of 6 per cent., carrying forward £1 956.

BIRKDALE DISTRICT ELECTRIC SUPPLY CO.—The revenue account for 1922 shows a surplus on working of £12 473. After adding interest and deducting administration and general expenses, etc., the balance was £9 475, making with £3 330 brought forward £12 805. The directors recommend placing to reserve £3 500, dividend on the ordinary shares at 10 per cent. for the year, carrying forward £4 705.

PENARTH ELECTRIC LIGHTING CO.—The net profit for 1922, after providing for administration and general expenses and other items, including debenture interest and provision of £3 000 for renewals, amounting in all to £5 975, was £4 065, plus £2 532 brought forward, making £6 597. The directors recommend placing to reserve £1 500, dividend on ordinary shares of 7½ per cent. for the year, carrying forward £3 187.

WESTON-SUPER-MARE AND DISTRICT ELECTRIC SUPPLY CO.—The net revenue for 1922 was £25 945. Deducting administration and general expenses, debenture and other interest, and placing £12 000 to renewals account, the balance was £7 982, making with £2 697 brought forward £10 679. The directors propose to apply to reserve £2 000, to pay a dividend on the ordinary shares at 7½ per cent. for the year, carrying forward £3 654.

BANBURY AND DISTRICT ELECTRIC SUPPLY CO.—The revenue account for 1922 shows a surplus on working of £11 184. After adding interest £122 and deducting administration and general expenses, debenture interest, sinking fund instalment for redemption, provision of £1 800 for renewals, the balance was £6 928, making with £1 116 brought forward £8 044. The directors recommend placing to reserve £3 500, dividend on the ordinary shares at 7½ per cent. for the year, carrying forward £2 669.

Traction Companies' Results.

YORKSHIRE (WEST RIDING) ELECTRIC TRAMWAYS CO.—Interim dividend declared of 3 per cent. on the 6 per cent. cumulative preference shares, less tax, for the six months ending June 30th next.

MERTHYR ELECTRIC TRACTION AND LIGHTING CO.—The net revenue for 1922 was £25 728, and the balance, after deducting expenses, debenture and other interest, and placing £7 500 to renewals account, is £7 128, plus £1 332 brought forward, making £8 468. Dividend proposed of 7½ per cent. on the ordinary shares, placing £1 807 to reserve and carrying forward £2 152.

BRITISH ELECTRIC TRACTION CO.—The gross profit for the year ended March 31st was £263 824, from which fall to be deducted general expenses £35 878, income tax and corporation profits tax £9 948, staff endowment fund £1 067, and interest on debenture stocks £82 190, leaving a balance of £134 740 for appropriation. After payment of the 6 per cent. preference dividend—£42 765—a further 3 per cent. is declared on the ordinary stock, making the total distribution 5 per cent. for the year, which is ½ per cent. better than last year. The ordinary dividend absorbs £66 313, leaving a surplus of £25 662, to be added to the undivided profits account, making that account £215 362. The reserve fund remains at £520 000. During the year £61 594 debenture stock has been purchased and the discount, amounting to £11 597, has been applied in reduction of the book value of the investments.

Cable, Telephone and Telegraph Companies.

WESTERN TELEGRAPH CO.—Third quarterly interim dividend declared of five shillings per share, free of tax, for the year ending June 30th, 1923, being at the rate of 10 per cent. per annum.

UNITED RIVER PLATE TELEPHONE CO.—The gross revenue for 1922 was £1 340 500, and the gross profit was £190 052. After deducting dividends already paid, the balance was £102 352, making, with the amount brought forward, £141 050. Final dividend recommended of 5 per cent. on the ordinary shares, free of tax, making 8 per cent. for the year, carrying forward £33 056.

INTERNATIONAL AUTOMATIC TELEPHONE CO.—The profit for 1922 was £15 903, plus £643 brought in, making £16 545. From this are deducted preliminary and formation expenses (part written off), £2 000, and dividend on preference shares, £11 782, leaving £2 754, which is to be carried forward, the directors regretting that the profits are not sufficient to enable a dividend to be paid on the ordinary or deferred shares.

AUTOMATIC TELEPHONE MANUFACTURING CO.—The directors again regret that it is not possible to pay a dividend on the ordinary shares. The profit for 1922 was £42 258, plus £4 313 brought in, making £46 571. Directors' fees absorb £1 320, debenture interest £13 650, depreciation £6 000, proportion of development expenditure written off £4 000, proportion of debenture issue expenses written off £3 115, dividend on preference shares £12 000, leaving £4 486 to be carried forward.

New Issues.

URBAN ELECTRIC SUPPLY CO.—On Monday an issue of £250 000 5½ per cent. mortgage debenture stock was offered for subscription at 97½ per cent.

TOTTENHAM DISTRICT HEAT, LIGHT AND POWER CO.—It has been decided to issue £100 000 "B" consolidated stock, and tenders for any amount over £20 which is a multiple of £5 are invited by June 18th, at a minimum price of £102 per £100 stock.

ELECTRIC SUPPLY CORPORATION.—On Friday last an issue was made of £150 000 six per cent. cumulative preference shares of £1 each at par for the purpose of exercising the option to repay £154 914 five per cent. debenture stock at £105 per cent., due for repayment in 1929.

New Companies.

MARCHAND AND CHABLOZ, LTD.—Private. Reg. May 5th. Cap., £100 in £1 shares. Electrical engineers, manufacturers of and dealers in electrical, magnetic, galvanic, wireless and other apparatus, etc. Reg. office: 227A, City Road, London, E.C.1.

SCOTTISH RADIO CENTRE, LTD.—Private. Reg. in Edinburgh May 10th. Cap., £2 000 in £1 shares. Manufacturers of wireless instruments, sets, amplifiers, apparatus and accessories, etc. Solicitors: W. and J. Burness, 12, Hope Street, Edinburgh.

WIRELESS MANUFACTURERS, LTD.—Reg. May 17th. Cap., £1 000 in 1 000 cumulative 10 per cent. preference and 1 000 ordinary shares of 10s. each. The objects are as indicated by the title. Reg. office: Gloucester Mansions, Cambridge Circus, London, W.C.2.

F. C. BROWN (ELECTRICITY), LTD.—Private. Reg. May 15th. Cap., £1 000 in £1 shares. To take over the business of an electrical engineer carried on by F. C. Brown at Coventry, and to carry on the same and the business of manufacturers and installers of wireless apparatus, etc.

SAUNDERS PATENTS, LTD.—Private. Reg. May 9th. Cap., £1 000 in £1 shares. To acquire from W. T. Saunders the benefit of a certain invention for improvements in wireless telephony. W. T. Saunders, 23, Victor Road, Teddington, electrical engineer, is managing director.

ELECTRON CO., LTD.—Private. May 14th. Cap., £100 in £1 shares. Electricians, mechanical and manufacturing engineers, manufacturers of glassware, electric discharge tubes, wireless, X-ray and other scientific apparatus, etc. Reg. office: Broadmead House, 21, Panton Street, Haymarket, London, S.W.1.

MACKERRON AND SCOTT, LTD.—Private. Reg. in Edinburgh May 8th. Cap., £3 000 in £1 shares. Electrical, mechanical, consulting and contracting engineers, manufacturers of and dealers in electrical, mechanical and scientific apparatus, machine equipment, etc. Reg. office: 98, West George Street, Glasgow.

WIRELESS AND ELECTRIC CO., LTD.—Private. Reg. May 10th. Cap., £1 000 in £1 shares. Manufacturers of and dealers in electrical, mechanical, scientific and technical instruments, apparatus, appliances, and products of all kinds, wireless broadcasting and receiving instruments and apparatus, etc. Solicitors: Harrington Edwards and Cobban, 33, Southampton Street, Strand, London, W.C.2.

BAY-BROOKE CO., LTD.—Private. Reg. May 17th. Cap., £2 000 in £1 shares (1 500 ordinary and 500 6 per cent. cumulative preference). Manufacturers and repairers of and dealers in receiving and transmitting wireless telephonic and telegraphic apparatus, magnetic, electrical and electro chemical apparatus and equipment, etc. Reg. office: Rogart House, 19, Park Hill Road, Harborne, Birmingham.

ANGLO-POLISH ELECTRICAL DEVELOPMENT CORPORATION, LTD.—Private. Reg. May 14th. Cap., £5 000 in £1 shares (2 500 "A" and 2 500 "B"). Electrical mechanical and general engineers, contractors, manufacturers of and dealers in electrical and other appliances and apparatus, machinery, pneumatic and other engines, financiers, concessionaires, general merchants, etc. Solicitors: Linklaters and Paines, 2, Bond Court, Walbrook, London, E.C.

BUSS, WEBB AND SON, LTD.—Private. Reg. May 14th. Cap., £5 000 in £1 shares (4 000 preference and 1 000 ordinary). To adopt an agreement with H. Buss and L. Webb, and to carry on the business of electrical engineers, builders and contractors as formerly carried on by the said vendors at Ipswich and that of manufacturers of and dealers in wireless and other electrical appliances and apparatus, etc. H. Buss, 28, Withipoll Street, Ipswich, electrical engineer, is a subscriber.

PICKFORD, JOHNSON AND CO., LTD.—Private. Reg. April 20th. Cap., £2 500 in £1 shares. To acquire the business carried on by L. Johnson and E. H. Pickford in Sheffield, and to carry on the business of designers, instructors, patentees, licensees, demonstrators, wireless service operators, photographers, draughtsmen and makers of and dealers in receiving and transmitting sets, components of wireless installations and equipments, armatures, vacuum and thermionic tubes, voltmeters, etc. Reg. office: 262, Eccleshall Road, Sheffield.

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Tenders Invited and Accepted.

GREAT BRITAIN.

CLYDE NAVIGATION TRUSTEES, June 9th.—Electrical stores; metals, rubber, oils, waste, paints, etc., for three, six, or twelve months. Specifications from Superintendent of Stores, 1, Graving Dock, Govan.

CHORLEY RURAL DISTRICT COUNCIL, June 11th.—Electric light wiring and fitting at the Council room and offices. Particulars from the Clerk.

EPSOM URBAN DISTRICT COUNCIL, June 12th.—One 200 kW d.c. generator direct coupled to 300 H.P. heavy oil engine; also lead covered and steel tape armoured cable and feeder pillars and joint boxes. Specifications from the Electrical Engineer, Church Street, Epsom.

MANCHESTER CORPORATION, June 12th.—Copper, silicium bronze, or other super-hard trolley wire for the Tramways Department. Specifications from the General Manager.

PONTYPRIDD GUARDIANS, June 13th.—Three months' stores, including electrical materials, ironmongery, etc. Forms of tender from the Clerk.

KENDAL CORPORATION, June 14th.—Overhead l.t. transmission line. Specification from the Borough Electrical Engineer.

GLASGOW EDUCATION AUTHORITY, June 16th.—Electric light wiring and fitting in 12 schools. Specifications from the Education Offices (Property Department), 129, Bath Street, Glasgow.

PARISH CHURCH, CHORLEY, June 16th.—Wiring and fitting the church for electric lighting. Tenders to Mr. R. Higham, Letchworth Drive, Gillibrand Park, Chorley.

MANCHESTER RIVERS COMMITTEE, June 18th.—Electric lighting installation for Davyhulme Sewage Works, Urmston. Specification from the Secretary, Rivers Department, Town Hall, Manchester.

DUMFRIES AND GALLOWAY JOINT SANATORIUM BOARD, June 19th.—Electric lighting installation and laundry plant and fittings at the new sanatorium at Lochmaben. Specifications can be seen at the offices of Mr. W. Arnott, 163, Hope Street, Glasgow, or the Clerk of the Board, County Buildings, Dumfries.

GRIMSBY CORPORATION, July 2nd.—Two water tube boilers of 21 000 lb. per hour output, with economisers, stokers, etc. (specification No. 174), one 1 000 kW converter and one 250 kW converter and l.t. switchgear, cable work, etc. (specification No. 175). Specifications from Lt. Col. W. A. Vignoles, borough electrical engineer.

LEEDS CORPORATION, July 31st.—Steam turbine and three-phase alternator and exciter of about 10 000 kW, running at a speed not exceeding 3 000 revs. per min., and auxiliaries for surface condensing plant. Specifications from Mr. C. Nelson Hefford, Manager, Electricity Dept., 1, Whitehall Road, Leeds.

AUSTRALIA.

CITY ELECTRIC LIGHT CO., BRISBANE, October 31st.—One 12 500 kW turbo alternator, for the company's works at Bulima, Brisbane.

COMMONWEALTH OF AUSTRALIA, August 7th.—Bells, cords and plugs (Y. 132), August 14th, telephone parts (V. 133). Particulars from the Supply Officer, Australia House, Strand, London, W.C.2.

BELGIUM.

MINISTRY OF RAILWAYS, MARINE, POSTS AND TELEGRAPHS, BRUSSELS, June 13th.*—Cables, wires and electrical accessories.

IRELAND.

DUBLIN CORPORATION, June 14th.—Nine coal shoots for Pigeon House electricity works. Particulars from the City Electrical Engineer, Fleet Street, Dublin.

DUBLIN CORPORATION, June 15th.—Air circuit-breakers for voltages not exceeding 660 V, a.c. Specification from the City Electrical Engineer, Fleet Street, Dublin.

MINISTRY OF FINANCE, NORTHERN IRELAND GOVERNMENT, June 22nd.—Electric light wiring and fitting in the Convalescent Hospital, Portrush. Specification from Assistant Secretary, Ministry of Finance, 15, Donegall Square West, Belfast.

SOUTH AFRICA.

WINDHOEK (CAPE PROVINCE) MUNICIPALITY, June 30th.*—Equalising booster aggregate; and storage battery.

URUGUAY.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO, July 12th.*—General stores.

COVENTRY GUARDIANS have accepted the tender of F. B. Brown and Co. for electric wiring in the dining hall, etc., of their Institution, at £41 17s.

The tender of Callender's Cable and Construction Co. has been accepted by ERITH URBAN COUNCIL for cables in connection with the lowering of Friday Hill.

SCUNTHORPE AND FRODINGHAM URBAN COUNCIL has accepted the tender of Galpin, Hall and Co. for electrical recorders, etc., for the new reservoir, at £600 6s. 2d.

LONDON COUNTY COUNCIL have accepted the tender of the Rail Welding Co. (lowest tender) for electric arc welding, £437 10s. Four tenders were received, the highest being £980.

The UNDERGROUND ELECTRIC RAILWAYS CO. OF LONDON have placed a contract with John Mowlem and Co. for escalators at Tottenham Court Road Station, £67 784.

The tenders of Ferguson, Pailin Ltd., for switchgear, £1 001 16s., and the Metropolitan-Vickers Electrical Co. for cubicle equipment, £373 15s., have been accepted by CROYDON CORPORATION.

* Particulars from the Department of Overseas Trade.

Forty Years Ago.

"The Electrician," June 9th, 1883.

THE BRITISH ASSOCIATION.—Prof. Lord Rayleigh has been nominated by the Council of the British Association as president for the meeting at Montreal in 1884.

MESSRS. JOHNSON & PHILLIPS.—We are informed that Mr. Bennett Pell, late of the Eastern Extension Telegraph Company, has become associated with the firm of Messrs. Johnson and Phillips, telegraph engineers and electricians. We think that this well-known firm are fortunate in securing the co-operation of a gentleman of such activity and wide telegraph experience, and Mr. Pell will, we are sure, find ample scope for his energies in his new sphere of labour.

ELECTRIC LIGHTING ON A YACHT.—The "Empress," steam yacht which we mentioned some time ago as about to be lighted by in, candescent lamps, is now lying in the Thames off Greenhithe. She has been fitted up with 32 Swan incandescent lamps, which are fed by Faure-Sellon-Volckmar accumulators supplied by the Electrical Power Storage Company. The accumulators are charged by means of a shunt wound Bürgin dynamo, driven by a three-cylinder Brotherhood engine fitted up near the yacht's engine-room. Steam is supplied to this engine by a separate boiler made by Messrs. Cochrane, so that steam can be got up when lying in harbour, or when the yacht is sailing, and fires damped down under her other boilers. The fittings have been supplied by Messrs. Faraday and Co., of Berners Street, Oxford Street, W., and are adapted for candles as well as electric lamps. The installation has been carried out by Messrs. R. E. Crompton and Co. The yacht was built by Earle's Shipbuilding Company, of Hull, for her owner, Sir A. Walker.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"Modern Cabinet Work by J. Henry Sellers"; "Full Size Details of Furniture Mouldings."

THE CHEMICAL AGE.—"Methods of Costing in Chemical Works, II.," by F. M. Potter; "Features of Interest at the International Mining Exhibition"; "A System for Harmonising Colours."

THE EUROPEAN COMMERCIAL.—"British Business Men and the Ruhr Question"; "The Position of the German Chemical Industry"; "An American View of the European Situation."

THE FRUIT GROWER.—"Red Plant Disease of Strawberries," by H. D. Turner; "Fruit Growers' Tour in Cambridgeshire"; "Horticultural and Trade Exhibits at Chelsea."

THE GAS WORLD.—"Type-Metal Melting by Town's Gas"; "Analyses of the Accounts of Metropolitan and Suburban Gas Companies for 1922."

THE HARDWARE TRADE JOURNAL.—"Pottery for the Hardwareman—A Profitable Sideline"; "Hints on Domestic Aluminiumware"; "The New Hall of the Worshipful Company of Ironmongers."

Business Items.

M. K. ELECTRIC, LTD., is the new title of the firm formerly known as the Heavy Current Electric Accessories Co., Park Road, Edmonton, London, N.9.

UNITED WATER SOFTENERS, LTD., inform us that the new "Corner House" of J. Lyons and Co., in Coventry Street, London, W., is equipped throughout with their new "Permutit" system of water softening.

WILLIAM GRICE AND SONS inform us that they supplied the whole of the air washing plant at the new Rotherham power station referred to in our last issue. They have supplied a similar installation for the Nechells station at Birmingham.

The Agent-General for New South Wales intimates that a consulting engineer established in Sydney desires agencies. A representative in London will interview on his behalf. Enquiries should be addressed to Commercial Department, Agent-General for New South Wales, Australia House, Strand, W.C.2, quoting Reference No. 536.

The "Board of Trade Journal" states that a gentleman recently arrived from Australia is desirous of representing English manufacturers of ELECTRICAL ACCESSORIES throughout the Australian States. References can be exchanged. Address, in the first instance, Commercial Bureau, Australia House, Strand, London, W.C.2, quoting reference No. Com. 412/7/1/1/117.

The Commercial Secretary at Copenhagen, Mr. R. M. A. TURNER, will be in attendance at the Department of Overseas Trade from June 25th to 30th, inclusive, and will be pleased to interview, by appointment, United Kingdom manufacturers and merchants interested in export trade to Denmark. Applications for interviews with Mr. Turner should be addressed, without delay, to the Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, London, S.W.1, and the reference 7 505 F.R. should be quoted.

The new bowling green of the sports club of the SHEFFIELD ELECTRICITY SUPPLY DEPARTMENT has now been officially opened for play. Councillor A. J. Ward, chairman of the Electric Supply Committee, declared the green (which is situated opposite the Neepsend Generating Station) open. Over 150 entries have been received for the first bowling tournament.

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Reference Index to Recent Wireless Publications.

R.000. RADIO COMMUNICATION (GENERAL)

O. Lodge. The Origin or Basis of Wireless Communication (*Nature*, 111, p. 328–332, March 10th, 1923). R.000.

Recommendations of the National Radio Committee (*Radio News*, 4, p. 2075, June, 1923). R.007.

Judgment (*Wireless Weekly*, 1, pp. 102–105, April 18th; pp. 188–189, April 25th; pp. 248–250, May 2nd, 1923).

A full account of the judgment given in the patent action between Marconi's Wireless Telegraph Co. and the Mullard Radio Valve Co. R.008.

Marconi *v.* Mullard. Proceedings before the Court of Appeal (*Wireless World and Radio Review*, 12, pp. 123–124, April 28th, 1923). R.008.

"Blind Spots" and "Fading of Signals." (*Wireless World and Radio Review*, 12, pp. 187–188, May 12th, 1923). R.010/113.

Symbols used in circuit diagrams (*Wireless World and Radio Review*, 12, p. 28, April 7th, 1923). R.030.

Radio Society of Great Britain—Report of Annual Conference held on January 24th, 1923 (*Wireless World and Radio Review*, 11, pp. 703–705, February 24th, 1923). R.060.

Second District Convention Big Success (*Q.S.T.*, 6, pp. 17–18, April, 1923). R.060.

U. Muntz. Inauguration of Cuban Radio Academy (*Radio News*, 4, p. 2077, June, 1923). R.070.

S. R. Winters. Public Education by Radio (*Radio News*, 4, p. 2074, June, 1923). R.070.

M. Egan. The Uses of Wireless (*Modern Wireless*, 1, pp. 232–233, May, 1923). R.090/000.

J. J. Honan. The Story of Wireless (*Wireless World and Radio Review*, 12, pp. 180–181, May 12th, 1923). R. 090.

J. Liston. Twelve Months of Radio—Record of 1922 (*Scientific American*, 128, p. 242, April, 1923). R.094.

R.100. RADIO PRINCIPLES AND THEORY

J. A. Fleming. Electrons, Electric Waves and Wireless Telephony (*Radio News*, 4, pp. 2086–2087, June, 1923). R.100.

O. Lodge. Vast Range of Ether Vibrations (*Radio News*, 4, pp. 2078–2079, June 1923). R.110.

Effects of Local Conditions on Radio Direction-Finding (*Scientific American*, 128; p. 237, April, 1923). R.113.

W. G. W. Mitchell. Wireless Assists the Study of Earthquakes (*Wireless World and Radio Review*, 12, pp. 189–193, May 12th, 1923). R.113/580.

Tracking Thunderstorms (*Wireless Weekly*, 1, pp. 298–299, May 9th, 1923). R.113.

C. J. P. Cave and **R. A. Watson-Watt.** The Study of Radio-telegraphic Atmospherics in Relation to Meteorology (*Journal of the Meteorological Society*, pp. 35–42, January 1923). R. 114/113.

R. M. Deeley. Atmospherics (*Nature*, 111, p. 362, March 17th, 1923). R.114.

R. A. Watson-Watt and **E. V. Appleton.** On the Nature of Atmospherics (*Proceedings of the Royal Society*, 103A, pp. 84–102, April 3rd, 1923). R.114.

The Nature of Atmospherics—Investigations with the Cathode Ray Oscillograph (*Wireless Weekly*, 1, pp. 272–273, May 9th, 1923). R.114.

L. Frank. Principles of the Antenna System (*Radio News*, 4, pp. 2090–2091, June, 1923). R.120.

D. E. Garnett. The Vario-Aerial (*Radio News*, 4, p. 2083, June, 1923). R.124.

H. H. Beverage, C. W. Rice and **E. W. Kellog.** The Wave Antenna; A new type of Directive Antenna (*Journal of the American Institute of Electrical Engineers*, 42, pp. 258–269, March; pp. 372–381, April, 1923). R.125/325.

J. Robinson. "Directional Wireless." (*Modern Wireless*, 1, pp. 234–236, May, 1923). R.125.

The earthing resistance of antennæ (*Annales des Postes, Télégraphes et Téléphones*, 12, p. 282–283, February, 1923). R.126.

L. Chaffee. Oscillographic Study of Electron Tube Characteristics (*Proceedings Institute of Radio Engineers*, 10, pp. 440–450, December, 1922). R.131.

J. Scott-Taggart. Notes on Reaction (*Modern Wireless*, 1, pp. 273–280, May, 1923). R. 134.

W. P. Powers. Matching Impedances (*Radio News*, 4, p. 2105, June, 1923). R.136/137.

Electrons from Hot Filaments (of various materials) (*Scientific American*, 128, p. 284, April, 1923). R.138.

C. H. Lees. Inductively Coupled Low Resistance Circuits (*Proceedings of the Royal Society*, 103A, pp. 79–83, April 3rd, 1923). R.142.

F. W. Grover. Tables for the Calculation of the Inductance of Circular Coils of Rectangular Cross Section (*Scientific Papers of the Bureau of Standards* (No. 455), 18, pp. 451–487, 1922). R.145.

M. Child. Fundamental Principles of Radio Reception (*Wireless World and Radio Review*, 12, pp. 22–24, April 7th; pp. 55–57, April 14th, 1923). R.160.

J. Scott-Taggart. The possibilities of a new Receiving Principle (*Wireless Weekly*, 1, pp. 267–268, May 9th, 1923). R.160.

R.200. RADIO MEASUREMENTS AND STANDARDISATION.

Conference on Radio Standardisation (*Scientific American*, 128, p. 212, March, 1923). R.200.

Radio Standardisation (*Journal of the American Institute of Electrical Engineers*, 42, p. 279, March, 1923). R.200.

E. B. Moullin. A direct-reading Thermionic voltmeter, and its applications (*Proceedings of Institution of Electrical Engineers*, 61, pp. 295–303, February, 1923). R. 261.

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L. W. Austin. Discussion of "Note on the measurement of Radio Signals" (*Proceedings of the Institute of Radio Engineers*, 11, pp. 153–162, April, 1923). R.270.

R. Bown, C. R. Englund and **H. T. Friis.** Radio Transmission Measurements (*Proceedings of the Institute of Radio Engineers*, 11, pp. 115–152, April, 1923). R. 270.

Discussion on "Observations on the Field Strength of Horsea Wireless Station" (*Proceedings of the Institution of Electrical Engineers*, 61, p. 308, February, 1923). R. 270.

R.300. APPARATUS AND EQUIPMENT.

The Olympia Exhibition. Some Notes on the Wireless Section (*Wireless World and Radio Review*, 11, pp. 790–791, March 17th, 1923). R.306.

P. R. Coursey. Application of the "Double-Click" Method to Capacity Measurement (*Wireless World and Radio Review*, 12, pp. 139–142, May 5th, 1923). R.307.

P. R. Coursey. Notes on Apparatus and Methods (*Wireless World and Radio Review*, 12, pp. 9–11, April 7th, 1923). R.307.

The Antennæ—Transmitting Stations Radiating System (*Wireless World and Radio Review*, 9–11, pp. 795–799, March 17th, 1923). R.320.

L. Bellingham. Use of the Triode Valve in Spectrometry (*Nature*, 111, p. 534, April 21st, 1923). R.330.

H. A. Brown. Photoelectric Electron Tubes (*Proceedings of the Institute of Radio Engineers*, 10, pp. 451–467, December, 1922). R.330.

H. P. Donle. A New Non-Interfering Detector (*Proceedings of the Institute of Radio Engineers*, 11, pp. 97–109, April, 1923). R.330.

F. S. McCullough. Thermionic Tubes (*Proceedings of the Institute of Radio Engineers*, 10, pp. 468–485, December, 1922). R.330/333.

The Kenotron Rectifier (*Scientific American*, 128, p. 355, May, 1923). R.332.

S. O. Pearson. The Neon Tube—How it can be made to produce oscillation currents—Application to Relays and Recorders (*Wireless World and Radio Review*, 12, pp. 2–5, April 7th; pp. 34–37, April 14th, 1923). R.332.

J. H. T. Roberts. The Cold Valve of the future (*Modern Wireless*, 1, pp. 223–226, May, 1923). R.333.

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The Dynatron and Super-Regeneration (*Modern Wireless*, 1, p. 243, May, 1923). R.334/343.

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H. Dewhurst. Loud-Speaking and Power-Amplification (*Wireless Weekly*, 1, pp. 205–207, May 2nd, 1923). R.342.

An Electron Tube Amplifier using A.C. current for Filaments and Plates (*Scientific American*, 128, p. 236, April, 1923). R.342.

L. A. Hazeltine. The Neutrodyne Receiver (*Wireless Weekly*, 1, pp. 225–226, May 2nd, 1923). R.342/343.

W. James. Double Magnification Circuits (*Wireless World and Radio Review*, 12, pp. 164–167, May 12th, 1923). R.342.

J. Scott-Taggart. Some New Dual Amplification Circuits (*Radio News*, 4, pp. 2084–2085, June, 1923). R.342.

P. D. Tyers. Resistance Coupled Amplifier for Speech Frequencies (*Wireless World and Radio Review*, 12, pp. 177–180, May 12th, 1923). R.342.

Useful hints on Power Amplification (*Popular Wireless*, 1, p. 384, April 28th, 1923). R.342.

P. G. A. H. Voigt. Receiving Telephony without Reaction (*Wireless World and Radio Review*, 12, pp. 38–41, April 14th, 1923). R.342/343.

A. D. Cowper. An Improved Single-Valve Super-Regenerative Receiver (*Modern Wireless*, 1, pp. 259–264, May, 1923). R.343.

E. W. Cutting. A Portable Super-Regenerative Set (*Radio News*, 4, p. 2080, June, 1923). R.343.

J. W. Harper. The Armstrong Super-Regenerative Receiver (*Radio News*, 4, pp. 2081–2082, June, 1923). R.343.

L. A. Hazeltine. Tuned Radio-Frequency Amplification with Neutralisation of Capacity Coupling (*Q.S.T.*, 6, pp. 7–12, April, 1923). R.343/342.

A. W. Hull. A Combined Kenotron Rectifier and Pliotron Receiver capable of operation by Alternating Current Power (*Proceedings of the Institute of Radio Engineers*, 11, pp. 89–96, April, 1923). R.343.

O. A. Kimball. Building a Super-Heterodyne and Making it Work (*Q.S.T.*, 6, pp. 19–21, April, 1923). R.343.

J. Scott-Taggart. Some Unusual Methods of receiving continuous waves (*Wireless Weekly*, 1, pp. 201–202, May 2nd, 1923). R.343.

S. T. Woodhull. A High Voltage Mechanical Rectifier (*Proceedings of the Institute of Radio Engineers*, 11, pp. 111–113, April, 1923). R.344/355.

Radiophones (*Nature*, 111, pp. 628–629, May 12th, 1923). R.346.

F. Conrad. Radio Receiving Equipment (*Proceedings of the Institute of Radio Engineers*, 10, pp. 426–439, December, 1922). R.360.

S. T. Woodhull. Receiver Plate Supply from A.C. (*Q.S.T.*, 6, pp. 13–14, April, 1923). R.360–344.

A Microphone Amplifier for Crystal Sets (*Scientific American*, 128, p. 258, April, 1923). R.363.

J. F. J. Bethenod. Distortion-Free Telephone Receivers (*Proceedings of the Institution of Radio Engineers*, 11, pp. 163–167, April, 1923). R.366.

G. P. Kendall. Loud-speaker Horns (*Modern Wireless*, 1, pp. 238–241, May, 1923). R.366.

A new French loud speaker (*Wireless Weekly*, 1, pp. 269–270, May 9th, 1923). R.366.

N. W. McLachlan. A New Recorder for high-speed wireless (*Popular Wireless*, 3, pp. 375–376, April 28th, 1923). R.367.

G. P. Kendall. Multilayer Coils (*Modern Wireless*, 1, pp. 250–253, May, 1923). R.382.

M. G. Goldberg. A Study of Filter Systems for Transmitter Tube Plate Supply (*Q.S.T.*, 6, pp. 14–17, April, 1923). R. 386/344.

P. Thomas. A Diaphragmless Microphone for Radio Broadcasting (*Journal of the American Institute of Electrical Engineers*, 42, pp. 219–222, March, 1923). R.385/550.

R.400. RADIO COMMUNICATION SYSTEMS.

S. Kruse. Getting the Transmitter Down to 100 Metres (*Q.S.T.*, 6, pp. 24–25, April, 1923). R.402.

Carrier Current Telephone between Holtwood and Baltimore (*Journal of the American Institute of Electrical Engineers*, 42, p. 246, March, 1923). R.470.

R.500. APPLICATIONS OF RADIO.

C. A. Reberger. A Modern Liner Radio Outfit (*Radio News*, 4, p. 2076, June, 1923). R.510.

G. Dacy. The Radio Typewriter for Airplanes (*Scientific American*, 128, p. 173, March, 1923). R.521.

Navigating the Air by Wireless (*Wireless Weekly*, 1, pp. 232–233, May 2nd, 1923). R.521.

R. C. Denny. Experience with the Radiophone in San Joaquin, Fresno, California (*Electrical World*, 81, pp. 973–977, April 28th, 1923). R.530.

Trolley Cars try Radiophones (*Radio News*, 4, p. 2075, June, 1923). R.533.

C. Manneback. Radiation from Transmission Lines (*Journal of the American Institute of Electrical Engineers*, 42, pp. 95–105, February, 1923). R.537.

American Amateurs heard in New Zealand (*Radio News*, 4, p. 2104, June, 1923). R.545.

P. R. Coursey. The Progress of Amateur Radio (*Modern Wireless*, 1, pp. 255–256, May, 1923). R.545.

P. R. Coursey. Transatlantic Amateur Tests. Summarised Report of British Receptions (*Wireless World and Radio Review*, 11, pp. 769–774, March 10th; pp. 807–812, March 17th; pp. 840–843, March 24th, 1923). R.545.

The Acoustical Problem in Broadcasting (*Scientific American*, 128, p. 213, March, 1923). R.550.

Broadcasting and Wireless Licences (*Nature*, 111, pp. 589–591, May 5th, 1923). R.550/007.

Colleges to Broadcast Lectures (*Journal of the American Institute of Electrical Engineers*, 42, p. 34, January, 1923). R.550.

Commercial Broadcasting in Germany (*Journal of the American Institute of Electrical Engineers*, 42, p. 319, April, 1923). R.550.

Early Morning Exercises by Radio (*Scientific American*, 128, p. 212, March, 1923). R. 550.

P. P. Eckersley. The Technicalities of Broadcasting (*Wireless Weekly*, 1, pp. 240–241, May 2nd, 1923). R.550.

H. Gernsback. The Broadcast Listener (*Radio News*, 4, p. 2073, June, 1923). R.550.

2LO's New Studio (*Wireless Weekly*, 1, p. 301, May 9th, 1923). R.550.

E. Shaughnessy. Practical Broadcasting (*Electrical Industries*, 33, p. 648, May 9th, 1923). R.550.

Up-to-date list of American Broadcasting Stations (*Modern Wireless*, 1, p. 257, May, 1923). R.550.

J. H. Dellinger. The Work of the International Union of Scientific Radio Telegraphy (*Proceedings of the Institute of Radio Engineers*, 11, pp. 75–82, April, 1923). R.555/007.

Testing Wheel-Slip by Wireless (*Autocar*, 50, pp. 699–700, April 27th, 1923). Describes the application of radio methods to determinations of the wheel-slip of racing cars. R.580.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

CULKIN AND PARKINSON, LTD., 111, Woodhouse Lane, Lee ds electrical engineers. £14 15s. 1d. April 17th.

NEW UNION ELECTRIC CO., LTD., 2, Castle Street, Endell Street, electricians. £13 13s. 10d. April 5th.

PREMIER ELECTRICAL SUPPLIES, LTD., 3, New Oxford Street, W. £12 8s. 10d. April 9th.

STANDARD ELECTRIC SIGN CO., LTD., 62, Oxford Street, W., advertising contractors. £14 12s. 2d. March 27th.

Deeds of Arrangement.

DOUGHTY, John William, trading as DOUGHTY AND CO. 32, Queen Street, Manchester, electrical engineer and contractor. Filed May 23rd. Trustees, A. Yearsley, 27, Brazennose Street, Manchester, I.A., and another. Liabilities unsecured, £1 299; assets, less secured claims, £1 212. The following are creditors:—Jeary Electrical Co., London, £41; Telephone Manufacturing Co., London, £50; Star Lamp Co., Manchester, £87.

HOAD, Herbert George, 36, St. Martin's Court, Charing Cross, and Morningside, Woodthorpe Road, Ashford, electrical engineer. Filed May 23rd. Trustee, A. E. Quaife, 155, Fenchurch Street, E.C., accountant. Liabilities unsecured, £1 812; assets, less secured claims, £894.

NICHOLS, Charles James, 7, Park Street, and 9, Newcastle Hill, Bridgend, electrical engineer. Filed May 25th. Trustee, S. E. Clutterbuck, 31, Queen Street, Cardiff, I.A. Liabilities unsecured, £816; assets, less secured claims, £434.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

MIDLAND ELECTRIC LIGHT AND POWER CO., LTD., London, E.C.—Registered May 16th, £2 000 debentures part of £20 000; general charge. *£48,000. March 9th, 1923.

PARMITER, HOPE AND SUGDEN, LTD., Manchester, electricians.—Registered May 14th, £500 further charge, to Mrs. M. J. Ross, 45, Howard Street, Salford, and others; charged on warehouse, etc., in Vernon Street, Longsight. *Nil. November 2nd, 1921.

WIRELESS INSTALLATIONS, LTD., London, E.C.—Registered May 16th, £1 000 debentures (filed under sec. 93 (3) of the Companies (Consolidation) Act 1908), present issue, £600; general charge.

Satisfaction.

BURY ELECTRICAL PLANT CO., LTD.—Satisfaction registered May 22nd, all moneys, etc., registered July 15th, 1919.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

RADIO INSTALLATIONS, LTD., Empire House, 175, Piccadilly, W. Liabilities £808 13s. 5d. and assets expected to produce £511 were reported at the statutory meeting last week of creditors in this voluntary liquidation. The company was registered on September 12th, 1922, with a nominal capital of £1 000 divided into 700 shares of £1 each and 6 000 of 1s. each. The books of the company had been properly kept and since the inception of the company up to the date of liquidation there had been a loss of £249. Mr. Askew stated that he had had notification from Marconi House that royalties were due from the company but he could not say how much they claimed. The sales had been £1 796, and the purchases £1 457. The landlords were in possession of the premises for rents due, and seized furniture valued at £170. The voluntary winding-up of the company was approved, with Mr. G. W. Askew, accountant, 14, St. Mary Axe, E.C. The following are creditors:—Surrey Scientific Co., Ltd., £464; Edison Swan Electric Co., £152; D.P. Battery Co., £30.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-up.

LEITNER ELECTRICAL CO., LTD. Third and final dividend of 1¾d. per £. Payable June 11th, or any subsequent day (except Saturday) between 11 a.m. and 2 p.m., at the office of the Official Receiver and Liquidator, 33, Carey Street, Lincoln's Inn, London, W.C.2.

Companies Winding-Up Voluntarily.

ARROWSMITH (H.) AND CO., LTD. Harry Sharp, 30, Brown Street, Manchester, appointed liquidator.

CARK AND DISTRICT ELECTRIC SUPPLY CO., LTD. Albert E. Stringer, 31, Manor Row, Bradford, incorporated accountant, appointed liquidator.

Bankruptcy Information.

THE BRITISH RADIOPHONE CO., Downing Street, Bulwell, Nottingham, makers of wireless apparatus. Receiving order, May 30th. Creditor's petition.

Notices of Dividends.

GREATHEAD, Oswald, and GREATHEAD, Walter, carrying on business in co-partnership, under the style of GREATHEAD BROTHERS, 50, Burnley Road, Brierfield, electrical engineers and contractors. Composition of 6s. 6d. per £. Payable June 8th, Official Receiver's Offices, 11, Winckley Square, Preston.

HAXBY, Charles Johnson, and BRADY, Edward, carrying on business at 1A, East Parade, Harrogate, in partnership, under the style of HAXBY AND BRADY, electrical engineers. First and final dividend of 8s. 4d. per £. Payable June 5th, Official Receiver's Offices, Duncombe Place, York.

INCE, Arthur Courtenay, carrying on business at 21, Fenkle Street, Newcastle-upon-Tyne, formerly under the style of THE NEWCASTLE ELECTRICAL ENGINEERING CO., now with a partner under the style of The Tyne Electrical Industries, electrical contractor. First and final dividend of 2s. 7¼d. per £. Payable June 11th, Official Receiver's Office, Pearl Buildings, 4, Northumberland Street, Newcastle-upon-Tyne.

Bankruptcy Proceedings.

RUDD, Richmond, Long Ashton, Somerset, electrical engineer. The statement of affairs shows liabilities £261, against assets £132, a deficiency of £129. Debtor commenced business as an electrical engineer at Long Ashton in May, 1919, and purchased Yanleigh Cottage for £155 with his savings. He had no other capital, but about three months later obtained an overdraft at the bank, giving as security a mortgage upon the house. He states that the business was successful for the first two years, but then he entered into a large contract with a firm which, upon its going into liquidation, owed him a balance of account amounting to £280. Debtor had to wait eight months before the account was paid, but in the meantime some of his creditors began to sue him, and since then his business had steadily diminished. He became aware of his position six months ago.

Prices of Metals, Chemicals, etc.

TUESDAY, June 5.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£69 10 0	£2	—
Electro Wirebars	,,	£74 0 0	—	10s.
H.C. Wire, basis	per lb.	10 5/8d.	—	1/8d.
Sheet	,,	10¾d.	—	3/16d.
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2 1/16d.	—	1/16d.
Brass 60/40—				
Rod, basis	,,	7½d.	—	—
Sheet, basis	,,	10¼d.	—	—
Wire, basis	,,	10¼d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£6 5 0	—	2s. 6d.
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 10 0	—	—
Lead Pig—				
English	,,	£27 0 0	—	—
Foreign or Colonial	,,	£25 15 0	—	2s. 6d.
Tin—				
Ingot	,,	£197 5 0	5s.	—
Wire, basis	per lb.	2s. 7 1/8d.	—	—
Aluminium Ingots	per ton	£120 0 0	£5	—
Spelter	,,	£31 0 0	7s. 6d.	—
Mercury	per bottle	£10 7 6	—	5s.

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2⅜d.
,, (Roll-Brimstone)—,, £8 5s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. ,, £26 10s. per ton, £7 10s.
Boric Acid (Crystals). ,, £50 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 2¼d.; plantation 1st latex, 1s. 3d. to 1s. 3⅛d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

182 762 C. LORENZ AKT.-GES. and R. HERZOG. Apparatus for wireless telegraphy and telephony for producing undamped oscillations of short wave lengths. (2/7/21.)
179 510 AUTOMATIC TELEPHONE Co. Telephone systems. (3/5/21.) (Addition to 163 807.)
193 606 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Protective devices for electric circuits. (10/1/22.)
193 608 METROPOLITAN-VICKERS ELECTRICAL Co., R. BROOKS and E. H. CROFT. Railway electric motor control systems. (11/1/22.)
193 611 METROPOLITAN-VICKERS ELECTRICAL Co., R. BROOKS and N. E. NORTH. Electric railway motor equipments. (12/1/22.)
193 626 W. FRISBY. Retarding devices for switches, and automatic circuit-breakers. (24/1/22.)
193 628 L. G. PRESTON and B. HODGSON. Thermionic vacuum tubes. (24/1/22.)
193 629 L. G. PRESTON and B. HODGSON. Construction of thermionic valves and other vacuum tubes. (24/1/22.)
193 633 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Current conducting seals for electric apparatus. (27/1/22.)
193 647 BRITISH THOMSON-HOUSTON Co. and R. C. CLINKER. Electrical indicating instruments. (4/2/22.)
193 657 NEW BRITISH ELECTRIC SUPPLY Co. and H. C. E. JACOBY. Electro-magnetic devices. (10/2/22.)
193 675 GENERAL ELECTRIC Co., LTD. (DR. A. JUST). Incandescent lamps of gas-filled type. (25/2/22.)
193 690 H. P. P. REES. Wireless telegraphic and telephonic receiving instruments. (7/3/22.)
193 692 A. S. CACHEMAILLE (WESTINGHOUSE ELECTRIC AND MFG. Co.). Control systems and apparatus for electric machines. (8/3/22.)
193 694 AUTOMATIC TELEPHONE MFG. Co. Telephone systems. (23/2/22.)
193 708 T. J. T. HODGKINSON. Electric massage apparatus. (17/3/22.)
193 732 F. W. LE TALL (WESTINGHOUSE ELECTRIC AND MFG. Co.). Frequency regulators for a.c. circuits. (4/4/22.)
193 760 B. SCHMELZER. Electrically driven fans. (23/5/22.)
193 761 P. LONSDALE. Timing device principally for use with telephones. (23/5/22.)
190 441 AUTOMATIC TELEPHONE MANUFACTURING Co. Supports for telephone transmitters. (19/12/21.)
184 475 H. ABRAHAM. Wireless telegraphy. (9/8/21.) (Addition to 169 997.)
186 341 METROPOLITAN-VICKERS ELECTRICAL Co. Switches. (14/2/21.) (Divided application on 175 629.)
193 795 W. E. MARSHALL and P. G. P. MCCULLOCH. Electric head lamps for motor cars. (27/4/22.) (Divided Application on 190 408.)
190 477 SOC. ANON. QUARTZ ET SILICE. Manufacture of fused quartz by the electric furnace. (16/12/21.)
193 879 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.) Electric motors. (26/8/21.)
193 881 N. V. HYBINETTE. Separating, plating, and refining of metals by electrolysis. (29/8/21.)
193 882 RADIO COMMUNICATION Co. and J. SCOTT-TAGGART. Signalling systems employing electric oscillations. (30/8/21.)
170 851 AKT.-GES. BROWN, BOVERI ET CIE. Suppression of higher harmonic voltages in a. c. dynamos. (28/10/20.)
171 087 R. BOSCH AKT.-GES. Magneto-electric machines. (8/11/20.)
193 903 LODGE FUME Co. (E. MÖLLER.) Separating suspended particles from electrically insulating fluids, more particularly gases. (29/10/21.)
171 379 PHILIPS GLOEILAMPENFABRIEKEN. Thermionic valves. (10/11/20.)
193 935 V. HOPE. Ironclad switches. (28/11/21.)
193 940 W. B. SAYERS. Windings for armatures. (28/11/21.) (Cognate Applications, 8 082/22 and 16 362/22.)
193 957 E. S. HEURTLEY. Working of telegraph cables. (1/12/21.)
172 312 CIVILINGENIEURE SEYFFERTH AND HANSEN GES. Electro-magnetic devices for the distant control of electric switches. (6/12/20.)
193 980 J. E. POLLAK (SIEMENS AND HALSKE AKT.-GES.) Telephone systems. (5/12/21.)
193 981 J. B. REGAN. Intermittent a.c. induction train control systems. (5/12/21.)
193 984 P. WATSON. Electric pianoforte driers. (6/12/21.)
193 988 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.) Electric lamp fittings. (6/12/21.)
193 996 H. LEWIS. Magnetos. (8/12/21.)
194 005 CALLENDER'S CABLE AND CONSTRUCTION Co., P. V. HUNTER and J. MATHER. Electric feeder connectors for contact rails. (9/12/21.)
194 006 CALLENDER'S CABLE AND CONSTRUCTION Co., R. A. D. MACALISTER and J. S. MCCALLUM. Supports for electric cables, pipes, etc. (9/12/21.)
194 007 H. SEFTON-JONES. (LORENZ AKT.-GES., C.) Method for increasing frequency of electric currents. (9/12/21.)
182 425 SIEMENS-SCHUCKERTWERKE GES. Electrically precipitating suspended particles from fluids. (28/6/21.) (Addition to 174 046.)
172 961 WESTINGHOUSE LAMP Co. High-frequency electric furnaces. (13/12/20.)
194 038 ELECTRIC CONTROL, LTD., A. WEST AND CO., O. ELLEFSEN and H. BROOKE. Controllers for electric motors. (29/12/21.)
194 062 S. O. COWPER-COLES. Manufacture of telephone receiver cases. (10/1/22.)
194 066 L. G. DE KERMOR. Electrical heat generators. (13/1/22.)
194 070 E. POLLOCK. High-frequency telephone systems. (14/1/22.) (Cognate Application, 1 848/22.)
194 071 W. S. SMITH. Electrical conductors. (14/1/22.)
194 072 METROPOLITAN-VICKERS ELECTRICAL Co. and E. A. BINNEY, LTD. Control of motors. (17/1/22.)
194 075 METROPOLITAN-VICKERS ELECTRICAL Co., L. MILLER and J. P. CAMPBELL. Electrical ship propulsion systems. (19/1/22.)
194 086 C. C. GARRARD and A. H. RAILING. Electric propulsion of ships. (27/1/22.)
194 094 BIRMINGHAM SMALL ARMS Co. and A. R. PAGE. Thermo-electric pyrometers. (1/2/22.)
194 095 METROPOLITAN-VICKERS ELECTRICAL Co. and A. B. FIELD. Electric power drives. (1/2/22.)
194 109 A. ZACCANTI. Electric apparatus for the destruction of insects and stinging flies. (9/2/22.)
175 657 J. MASSOLLE, DR. J. ENGL, and H. VOGT. Amplifier connections for wireless telegraphy. (18/2/21.)
194 117 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Electro-magnets. (20/2/22.)
194 133 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Electric conductors suitable for sealing into vitreous material. (2/3/22.)
194 142 ELECTRICAL IMPROVEMENTS, LTD., and R. W. GREGORY. Switch fuses. (10/3/22.)
194 148 E. C. R. MARKS (COLONIAL LAMP AND FIXTURE WORKS, INC.). Portable electric light fittings. (14/3/22.)
194 185 SOC. ANON. LE CARBONE. Primary cells. (18/3/22.)
194 197 EVER READY Co. (GREAT BRITAIN), and F. S. JOHNSON. Electric torches. (3/5/22.)
194 200 WESTERN ELECTRIC Co. (WESTERN ELECTRIC Co., INC.). Loaded signalling conductors. (10/5/22.)
180 334 GENERAL ELECTRIC Co., LTD. Manufacture of incandescent lamps. (10/5/21.)
194 221 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.) Dynamo-electric machines. (24/6/22.)
184 783 WESTERN ELECTRIC Co. Loaded signalling conductors. (16/8/21.)
190 476 SOC. ANON. QUARTZ ET SILICE. Manufacture of fused quartz by electric furnace. (16/12/21.)
194 247 A. S. CACHEMAILLE (WESTINGHOUSE ELECTRIC AND MFG. Co.). Motor control systems. (8/3/22.) (Divided Application on 193 692.)
194 248 A. S. CACHEMAILLE (WESTINGHOUSE ELECTRIC AND MFG. Co.). Motor control systems. (8/3/22.) (Divided Application on 193 692.)

APPLICATIONS FOR PATENTS.

May 22.

13 405 SIMPLEX CONDUITS, LTD., and H. F. MCLAUGHLIN. Conduits, etc.
13 409 H. STANBRIDGE. Terminal members for cables.
13 411 J. S. WILSON. Fuse-holder.
13 415 A. W. LOTINGA. Rheostats.
13 429 and 13 430 WHIPP AND BOURNE. Three-way switches.
13 451 S. S. RICHARDSON. High-frequency intervalve coupling unit.
13 464 H. L. MCMICHAEL. Aerials for wireless telegraphy.
13 499 I. A. SANA. Variable inductance.
13 518 G. OLIVETTO. Attachment for wireless telephone receivers.
13 523 WRIGHT AND WEAIRE. Variable coupling between high frequency tuning and reactance coils.
13 526 C. E. VAWTER. Electric condensers. (23/5/22, U.S.)
13 530 METROPOLITAN-VICKERS ELECTRICAL Co. Balancing machines. (31/5/22, U.S.)
13 541 E. T. BAUZHOF. Electric ignition system for gas burners.
13 544 A. S. WADDINGTON. Electromagnetic make, break and resetting mechanism.
13 554 MUIRHEAD AND Co. and F. H. MUIRHEAD. Rectifying a.c.
13 555 VENOOTSCHAP MACHINERIEEN EN APPARATEN FABRIEKEN. Illuminating landing places in aerodromes. (23/1/23, Germany.)
13 576 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co.). Protective devices for a.c. systems.
13 579 W. J. OLIVER. Crystal detector.

May 23.

13 600 A. P. SCULLY. Battery terminals.
13 602 T. F. WALL. Control of induction motors.
13 605 C. W. NANCE. Vacuum condensers.
13 616 W. T. GLOVER AND Co. and C. J. BEAVER. Paper insulated cables.
13 618 WESTERN ELECTRIC Co. Vacuum tube amplifier systems, etc. (23/5/22, U.S.)
13 628 C. LOTT. Electric starting and stopping devices for talking machines.
13 637 S. E. LANGLEY. Variable inductance devices.
13 667 H. WADE (WHITE FUEL OIL ENGINEERING CORPORATION). Arc current generators.
13 671 P. G. A. H. VOIGT.
13 683 W. DUBILIER. Electric condensers.
13 684 W. DUBILIER. Electric condensers. (23/5/22, U.S.)
13 685 S. C. R. MARKS (IDEAL ELECTRIC AND MANUFACTURING Co.). Dynamos.
13 687 A. W. EMPSON. Apparatus for determining dielectric strength.
13 689 H. DREGHORN. Electric drives for printing presses, etc.

May 24.

13 694 W. P. DURTNALL. Battery-propelled locomotives.
13 733 H. P. RAPINET. Automotive driving and electric generating machine.
13 739 A. H. JACKSON. Motor control systems.
13 744 W. B. GOOD. Measuring instrument for d.c.
13 748 SIEMENS BROS. AND Co. and E. A. RICHARDS. Electric arrangements for controlling movement of a switch.
13 756 IGRANIC ELECTRIC Co. and M. J. RANTZEN. Electric control systems.
13 771 AUTOMATIC TELEPHONE MANUFACTURING Co. Telephone systems. (11/9/22, U.S.)
13 776 and 13 777 CALLENDER'S CABLE AND CONSTRUCTION Co. and J. B. GALL. Cables.

May 25.

13 793 O. W. WALKER. Thermionic valve holder.
13 807 B. A. PILKINGTON. Electromagnetic sound apparatus.
13 815 M. B. FIELD. Electrical instruments.
13 841 METROPOLITAN-VICKERS ELECTRICAL Co. and B A. G. CHURCHER. Measuring electric currents.
13 843 SOC. ANON. CALOR. Temperature-controlled electric switch. (29/5/22, France.)
13 847 AKT. GES. BROWN, BOVERI ET CIE. Steam turbine rotors. (24/7/22, Germany.)
13 853 PHILIPS GLOEILAMPENFABRIEKEN. X-ray tubes. (6/12/22, Holland.)
13 856 A. E. FIELD. Electric light signs.
13 857 P. BOURET and P. LEDREUX. Ohmic resistances.
13 859 MARCONI'S WIRELESS TELEGRAPH Co. Radio-telephony. (26/5/22, U.S.)
13 864 D. F. CAMPBELL. Electric furnace for heating drill steel tools.
13 868 P. R. JACKSON (SPERRY GYROSCOPE Co.). Gyroscopic apparatus.
13 880 E. A. GRAHAM. Thermionic valve arrangements.

May 26.

13 886 H. CONSTABLE and K. SECRETAN. Tester for wireless circuits.
13 887 A. DINSLEY and F. H. HENRI. Selectivity apparatus for wireless apparatus.
13 921 WESTERN ELECTRIC Co. Electric welding and annealing apparatus. (31/8/22, U.S.)
13 929 BAILEY, PLANT AND Co. Telephone mouthpieces.
13 931 A. MULLAR. Incandescent lamps. (26/5/22, Spain.)
13 936 W. E. HIGHFIELD and J. E. CALVERLEY. Electric transforming apparatus.
13 950 A. E. CHAPMAN. Electric contact or terminal.
13 956 J. HENDERSON. Wireless signal systems.
13 960 J. H. ST. H. MAWDSLEY. Dynamos.
13 964 G. W. MASCORD. Electric cut-outs.
13 965 AUTOMATIC TELEPHONE MANUFACTURING Co. and A. E. HUDD. Railway signalling systems.
13 967 B. E. F. RHODIN. Electrolytic separation. (26/5/22, U.S.)

Arrangements for the Week.

FRIDAY, JUNE 8th (To day).

DIESEL ENGINE USERS' ASSOCIATION.

At the Institution of Electrical Engineers. Paper on "Losses in Heat Engines and Means of Avoiding Them," by Engineer-Com. W. P. Sillince, R.N.

PHYSICAL SOCIETY OF LONDON.

5 *p.m.* At the Imperial College of Science, South Kensington, London, S.W. Lecture on "A General Solution of the Problem of Finding the True Vertical for All Types of Marine and Aerial Craft," by Prof. J. G. Gray.

WEDNESDAY, JUNE 13th.

INSTITUTION OF RAILWAY SIGNAL ENGINEERS.

6.30 *p.m.* At the Institution of Electrical Engineers, Victoria Embankment, London, W.C.2. Paper on "Theory of Interlocking, with Some Problems and Suggestions," by Mr. J. S. Moore.

THURSDAY, JUNE 14th.

THE OPTICAL SOCIETY.

7.30 *p.m.* At the Imperial College of Science and Technology, South Kensington, London, S.W.7. Papers by Mr. S. G. Starling on "Levels and Level Bubbles," Mr. T. F. Connolly on "A New Form of Balloon Theodolite," and Mr. E. Wilfrid Taylor on "The Primary and Secondary Image Curves Formed by a Thin Achromatic Object Glass with the Object Plane at Infinity."

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CONTENTS.

Notes of the Week	639	Association of Consulting Engineers	659
Manchester	641	The Economy of Panel Heating	660
The Fourteenth Kelvin Lecture. By Prof. J. A. Fleming	642	E.D.A. and the Empire Exhibition	660
Radio Transmission Measurements. By Ralph Bown, C. R. Englund and H. T. Friis. Illustrated	645	Diesel Engine Users' Association	660
		Books Received	660
The Institution Summer Meeting	648	The Liffey Power Scheme	661
Australian Electrical Enterprise. Illustrated	649	Institution Notes	661
Barton in Pictures	650	A Great Electrical Concern	661
Ten Years of Switchgear Manufacture. Illustrated	652	Foreign Notes	662
Correspondence	653	Imperial Notes	662
Street Advertisements	654	Electricity Supply	663
Municipal Tramway Finance	655	Personal Items	663
Electricity Consumption in Shanghai	655	Tenders Invited and Accepted	664
British Standard Generators and Motors	655	Business Items	664
Merchandise to Sell and Profit By. Illustrated	656	Electric Traction	665
Parliamentary Intelligence	658	Institute of Transport	665
Forty Years Ago	658	Wireless News	665
The Dismissals at Wimbledon	658	Companies' Reports, Dividends, etc.	666
British Association Programme	658	Commercial Intelligence	667
The Prince at Birmingham	659	Prices of Metals, Chemicals, etc.	667
		Patent Record	668
		Arrangements for the Week	668

Notes of the Week.

Telephone Problems and Research.

Prof. Fleming's well-known radio-frequency delivery made it appear to us wise that no account of his recent Kelvin lecture should be published in The Electrician until he had had an opportunity of revising his remarks. The subject was highly technical, and in such cases no harm is done by sacrificing up-to-dateness to accuracy. On another page of this issue we publish what is only a short abstract of a most instructive lecture. It is practically a technical history of telephony delivered by one who has played a considerable part in the development of this fascinating electrical application. From Prof. Fleming's review four names stand out as having had most to do with this progress—Graham Bell who invented the telephone, Heaviside who propounded its theory, Pupin who devised a system of loading, and Prof. Fleming himself who invented the thermionic tube. Around these names has been built a vast amount of work and effort which has made modern telephone communication and turned high scientific principles into an industry. But not without a certain deftness Prof. Fleming indicates that this is not enough. Too many telephonic improvements have come from other countries, and in organised research on telephonic problems we are far behind the United States. The importance of greater knowledge of the theoretical and practical problems of this branch of electrical science cannot be overstressed. But it must be seen to that we play our full part in solving them.

The I.M.E.A. Convention.

The twenty-eighth annual Convention of the Incorporated Municipal Electrical Association, which begins at Scarborough on Monday, should provide a platform for the discussion of many important topics which will not be of interest solely to the station engineer. The President, Lieut.-Col. W. A. Vignoles, has shown that, though he is in charge of a relatively small undertaking, he is convinced that electrical development in the broadest sense is necessary for the good of the electricity supply industry, and he is not unlikely to have something to say on this topic in his address. Mr. T. Hall will consider the same subject in his Paper, while more technical questions will be dealt with by Mr. J. E. Storr and Mr. F. W. Purse. The most interesting discussion is, however, likely to arise on "The Development of Cooking Apparatus." We do not argue, and neither does anybody else, that electric cooking apparatus is perfect. On the other hand it is a good deal better and more efficient than many people think, and is quite capable of carrying out the duties that it may be called upon to perform. We hope, therefore, that any criticisms that may be made will be constructive and that the fainthearted will be given no chance or argument for continuing to hold the opinion that it is better to do nothing until later on. We hope that the weather will be fine and that the many opportunities for the unofficial exchange of views will be taken full advantage of.

Wales and Water Power.

According to the official statistics the rainfall in the area from which the Dolgarrog works of the Aluminium Corporation draw their power varies between 70 and 100 in. per annum. The members of the Institution of Electrical Engineers, who visited these works last Friday, may be forgiven for supposing a goodly proportion of this rainfall was concentrated into that particular day for their especial benefit. But unpleasant as the climatic conditions were, they at least gave those present a chance of realising the possibilities of the development of water power in that region. The rain itself, the numerous mountain torrents so

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whitened by their dashing over the rocks as to look like snow, and the sheer precipices falling away from the hills to the valleys, all indicated where hydro-electric power could be employed in ways which would be both economical and useful. The works of the Aluminium Corporation and the generating stations and transmission lines of its associated concern, the North Wales Power Co., show what has been done, and are a sufficient indication of what could be done, not only to employ electricity for processes, such as the manufacture of aluminium, but for the supply of the surrounding towns and villages. The Company are to be congratulated on their present enterprise and on their determination to go on with extensions. These extensions include a 30 000 kW station, which is already under construction at Dolgarrog, and a 110 000 V ring system connecting this station with one at Maentwrog which will have a capacity of 24 000 kW, and for transmitting power to the eastern area of the North Wales and Chester district.

A Chance for Further Enterprise.

THIS development will be spectacular enough, and we wish it success, but we hope the Company will show enterprise in another direction, where it will be even more useful and at least as profitable. Lady STOCKTON, replying to a vote of thanks to the London Midland and Scottish Railway for the entertainment given to the members of the Institution of Electrical Engineers at Llandudno, referred, she said with some trepidation, to the fact that in Canada every little village had its supply of electricity, while in this country such a supply was exceptional. We have been told that one of this country's greatest assets is coal. We do not deny this, but it is in some ways an obstacle to the development of electricity supply. In that part of North Wales through which the tour was made, coal must be expensive and hard to obtain. That district is largely given over to holiday makers, who require such amenities as hot water and quickly evoked meals. To provide these by using coal must be difficult; to provide them by using electricity would be easy. The district contains a number of large houses and more than one industrial concern, such as the Penrhyn slate quarries, to which the same arguments apply. Here are chances for the North Wales Power Co., which they should seize with both hands.

The Achievement of Simplicity.

THE path of invention is through complication to simplicity. We have only reached the former stage in much of the equipment which is being used for the control of generating plant and the interconnected systems, and as the size and ramifications of these systems grow, so does the number and character of what are irreverently called the gadgets employed increase and multiply. We have main turbo-alternators and auxiliary turbo-alternators, and something very like auxiliary auxiliary turbo-alternators. We have main switches which are operated by circuits containing other switches, and these in turn function by means of circuits containing batteries, relays and other similar apparatus. There is not only complication but danger in this. The more apparatus there is the more there is to go wrong at awkward times and the more reason for designers to turn their ingenuity towards a simplification of devices. We are glad to see that this is being done, and on another page of this issue we give an account of a new tripping device, which has been designed by Ferguson, Pailin, Ltd., for use with their oil switches. The essential feature of this apparatus is that it does not require the use of relays, batteries and auxiliary contacts, but is direct acting by means of the energy stored in a spring by the closing of the switch. The trips are set mechanically, so that there is no alteration in the impedance of the coils. But the main point we wish to make, whether this apparatus is successful or not, is that the device is a realisation of the need for greater simplification in electrical design which, in other words, is an insurance of greater safety in working.

The Nature of Atmospherics.

AT a recent meeting of the Royal Society an interesting paper "On the Nature of Atmospherics" was read by Mr. R. A. WATSON WATT and Dr. R. V. APPLETON. The paper described observations with a cathode ray oscillograph, on the temporal variation of the electric force occurring in radio-telegraphic atmospherics. It is shown that approximately faithful reproduction of the field changes can be assured by using a highly damped antenna whose time constant is kept much less than the duration of the atmospheric. The principal constants of six hundred typical atmospherics, of which five hundred were delineated by an "eye and hand" method, are examined. A bare majority are quasi-periodic, consisting normally of one complete oscillation, of duration 2 000 micro seconds, the mean change of field being 0·128 V per metre, with no marked unbalanced transport of electricity on the whole group. A second group of almost equally frequent occurrence consists of aperiodic impulses, of duration generally about 1 250 micro seconds, but frequently reaching 0·025 of a second, the mean change of field being 0·125 V per metre, with a seven to one numerical predominance of discharges tending to carry negative electricity to earth in the receiving antenna. The form of the aperiodic type of atmospheric is shown to include a period of growth to maximum field strength whose duration is little short of the decay period.

Dr. Lee de Forest's "Talking Film."

IT is an open secret that Dr. LEE DE FOREST has been for some time studying the problem of the "talking film," but the demonstration which was given in this country for the first time by the inventor on Wednesday shows that rumour is a reality, and that the combination of visual and acoustic impression is not only a possibility, but a factor to be reckoned with by the entertainment industry. "Talking films" have actually appeared in a programme at a New York theatre, and this example will doubtless be followed before long in this country. As regards the effect on the audience, the synchronisation of the action of the performer on the film with the voice or music being played is exact. In fact it is a little too exact, for anyone sitting at the back of a large hall is conscious of an appreciable lag between the visual and the audible indication. This, however, is a small defect which it should not be difficult to overcome.

The System Employed.

As regards the actual apparatus employed, at the recording end, in addition to the usual phonographic equipment, is a telephone microphone, the current from which is amplified several thousand times by a bank of valves which is also connected to a high-frequency modulator. Connected to this high-frequency circuit is a gas filled tube known as the "Photion," which emits a highly actinic light, and the brilliancy of this light varies with the modulated high-frequency energy of the oscillator. This light is focussed by a lens through a small slit on to the side of the film on which the pictures are being taken. Each picture on the film is therefore accompanied by its appropriate sound record on the same film. At the projecting end two small co-axial tubes are mounted on the usual projecting machines. These contain a sound projector lamp and a photo-electric cell. The film passes between these two tubes, and in this way a varying light is thrown on the cell. The latter is connected through amplifying arrangements to loud speakers, which are placed at convenient positions near the screen. Without using exaggerated language it may be stated that Dr. DE FOREST has attained success by genuine scientific means where others have failed, and he is heartily to be congratulated.

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Manchester and Hot Water.

WHEN so much was provided by the organisers of the summer meeting of the Institution of Electrical Engineers, it is a little ungracious to complain that something was left out. But, in fact, there was little or no indication that one of the greatest outlets for the electrical industry and in the future lies in the home. Partly this omission was inevitable, as not much domestic apparatus is made in Manchester, but it could certainly have been overcome in part by an inspection of what the Electricity Department is doing in this direction. The object of this note, however, is not complaint but to insist how important the development of the domestic load is to the electrical industry and how that development depends on the design and manufacture of the right apparatus. For that reason we are looking forward to seeing some useful designs submitted in connection with our competition for a hot water scheme for an all-electric house, and remind our readers that the closing date is June 29th.

Manchester.

Rather less than one hundred years ago a revolution took place in this country in whose fomentation and conduct to a successful conclusion the inhabitants of Manchester played an important part. That revolution was economic in its inception, and political in its consequences, and the effect of those consequences is still being felt. The inhabitants of Manchester are proud of the part their ancestors played in that great movement, and their city has given its name not only to a political school, but to an idea which has had great influence in shaping the history of the British Empire. But in one hundred years much has happened, and the events of the past few years especially have played a great part in re-adjusting our economic and commercial ideas, and have given pause to the further development of the political idea for which Manchester stands. Manchester would probably be the first to recognise this, and will act accordingly.

Science and Human Affairs.

In those hundred years also a more profound change has taken place in the conditions of existence than could have been brought about by any political school or economic theory. To quote the introduction to a booklet issued to those members of the Institution of Electrical Engineers who attended the summer meeting in Manchester last week, "The characteristic feature of our age is the great part which science plays in human affairs." In emphasising the truth of this statement we may assume that science includes engineering, and that what the writer wished to imply was that the sceptre of influence in world affairs and in the development of civilisation has passed from the politician to the scientist and to the engineer. It is probable that as yet neither the politician or the engineer recognises this, but it is nevertheless true, and its truth may be confirmed by indicating that as in politics so in engineering Manchester has become the centre of a school of thought, and more than a school of thought, a school of action and progress, which will have the profoundest influence in bringing about the advancement of technical knowledge and endeavour and the betterment of the human race.

A Definite Engineering Centre.

Partly by accident, and partly by design, Manchester has become a definite engineering centre whose sphere of influence must increase as years go on. With its engineering history the names of DALTON, JOULE, FAIRBAIRN, OSBORNE REYNOLDS and HOPKINSON will always be connected, while the line of succession is being worthily carried on by those who bear names that are familiar to our readers. Its connection with engineering began in 1882, almost as soon as electrical engineering itself, and the early days of electricity supply and of electric traction will always be connected with the names of Mather and Platt, whose present works were inspected during the visit. For many years Openshaw, on the east of the city, was the centre of the engineering trades, but in modern times this has been counterbalanced, and as far as electrical engineering is concerned more than counterbalanced by the growth of Trafford Park during the last twenty years. The result is, and it is a result of which the city and all those responsible may be proud, that if a cloud burst or other cataclysm swept away the electrical engineering works in every other centre but Manchester, that city would, from its own resources, be able to build and equip generating stations, erect transmission lines, lay cables, and supply motors and other electrical equipment for the remainder of the country. That this is no phantasy those who forsook the lotus life of the metropolis and other towns to take part in the summer meeting of the Institution to Manchester last week will amply bear witness.

Barton and Electricity Supply.

There is little need, therefore, to illustrate our thesis by examples. The Barton station of the Manchester Corporation shows that the city takes its own medicine. There are installed the largest boilers in the country, and turbo-alternators which are second in size only to the set at Rotherham. These turbo-alternators are a local product. The switchgear can only be described by the adjective impressive. The arrangement of the auxiliaries is sufficient to show that continuity of supply has been regarded quite rightly by Mr. PEARCE as the first essential, and he is to be congratulated most heartily on a station which is not only worthy of the electrical character of the district in which it is situated, but will assist in still further bringing about a development of which we have not seen the end. The outdoor sub-station at Chorlton-cum-Hardy, and the automatic sub-station in the High Street, are but further evidences of this determination to take advantage of all that is best and most modern in electrical knowledge.

Trafford Park and Manufacturing.

On the manufacturing side the same evidences are to be found. As we mentioned last week, members were given an opportunity of seeing how the use of electrical equipment can bring about increased production in other trades. They were also given an opportunity of seeing how the production of the electrical equipment itself is conducted on the most modern lines. We do not wish to be invidious, and we do not wish to hint that the visit should have been more strenuous than in fact it was, when we remark that those attending the meeting did not see all the electrical works in Manchester, but only the most important. For we think it will be agreed that the Trafford Park Works of the Metropolitan-Vickers Electrical Co. may be regarded in this light, not only on account of their size, but on account of the widespread character of their productions. By visiting them it was therefore possible to see what Manchester can do in the manufacture of all classes of electrical apparatus more easily than would have been the case had the works of more specialised firms been inspected.

The Lesson.

Hope in what the future may bring may therefore well be the result of what was seen during this visit to England's electrical centre. If it is the result none better can have arisen. Sir PHILIP NASH said that we were behindhand in electrical education, and that foreign opinion ascribed this to our lack of brains. We agree with Sir PHILIP NASH that this is a wrong deduction. We have the brains if we would but use them. What could be seen at Manchester last week is sufficient guerdon of that. But we are absurdly diffident and a little lazy, and the Manchester visit proves that there is no reason to be either. Diffidence is only excusable when first-class results cannot be expected, and laziness is not excusable at all. The brains we have and the hard work we can supply. The future of the British electrical industry should therefore be both safe and rosy.

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The Fourteenth Kelvin Lecture.

Problems in Telephony Solved and Unsolved.

By Prof. J. A. FLEMING, F.R.S.

In looking back at the titles of previous Kelvin lectures, it is noticeable that one subject in which the late Lord Kelvin took a profound interest from its earliest days has not yet received attention in them—viz., that of telephony. In the year following that of the decease of the illustrious inventor of the speaking telephone it is appropriate that the Kelvin lecture should direct attention to some of the problems of telephony which have been solved in the past fifty years or have remained unsolved.

Starting with a statement of the physical relations of measurable quantities concerned and of the methods by which the energy expenditure in creating audible and articulate sounds can be determined, the lecturer dealt with the problems of sound-wave energy, which is a variable pressure imposed on the steady pressure of the atmosphere. The conditions may be defined by stating the R.M.S. value of the variable part of the pressure in absolute units or by the ratio of the maximum of the variable part of the steady pressure. A number of formulæ can be derived which give a means of making deductions from experimental results as to the variation of air pressure and amplitude of motion of the air particles in a sound-wave.

Aerial Wave Energy.

During the last fifty years a large amount of research work has been done in determining the aerial wave energy per sq. cm. per sec. which must be passing at a certain frequency in order that the ear may just perceive it as an audible sound or a sound of a certain pitch and loudness, and an account of the work of Töpler and Boltzmann, Rayleigh, Weir, Minton, Lane, Hewlett, Fletcher and Wegel, and Wente in this direction is given.

In a paper on "The Analysis of the Energy Distribution in Speech," by L. B. Crandall and D. Mackenzie, these observers found that at a distance of 1 in. from the mouth of a speaker in ordinary conversational tone the R.M.S. value of the variable part of the pressure due to speech waves was 11·3 dynes per sq. cm. This corresponds to an energy flow of 3·2 ergs per sq. cm. per sec. E. C. Wente found a similar value—viz., 10 dynes per sq. cm. at 3 cm. distance.

Assuming the energy to flow out equally over the surface of a hemisphere of 2·5 cm. radius with centre on the lips, this amounts to a total energy emission of 125 ergs per sec. If we assume the speaking to be kept up for 1 hour, the energy represented by such speech waves would only amount to 1/20 joule, or 1/27 ft.-lb. of work. Even if we consider the wave amplitude to be increased 20 or 25 times, as might be the case in loud speaking or public lecturing, the total production of air-wave energy in the form of speech might only amount to 20 or 25 ft.-lb. in an hour. The total bodily energy expenditure as roughly judged by the fatigue of speaking to a large audience for an hour, even apart from bodily movements, is probably much greater. This gives an indication that the human vocal organs, considered simply as an energy-translating device for the production of speech-wave energy, may have small efficiency in the technical sense of the term.

Nature of Speech Sounds and the Ear.

The possible improvements in telephony are closely dependent upon a knowledge of the nature of speech sounds and of the operation of the ear in appreciating them. A careful study of the problem of phonetics in its relation to telephony has been made during the past few years in the United States. The important matter, from the telephonic point of view, is the study of the frequency-ranges required to convey specific articulate sounds with adequate reproduction at the receiving end.

An account of certain research work on the above subject has been described by Harvey Fletcher in a paper on "The Nature of Speech and its Interpretation." *

The Telephone as an Energy-Translating Appliance.

In a paper † published in 1912 by A. E. Kennelly and G. W. Pierce, it was shown that there are four constants of a telephone receiver which determine its performance throughout the frequency range of ordinary telephony—viz., 100 to 2 500 p.p.s. These are: (1) The force factor or electromagnetic pull on the diaphragm in dynes per absolute C.G.S. unit of current in the coils; (2) the equivalent mass of the diaphragm or a mass which, moving with the velocity of the centre of the diaphragm, has the same kinetic energy as the whole diaphragm; (3) the natural resistance of the diaphragm, in dynes per unit of velocity referred to the motion of the equivalent mass; and (4) the stiffness constant or force in dynes per unit displacement in cm. opposing the movement of the diaphragm and referred to the equivalent mass at the centre.

Kennelly and Pierce showed that valuable help could be derived in determining these constants from a diagram called the motional impedance circle of the instrument. The diameter of this circle is depressed below the horizontal by an angle called the depression angle, and the chords of this circle drawn through the orifice give the vector impedance of the telephone for the corresponding frequency. The diameter through the orifice gives the motional impedance of the telephone at resonance. An inspection of this circle therefore makes it possible to obtain data which assist in giving the values of the four principal constants when combined with the measurement of the amplitude of the vibration of the diaphragm at its centre.

Speaking very roughly, we might say that a Bell telephone receiver used in ordinary telephonic conversation is taking in power electrically about equal to 1 milliwatt, and is giving out power in the form of speech air-waves about equal to 1 microwatt. It is an extremely inefficient machine for the transformation of energy and far from perfect in its articulation as a speech-producing appliance. The inefficiency of the Bell telephone was pointed out many years ago by H. Abraham,* who deduced from certain measurements an acoustic efficiency of 1 part in 700 for a certain receiver at a frequency of 200 and a current of about 3·3 mA.

The Chief Unsolved Problem.

Here, then, is the chief unsolved problem of modern telephony—viz., the invention of a receiver acoustically more efficient than the present type of magneto receiver, and with equal or better speech-reproducing power.

The chief sources of the inefficiency of the magneto telephone receiver are:—

(1) Joulean heat loss in the coil; (2) eddy-current losses in the diaphragm and pole-pieces; (3) magnetic hysteresis losses in the same; (4) mechanical work done in bending the iron diaphragm; and (5) vortex motion or frictional losses due to air movements which do not contribute to wave production.

Radical Departure from Fundamental Principles Necessary.

Whilst considerable improvements have been effected, it is difficult to see how any great improvement in efficiency can take place without radical departure from the fundamental principles of Bell's invention. In the well-known telephones of S. G. Brown the iron diaphragm of the Bell receiver is replaced by a steel reed tuned to a certain frequency. The magnetic pull of the permanent part of the field magnets takes effect on this reed, which is capable of adjustment. To the reed is attached an aluminium cone with a flexible rim, which plays the part of the diaphragm. This diaphragm only partakes of these movements of the reed which are due to the telephone currents, so that when no speech currents are being received there is no strain on the diaphragm. Also, by reason of the material being aluminium, magnetic losses are absent. No doubt this type of receiver possesses a somewhat higher acoustic efficiency than the Bell, but no determinations of it by independent observers have been found.

Resonances Defects.

Apart from the energy losses in the telephone, another defect from one point of view is that its diaphragm has such a marked resonance for a frequency lying in the middle range of the voice. The amplitude of vibration is greatly increased at this resonance frequency and hence speech distortion occurs. In the human ear the tympanum is small and has a

* "Journal of the Franklin Institute," June, 1922.

† See "Proceedings of the American Academy of Arts and Sciences," 1912, vol. 48, p. 113.

* See "Comptes Rendus," 1907, vol. 144, p. 906.

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very high natural frequency. The result is that it can respond to those high harmonics which, as we have seen, give quality to the sound, especially consonantal speech sounds. Having regard to the enormous public use of the telephone, not only in ordinary te'ephony but in radio-telephony, where the available power is limited, the improvement of the acoustic efficiency of the receiver is one of the most important problems that can engage scientific attention. As it stands, the telephone receiver is by far the most inefficient of all our electrical energy-transforming devices.

Transmitter Investigations.

The energy-transforming efficiency of the microphone transmitter has not been made the subject of so much experimental investigation as that of the Bell receiver.

In the ordinary microphone transmitter with associated induction coil we supply power in two forms : (i) In the form of direct current, and (ii) in the form of aerial speech wave power which vibrates the diaphragm and modulates the direct current. We have, therefore, Joulean losses in the carbon granules and in the induction-coil circuits, as well as magnetic energy losses in the latter, and, in addition, work is spent in the deflection of the diaphragm and in creating eddy currents in the air near it. Owing to the necessity for supplying the direct-current power, the actual proportion of the whole power applied which makes its appearance as electric speech current-power in the line must be small, but it has not been possible to obtain actual measured results.

To overcome the difficulties connected with the low resonance frequency of the ordinary carbon microphone diaphragm, there has been a certain use of the condenser transmitter with a very tightly strained, and therefore more aperiodic, diaphragm for certain purposes, such as wireless telephone broadcasting. Also improved forms of magneto telephone with thick diaphragms which have a natural frequency above the ordinary speech range have been employed successfully for the same purpose in Great Britain. It would, however, be advantageous to get rid entirely of the necessity for a diaphragm. It is well known that the carbon electric arc can be used as a speech transmitter. Hence the new glow discharge microphone of Dr. Phillips Thomas, of the Westinghouse Electric Co. of America, in which the speech air waves directly modulate an electric discharge current, is a distinct advance, and is said to have been used for some time with marked success as a broadcasting transmitter in the United States.

Transmitter Problems.

A consideration of the telephone line shows a number of interesting problems to which a fairly satisfactory solution has been given in recent years. This is due especially to the work of Heaviside, Thompson and Pupin ; though while the problem of loading has been fairly well solved, Heaviside's condition for distortionless transmission has not been approached.

Nevertheless, starting with Heaviside's original suggestion, the successive improvements in loading due to Pupin and Krarup, as put into practice and improved by the careful research of great technical organi ations and by the public or Governmental telephone services, have resulted in an extension of the practical telephonic ranges up to, say, 2 000 or perhaps 3 000 miles by aerial lines, 500 miles on underground and 200 miles on submarine cables by suitable loading, as compared with about one-half or one-third of the above distances for unloaded lines of the same type and size.

The Problem of the Telephone Repeater.

An additional great extension of the practical telephonic range beyond that due to loading the line has been secured by the invention of the simple yet highly effective thermionic telephone repeater, and the lecturer gave an account of his early researches in this subject and of the various types of repeater now in common use.

The effect in practice of the introduction of the type of repeater used by the British Post Office has been to enable a great reduction to be made in the weight of copper used per mile in trunk lines, because the repeater can nullify line attenuation. Thus the London to Glasgow aerial trunk telephone lines employed a double copper conductor each weighing 600 lb. per mile—in other words, the whole 450-mile length involved the employment of 540 000 lb. or nearly 250 tons of copper. This may be contrasted with the recently laid underground trunks from London to Manchester, 183 miles long. This line has been equipped with repeater stations, and the copper conductors weigh 40 lb. to the mile in place of the 300 lb. which would have been necessary without repeaters. This fact alone shows the enormous economy in first cost which could have been effected in the trunk-line telephone system of this country if the thermionic repeater had been in existence when they were first projected.

The completed invention of the thermionic repeater has rendered commercially possible a vast extension of telephonic range and the establishment of telephone exchanges which may extend over the area of empires or continents rather than cities or countries.

Essentials for Good Carrier-Current Telephony.

To obtain good carrier-wave telephony a relatively large amount of electric current in the form of unmodulated carrier current must be sent along the line. This has led to a curious improvement which is called the suppressed carrier-wave system, in which the required surplus of unmodulated carrier current required to prevent speech distortion is not sent along the line, but supplied from a local source at the receiving end. This necessitates, however, special arrangements to secure that the added carrier current at the receiving end shall have exactly the same frequency as that supplied to the modulating valve at the sending end. The reduction of the carrier current has two advantages besides that of employing smaller line currents. It has been pointed out that the amplitude of the speech currents in the demodulator output circuit is proportional to the product of the amplitudes of the carrier current and that of the corresponding side-band component. Any changes in the leakance of the line by affecting the attenuation of the carrier current affects the loudness of the reproduced speech. This cannot occur when the greater part of the high-frequency carrier current is supplied at the receiving end. Again, interactions between the carrier current and any other stray currents due to cross-talk or want of perfect balance in the circuits are less prominent in the suppressed carrier-wave system. The carrier-wave system can be applied also in the transmission of telegraphic signals in Morse code, as well as to telephony. In the case of telegraphy it is not necessary to transmit such wide side bands or bands the frequency of which range over the same extent as are required for telephony. The result is that a much large number of independent side bands can be accommodated on one line without mutual interference, and therefore a larger number of simultaneous telegraph messages can be transmitted than is possible with multiple telephony.

Propagation and Amplification of H.F. Currents.

Some special difficulties in connection with the propagation and amplification of these high-frequency currents may be mentioned very briefly.

The propagation of high-frequency currents along telephone aerial lines or through cables follows the same general principles as in the case of low or audio-frequency currents. The inductance and capacity of the lines have much the same values for high as for low frequency. The resistance taken into account must, however, always be the high-frequency resistance as determined by the frequency. It is well known that the leakance of an aerial line is very much greater for high than for low frequency. This appears to be connected with the well-ascertained fact that the conductance of dielectrics increases rapidly with the frequency in many cases.*

Hence the attenuation of a line increases very rapidly with the frequency. For reasons which it is hardly necessary to state in detail, lines which are coil-loaded on the Pupin system are not suited for carrier-wave telephony owing to the reflection losses which take place at the points where the loading coils are inserted. In the case of land lines and at the ends of submarine cables the attenuation can be neutralised by the introduction of thermionic repeaters. There are some peculiarities in connection with amplification in lines conveying multiple carrier telephonic currents which may be mentioned. It would, of course, be possible to separate out the various bands of frequencies belonging to different channels of telephonic speech at any locality by suitable band filters and then amplify each by a separate thermionic repeater and return the amplified currents to the common line. But it is not necessary thus to separate them out. The whole complex group can be amplified by one or more thermionic repeaters in parallel. There is, however, in the case of carrier-wave telephony, a liability for the repeater to act as a modulator if the grid potential variations is extended beyond

* See J. A. Fleming and G. B. Dyke: "On the Power Factor and Conductivity of Dielectrics," "Journal I. E. E.," 1912, vol. 49, p. 323.

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narrow limits. To nullify this action the repeaters are worked in pairs. The incoming currents act so that the grid of one valve is increased in potential at the instant when that of the other is lowered by an equal amount. The output currents then co-operate together through the transformer and their combined energy is conveyed to the line. On the other hand any currents which have their origin in the valves owing to modulation are in opposition as regards phase and cut each other out.

The Problems of Commercial Telephony.

The great advances in the development of commercial telephony centre round three remarkable groups of inventions connected with the working out of the telephone exchange system. These are: (i) The common-battery system; (ii) the multiple switchboard; and (iii) the automatic telephone exchange. The use of the telephone would probably have been comparatively limited if it had not been for the conception of a telephone exchange for mutual conversation. This may be said to have originated with Bell almost immediately after he and others had given us the means of talking along a wire. It was the success which attended even the first crude attempts to establish an exchange system which created the necessity for grappling seriously with the unsolved problems in connection with it. The development of the automatic exchange is a story of fascinating interest. It presents us with a galaxy of inventions of astounding ingenuity, the result of which has been to give us a mechanical appliance which is almost a living organism in its capabilities and adaptability to the requirements of human intercourse.

Some Problems of Radio-Telephony.

The very remarkable progress in radio-telephony during and since the European war has been chiefly due to the wonderful intrinsic powers of the three-electrode thermionic valve, which have been brought to light by the researches and inventions of numerous investigators of the highest ability. Still there are many problems connected with radio-telegraphy as yet imperfectly solved, although astonishing progress has been made in some respects in the last few years. Limiting consideration to the subject of speech transmission by radio, it is found that in the transmitting part of the appliance as generator of the carrier electromagnetic waves required, the thermionic valve has displaced all other rivals such as the arc and high-frequency spark. It is questionable whether high-frequency alternators or Poulsen arcs will survive in competition with the valve. As long as we are concerned only with small-power radiation, the glass-bulb high-vacuum three-electrode valve provides a convenient generating appliance. Assuming that it is not too badly treated during the progress of manufacture by the electron bombardment of the metallic parts and consequent wear of the filament, it has a fairly satisfactory life.

High Power Valve Design.

Even up to a power of 5 kW the glass-bulb valve is still a practical appliance, although silica bulbs have been used for somewhat larger powers. An advance which has been made during the past year is therefore the discovery of a method of constructing high-power valves with bulbs partly of metal and partly of glass. The metal part also forms the anode, and can be kept cold by water circulation or air cooling. This new type of valve was rendered possible by the discovery by Mr. Housekeeper of a method of sealing together a glass and a copper-plated nickel tube. Hitherto it has been necessary to convey the currents into and out of the glass bulb by platinum wires sealed through lead glass.

The utility of long-distance wireless telephony is to a considerable extent frustrated by the great difference between the day and night transmission range, and especially by the as yet unconquered problem of atmospheric disturbances. So far, most of the remedies or schemes for the elimination of these disturbances have in actual practice been found to fall very far short of the claims made for them by their inventors. The chief unsolved problem in long-distance radio working is this annulment of strays. Much which may in time lead to further inventions for their conquest is being done towards a clear comprehension of the origin and source of these disturbances.

Blind Spot Troubles.

Another radio problem which awaits full solution is the manner in which the electromagnetic waves sent from broadcasting stations are, so to speak, lifted over certain districts so that the speech and music are in certain cases better heard at remote than at nearer distances. Moreover, there is a phenomenon called "fading" in which the sounds or signals carried by certain wave lengths, especially over long distances, fade away and then reappear and fluctuate in strength in an exasperating manner. These abnormalities are probably capable of explanation by reflection from higher ionised levels of the earth's atmosphere, by absorption of wave energy by ionised masses of atmospheric gases, or by absorption in passing over certain kinds of terrestrial surface.

In the case of electric waves, especially of the somewhat short wave-length used in broadcasting, the wave might be deflected upwards by reflection from certain inclined ground surfaces or by retardation of the part of the wave-front due to an increase of the dielectric constant of the air by water vapour and then brought down again by reflection from the under surface of masses of ionised air in the upper atmosphere, and so convey more energy to a distant receiving station than to a nearer one. The "blind spots" may perhaps be due to interference between waves which have reached that spot by two independent paths of different length. In these and innumerable other unsolved problems of radio-telephony very valuable contributions could be made towards their solution by the combined action of the numerous amateurs who now possess radio-telephonic receiving apparatus.

The Need for Research.

In conclusion reference is made to the position of research on telephonic problems in Great Britain. The great technical corporations in the United States maintain research staffs and laboratories for this purpose with equipments which have few equivalents in this country. They retain the services of scientific investigators of the highest ability who direct their attention not exclusively to problems of immediate commercial advantage, but look far ahead into the possible requirements of the future. The only research establishments in Great Britain which are on a par with those of America are the new and finely equipped laboratories of the General Electric Co. at North Wembley, the National Physical Laboratory at Teddington, and, on a smaller scale, the British Post Office Research Laboratory at Dollis Hill. There is, however, in Great Britain too much tendency to demand an immediate commercial return or at any rate a very close connection between the character of the research work done and its industrial applications, and also to consider that it can be fostered by small-scale expenditure on scholarships or committees, or usefully conducted by men of mediocre power. The first essential is to find the men with great initiative and original power, and then to place at their disposal adequate resources for research.

Telegraphy and telephony being under Government control in this country, there is less inducement for private investigators of high ability to make it the subject of their labours. There is not a single university in this country which possesses in its electrical engineering departments the necessary equipment for conducting advanced experimental investigations in telephony and telegraphy. Nevertheless, research in this subject is a matter of national importance especially to Great Britain with an Empire scattered over many seas.

Work of Pioneers not Appreciated.

We have never been deficient in the possession of men of the highest scientific originality in this country, but the pioneer work of such great investigators as D. E. Hughes, Oliver Heaviside, the late Lord Rayleigh, and even that of Lord Kelvin himself, was not at the time of its performance estimated at its true value or followed up with sufficient resources in the field of large-scale experiment, with the result that much of its practical outcome has reached us from other countries than our own. The unsolved problems in telephony are still many and of absorbing interest, and it is desirable that the attack on them should be from many sides, and not limited to the personnel of Government laboratories or to the official initiative of small Government Committees, but that facilities should exist for bringing to bear upon them the highest theoretical knowledge and most copious experimental skill, wherever found. These two rarely united kinds of ability were combined together in a surpassing degree in Lord Kelvin, and we cannot afford to allow the country which gave birth to him to fall behind in the effort to advance our knowledge of electric and magnetic phenomena, especially in relation to the arts of telephony and telegraphy, which have become of such supreme importance in relation to the intercourse of all mankind.

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Radio Transmission Measurements.*

By RALPH BOWN (American Telephone and Telegraph Co., New York) and C. R. ENGLUND and H. T. FRIIS (Western Electric Co., New York).

Almost from the beginning of the radio art attempts have been made to find a suitable way of measuring and expressing the strength of received signals and the effect of "static" on their audibility. The paper, as is indicated by its title, deals with such experimental measurements, and there are given brief descriptions of the methods and apparatus which the authors have been developing during the last two years for measuring experimentally two things of fundamental importance—namely, absolute values of the electric field strength of radio waves and the effective values of radio noise. Illustrative results have been included, but these results are given only as illustrations and no attempt is made adequately to discuss them as results.

Transmission Analysis of Radio Circuit.

A radio system viewed from the transmission standpoint may be divided naturally into three distinct parts. Firstly, there is the transmitting end of the system in which the radio frequency signal power is produced and radiated. Secondly, there is the ether transmission path, and, thirdly, there is the receiving antenna and its associated receiving apparatus. In all three of these divisions the signal-bearing currents or waves are subject to losses. In the first, and usually the third, they receive gains due to some form of amplification. Before the transmitting and receiving apparatus can be chosen to give the most suitable partitioning of the gain, the losses must be isolated and evaluated. It is with this part of the problem that the present paper is concerned.

At the transmitting end of the system the important element from the present standpoint is the radiation efficiency of the

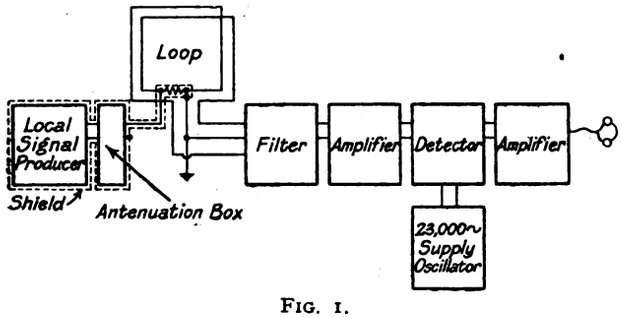

FIG. 1.

transmitting antenna structure. This efficiency is defined as the ratio between power input to the antenna and power actually radiated, expressed as a percentage. The input is readily determined as the product of the total antenna resistance and the square of the antenna current, both of which may be measured by well-known methods. The radiated power is the product of the radiation resistance and the square of the antenna current. The radiation resistance is in accordance with the usual theory $R = 1\,600\,\frac{h^2}{\lambda^2}$ O where h and λ are in the same units. The wave length being known, it remains to determine the effective height h. Now $h = \frac{E\lambda d}{377\,I}$ meters, where λ and I are the sending wave length and antenna current respectively in kilometres and amperes, and E is the effective or root mean square value of the electric field strength of the radiated waves in micro-volts per metre at a distance d kilometres from the antenna. All these quantities are readily found except the field strength E. If E is measured, all the data are available for calculating h and the radiated power.

Conditions at Receiving Station.

At the receiving station, which forms the third portion of the system, another factor enters into consideration. Interfering electric waves from static, other stations, local electric power systems, and so on, are usually present, and the incoming signal must be of sufficient strength to dominate them satisfactorily. With a simple form of receiving antenna, the antenna efficiency is important only in determining the amount of amplification required in the receiving set, since the antenna picks up both signal and noise in a ratio which is determined by their relative strength as ether waves. At the receiving station it would thus seem to be possible to state the minimum field strength of signal required for satisfactory operation, in terms of absolute strength of the radio noise field. It must be borne in mind, however, that the antenna and receiving set are in general designed to reduce radio noise without detriment to signal, by means of selectivity, directional effects and the like, so that the minimum permissible absolute value of signal depends also on the nature of the receiving system.

Long Wave Field Strength Measurements.

Fundamentally the measurement of radio field strength is simplicity itself. All that is required is the measurement of the received current in an antenna of known constants. The difficulties arise in determining the constants and measuring the minute currents produced by weak signals.

In many cases the ordinary open antenna has been used. It has the advantage of collecting relatively large amounts of power and making the current-measuring problem easier. The authors have, however, preferred the loop antenna as more stable, portable, and easily and accurately calibrated. Where the fields to be measured are strong, as near the transmitting station, it is possible to measure the current in the receiving antenna directly by means of a thermal instrument or a vacuum tube voltmeter. In the general case this is not so, and a comparison method must be resorted to as described below.

In a note published recently in the "Proceedings" of the Institute of Radio Engineers,† Mr. Englund has described the initial form of the field strength measuring sets for very long waves. For completeness and as illustrative of the method in its simplest form it will be briefly reviewed here. The apparatus was designed to measure signals in the neighbourhood of 23 500 cycles per second. From the diagram (Fig. 1) it will be seen that it consists of three main parts—namely, the local signal input apparatus, the loop antenna, and the receiving set.

There is nothing out of the ordinary in the loop antenna and the receiving set except the use of a band filter between them to give very high selectivity. The input apparatus consists of an oscillator circuit complete with its own "A" and "B" batteries, which generates 23 500 cycle current. This current passes through a thermocouple type of milliammeter into a 600 O adjustable artificial line designed for radio frequency use. The output end feeds through a 599 O resistance into a 1 O resistance shunt which is included in the loop circuit. The whole input system is covered by a copper shield.

Operation of the Set.

The operation of the set when measuring signals from a co-operating transmitting station sending dashes separated by spaces is as follows. The loop is oriented to receive maximum signals. The signals are tuned in properly through the filter and received as a tone by the aid of the heterodyne oscillator in the receiving set so that they may be listened to or, if static permits, read on a microammeter. The local signal oscillator is then turned on and its frequency adjusted to be exactly the same as that of the incoming signals. Then by means of a key the local signal is cut on and off during spaces in the incoming signals so that the two signals (incoming and local) are heard alternately. When the local signal oscillator is adjusted to the proper frequency the two will have the same tone pitch. It only remains then to adjust the local signal by means of the artificial line to have the same loudness as the incoming signal and to read the setting of the artificial line and the value of the current flowing into it.

Since the artificial line, when properly terminated, is a current attenuator, the current flowing into the line multiplied by the attenuation factor for which the line is set gives the much reduced current which flows out to the shunt in the loop circuit. A small portion of this current goes through the loop itself, which forms a series resonance circuit in parallel with the shunt, so that the current through the shunt is less than that coming from the artificial line by an amount equal to the ratio of the shunt and loop resistances. This ratio is usually too small to warrant the correction.

Voltage Calculations.

The shunt current in amperes multiplied by the shunt resistance in ohms (1 O in this case) gives the voltage introduced into the loop, which is in turn equal to the voltage

* Abstract of a Paper read before the Institute of Radio Engineers.

† "Proceedings of the Institute of Radio Engineers," vol. ii, No. 1, February, 1923, p. 26.

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induced in the loop by the incoming signal waves. The voltage V induced in the loop by incoming waves, the effective field strength of which is E micro-volts per metre is

$$V = \frac{2}{3}\pi f A N E \times 10^{-18} \text{ V}$$

where f = frequency in cycles per second, A = loop area in square centimetres and N the number of turns. Substituting for V its value $V = I_L F R_s$, where I_L = current into the artificial line in amperes, F the current attenuation ratio setting of the line, and R_s the resistance of the shunt in ohms, we have

$$E = \frac{3 I_L F R_s}{2\pi f A N} \times 10^{18} \text{ microvolts per metre.}$$

It should be noted that this calculation requires no accurate knowledge of the loop resistance, inductance or capacity, since the measurement matches voltages directly and the resulting current is of no import. There is, to be sure, some error due to the fact that the incoming signal voltage is induced in a distributed manner and the local signal voltage is introduced at a fixed point in the circuit, but our calculations lead us to believe that this error is too small to warrant any correction.

Experimental Difficulties.

It will no doubt be appreciated that one of the most difficult experimental problems in the construction of a field strength measuring set is to keep the oscillator which produces the local signal power from affecting the antenna directly. The success of the method depends on having all the power fed to the antenna through the circuits designed to meter and control

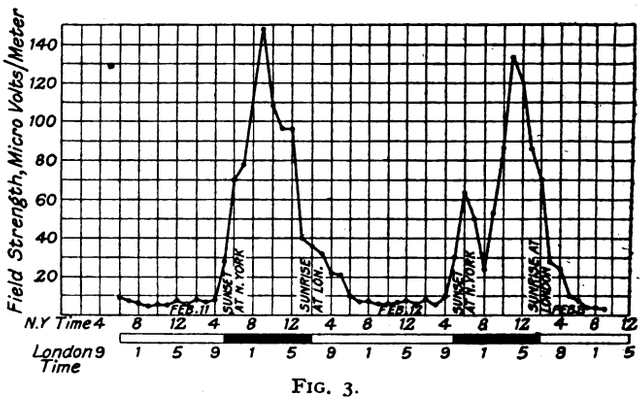

FIG. 3.

1 500 cycle tone in the telephone receivers. The operation of the outfit, except for the tuning of the receiving set, is exactly the same as with the simpler set.

An illustrative example of the data being taken is given in Fig. 3, where the field in microvolts per meter is plotted against the hour of the day.

Short Wave Field Strength Measurements.

In measuring short-wave signals, the higher frequency makes the " pick up " from the local signal oscillator harder to reduce to satisfactory values. In getting over this trouble authors

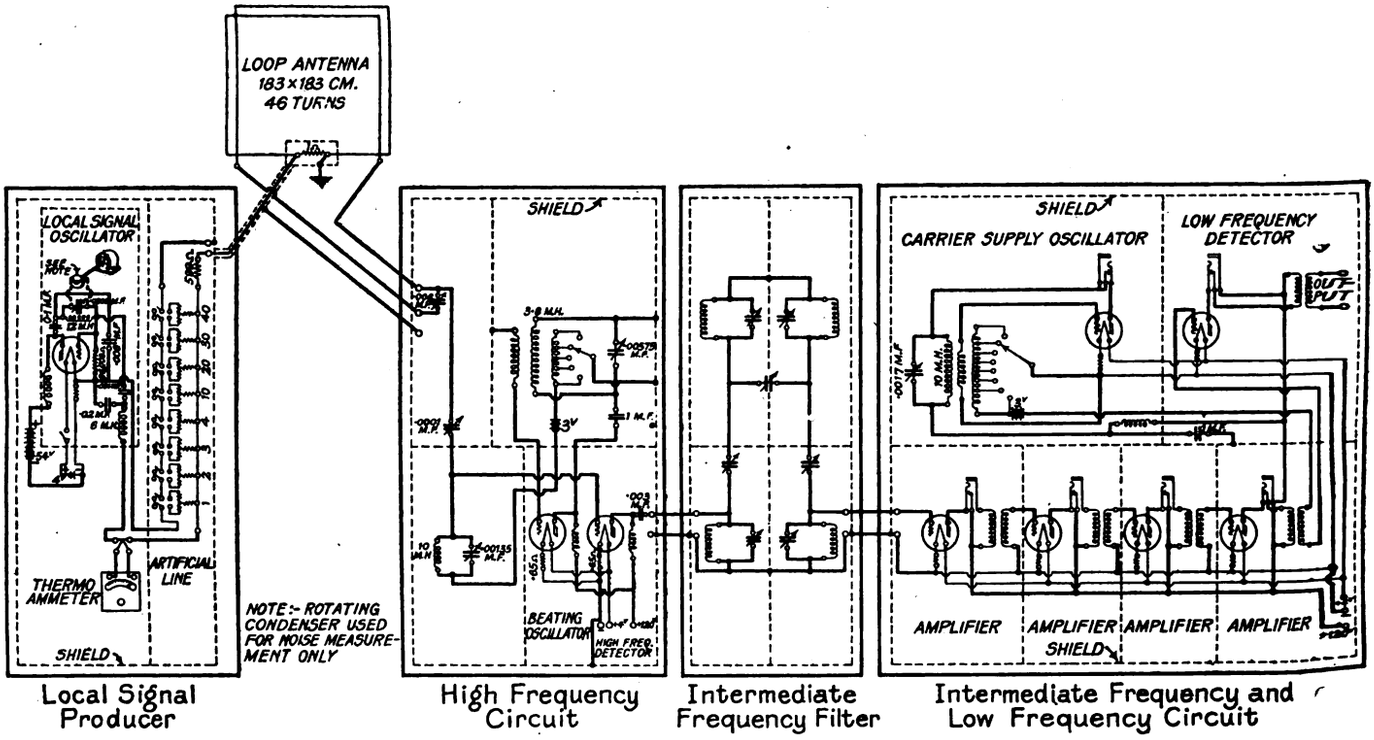

FIG. 2.—LONG WAVE FIELD STRENGTH MEASURING SET.

it and on having no external " pick up." It is found that this requirement can be met sufficiently if the oscillator power is kept to the lowest workable value, the oscillator is given a reasonable separation from the antenna and the whole input circuit is carefully and systematically shielded.

The second type of long wave measuring set employs double detection. The entire apparatus is shown in Fig. 2. The loop antenna has a very loose capacity coupling to a secondary circuit which feeds into the radio frequency detector. This detector also has impressed on its grid a 91 000 cycle voltage from the radio frequency beating oscillator. The incoming signal frequency is 57 000 cycles, so these two beating together produce 34 000 cycles in the detector output. This is selected by the filter circuit which permits the passage of a 2 000 cycle band from 33 500 to 35 500 cycles and greatly attenuates all other frequencies. The signal is then amplified to the desired degree and impressed on the audio frequency detector together with a 35 500 cycle voltage from the carrier supply oscillator. If the incoming signal is the 57 000 pure continuous wave which is used for measurement transmission it comes out as a

employ a modified method devised by Mr. Friis, which is believed to be entirely new. A detail circuit diagram of a measuring set of this type is shown as Fig. 4.

The loop antenna is provided with a tuning condenser across its terminals in the usual way, but its central point is earthed and connection to the receiving set is from earth to one side of the loop. This in great measure preserves the directional balance of the loop and minimises the damping due to the receiving set. The receiving set itself is of the double detection type and has intermediate frequency amplifying and selecting circuits designed for 45 000 cycles. If the incoming signal has a frequency of 750 000 cycles the loop is tuned to 750 000 cycles, but the radio frequency beating oscillator is set to produce a frequency of either 705 000 or 795 000 cycles, so that, beating with the 750 000 cycle signal in the radio frequency detector it will produce the 45 000 cycles necessary for further amplification and selection. The local signal oscillator is not set at 750 000 cycles, but at a frequency which is just 45 000 cycles the other side of the beating oscillator, so that it will also produce 45 000 cycles at the output of the

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radio frequency detector. This means that if the beating oscillator is below the loop tune, at 705 000 cycles, the local signal oscillator will be 45 000 cycles still lower, or at 660 000 cycles. Or if the upper position has been selected, the two will be at 795 000 cycles and 840 000 cycles respectively. In either case, in so far as the intermediate frequency and audio frequency output circuits are concerned, the incoming and local signals are delivered to them at exactly the same frequency. At the same time, the original frequency of the local signal is well off the loop tune, and induction into the loop is so reduced that only a moderate amount of shielding is required.

The resistance shunt through which the local signal is introduced is placed in the earth lead of the loop. Thus the shunt is not in the loop circuit proper, but, viewed from the input terminals of the receiving set, is in series with the parallel resonance circuit formed by the loop and its tuning condenser. Since the local signal voltage impressed on the receiving set comes directly from the shunt and is not increased by resonance, the current through the shunt is larger than in the case of the direct method used in the long wave sets, and no attenuation network is needed. In effect, the voltage across the shunt is compared by the receiving set with the voltage set up by the incoming signal across one-half of the loop. The inductance and resistance of the loop must be accurately known as its turns-area.

The distributed capacity of the loop and its connecting leads are determined by the well-known method of finding the values of the calibrated tuning condenser required to give resonance at various wave lengths, plotting these capacities against the corresponding wave length squared, and extrapolating the straight line thus obtained to its intercept on the capacity axis. Adding the distributed capacity to the capacity of the tuning condenser at resonance for some particular frequency, the inductance of the loop may be calculated by the usual method.

Determination of Loop Circuit Resistance

After experimenting with several methods it was found that the resistance of the loop circuit could be best determined from the resonance curve, by the capacity variation method. Each measuring set has permanently installed in parallel with the main tuning condenser a calibrated single plate variable condenser for the carrying out of this method. The radio frequency detector tube is one in which the change in plate current is proportional to the square of the radio frequency voltage impressed on its grid. In other words, it may be used as a vacuum tube voltmeter. The beating oscillator, with

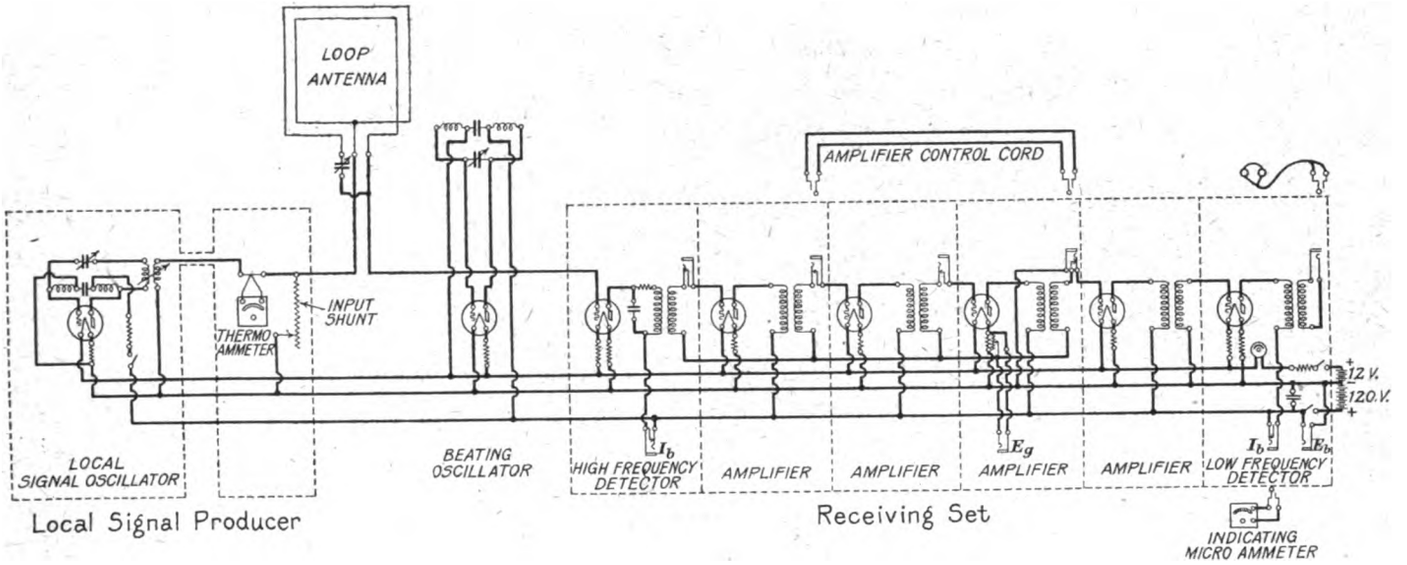

FIG. 4.—SHORT WAVE FIELD STRENGTH MEASURING SET.

two voltage sources are in series in a very high impedance circuit. The low impedance shunt has, therefore, no appreciable effect on the interaction of the loop and the receiving set. On the other hand, the loop, acting as a trap circuit, has sufficient impedance, even at the off-tune frequency of the local signal, to require that a simple experimental correction be made for it. The correction factor is determined as a part of the calibration of the set by taking the ratio of the voltage impressed on the receiving set from the shunt with the loop cut out of the circuit to that impressed when the loop is in the circuit. The voltage applied to the receiving set by the local signal input system is then: V (in millivolts) $= I_L \alpha R_s$, where I_L is the current in the shunt in milliamperes measured directly by a series thermocouple as indicated in the circuit diagrams, α is the correction factor, and R_s is the resistance of the shunt in ohms.

The potential applied to the receiving set as a result of the action of incoming waves of field intensity E microvolts per meter is one-half that across the loop terminals, or

$$V = \frac{1}{2} \frac{4\pi^2 f^2 LANE \times 10^{-15}}{3R} \text{ millivolts.}$$

Transposing, $E = VK$ microvolts per meter, where

$$K = \frac{0{\cdot}152\,R}{f^2 LAN} \times 10^{15}.$$

In the above, f = frequency in cycles per second; L = inductance of loop in henrys; A = area of loop in square centimetres; N = number of turns in whole loop; R = total radio frequency loss resistance of loop circuit in ohms.

V is measured by comparison with the voltage across the shunt. E is derived from it through the agency of the factor K, which is a calibration constant of the set. The short wave measuring set thus differs from the long wave set in that the reduced coupling to the loop, serves as a source of constant radio frequency power. Thus the resonance curve of the system may be run at any desired frequency by means of the single plate tuning condenser and a micro-ammeter plugged into the plate circuit of the radio frequency detector tube. The conditions of calibration are thus those of operation and the resistance derived from the resonance curve by the usual methods includes all losses in the radio frequency circuit. The accuracy of the set is dependent on the accuracy with which R is determined, and R sometimes varies appreciably with climatic conditions. For any given loop K may now be evaluated at any frequency.

In using this type of set, the practice is to dispense with ear comparisons and employ a micro-ammeter in the plate circuit of the audio frequency detector as the indicating means. The audio frequency detector then acts as a vacuum tube voltmeter to measure the amplitude of the carrier of the incoming radio telephone signals. Unless the transmitting station is badly over-modulating, the micro-ammeter is unaffected by the speech or music being sent. It is the carrier field strength which is measured, without reference to the degree or nature of the modulation.

Operation of the Apparatus.

The operation of the set is as follows. The desired signal is picked up by the loop and receiving set and brought to a volume which gives a satisfactory reading on the indicating instrument. By means of the fine adjustment condensers, and by watching the indicating instrument, the loop is tuned to exact resonance and the beating oscillator is set to place the intermediate frequency in exact resonance with the 45 000 cycle selective circuit of the amplifier. The loop is also oriented to give maximum response. The instrument reading is then recorded. Since the vacuum tube voltmeter indicates

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by virtue of the change in its plate current produced by the input voltage, a reading must also be taken with the incoming signal cut off. This is accomplished by shutting off the beating oscillator for a moment and recording the instrument reading, which is lower than with the signal on. The local signal oscillator is then started, set approximately to its proper frequency and the shunt adjusted to give a suitable value of input. A beat note is now heard between the 45 000 cycles due to the incoming signal and that due to the local signal. When this beat note is reduced to zero by means of the local signal oscillator frequency control, the local signal has been set exactly to its proper frequency position. If the transmitting station is co-operating it is then shut down, or if not co-operating, the loop is turned 90 deg. to balance its signals out. Following this, the input shunt is adjusted to give a difference reading

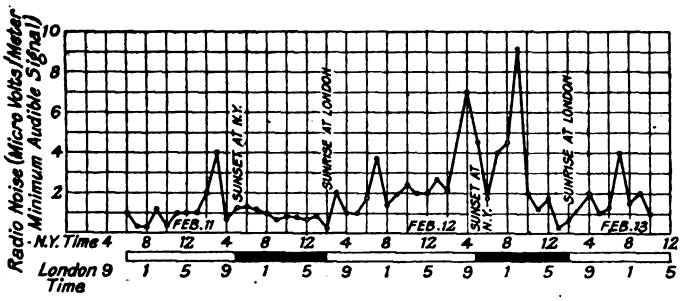
Radio Noise (Micro Volts/Meter Minimum Audible Signal)
10
8
6
4
2
SUNSET AT N.Y.
SUNRISE AT LONDON
SUNSET AT N.Y.
SUNRISE AT LONDON
FEB. 11
FEB. 12
FEB. 13
N.Y. Time 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12
London 9 Time 1 5 9 1 5 9 1 5 9 1 5 9 1 5

FIG. 5.

on the indicating instrument, due to the local signal, exactly the same as that which was given by the incoming signal. The measurement is now completed except for recording the various settings.

Measurement of Radio Noise.

The authors have naturally approached noise from the telephone standpoint, since their primary interest is in radio telephony. Radio noise results in audible noise, which comes to the ear of the listener and interferes with the understanding of speech on the circuit. Within upper and lower limits set by the capabilities of the ear, the absolute volumes of speech and noise are not important as long as their relative volumes—that is, the ratio between their volumes—remains constant. It follows, therefore, that a good way of measuring noise should be to express it in terms of a volume of speech upon

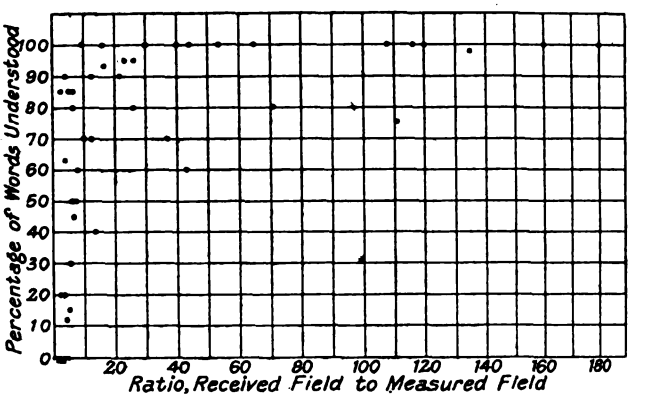

FIG. 6.

which it produces a certain standard interfering effect. In taking and interpreting the noise the receiving set itself must be free of appreciable noise.

Taking readings when the radio noise is the steady drum-fire type of static is relatively easy. When it is a steady background with occasional heavy crashes the crashes must, perforce, be neglected and the background measured. When the crashes are loud and frequent enough to be of real importance, they have the effect of partially deadening the ear so that they produce somewhat the same effect on the hearing of the artificial speech in between times as they would have on the understanding of speech. Making the setting is more difficult, however, and the method is no doubt least accurate in measuring this type of noise.

The Institution Summer Meeting.

Thursday, June 7th.

On Thursday morning those attending the meeting were conveyed by special train to Liverpool, where a number of alternative visits were paid to various works and places of interest. These included the works of the British Insulated and Helsby Cable Co. at Prescot, the Lambeth Road Works of the Liverpool Tramways, the automatic sub-station at Walton, the Lister Drive Power Station of the Liverpool Corporation and the Cunard Co.'s Liner "Scythia."

Modern Cable Manufacture.

The BRITISH INSULATED AND HELSBY CABLE CO.'S works were established in 1891, and now after thirty years' development they include 30 acres of land, of which some 18 acres are roofed over. In these works all the processes of cable making are performed, including the melting, rolling, drawing, annealing and stranding of the copper wire, the impregnating and lead covering, armouring and testing. In addition to a complete pattern-shop and foundry, there is a fittings department where reactances, welders, fans, and tramway and railway material are made. The power for the works is supplied from a private power station which incidentally supplies energy to the area round.

A full account of the recent developments of the Liverpool Corporation's Electricity Department will be found in THE ELECTRICIAN of December 22nd, 1922; while a description of the Walton automatic sub-station which was visited during the afternoon was given in the same issue. The connections to the undertaking now number 82 951 kW, and the generating capacity is 70 000 kW. The tramways system comprises 67 miles of single track, and it links up with the South Lancashire and St. Helens tramway systems.

At the conclusion of these visits, the party were entertained to luncheon by the Tramways and Electric Power and Lighting Committee of the Liverpool Corporation.

In the afternoon visits were paid to Port Sunlight, to the works of the Automatic Telephone Manufacturing Co., to the University Electrical Laboratories, to the power stations of the Mersey Power Co. and the United Alkali Co. at Runcorn and Widnes respectively, and to the electrified lines of the London, Midland and Scottish Railway between Liverpool and Southport.

Automatic Telephone Production.

The AUTOMATIC TELEPHONE MANUFACTURING CO. was organised in 1911 to exploit the Strowger system of automatic telephony.

The works occupy a site of about ten acres, and include an up-to-date laboratory and research department, besides the manufacturing and assembly shops.

During the War the entire activities of the company were directed to the production of munitions of war and large quantities of fuses, radio apparatus and listening gear, for anti-submarine operations, were turned out. The peace-time efforts of the company have been concentrated on communication engineering, and a number of public exchanges have been supplied to the British post office and foreign administrations.

The first public automatic exchange in this country was successfully completed and opened for service at Epsom on May 18th, 1912. The largest automatic exchange in England is Leeds, serving some 6 800 subscribers with an ultimate capacity of 13 000.

Both these exchanges were installed by Automatic Telephone Manufacturing Co., who have since erected public automatic exchanges at Accrington, Blackburn, Chepstow, Newport, Paisley and Portsmouth.

The power station of the MERSEY POWER CO. at Runcorn was opened in 1911. The production of salt from brine requires large quantities of steam, and the Salt Union determined to obtain this steam from turbo-generators, the electrical energy from which was partly used in the salt works and partly supplied to the surrounding district. The Mersey Power Co. was therefore formed, and now supplies a large area, including the towns of Runcorn and Widnes. The original station was extended from time to time, but in 1918 a point was reached when electrical generation could no longer be carried on economically with salt making, and it was therefore decided to erect a separate station with an ultimate capacity of 100 000 kW. This station, which was opened in

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1921, at present contains two 12 500 kW Parsons turbo-generators. Transmission takes place at 33 000 V underground to Ellesmere Port, open-air Metropolitan-Vickers transformers being installed for this purpose, and short distance transmission is at 6 000 V and 3 000 V.

The UNITED ALKALI CO.'s power station at Widnes contains two 5 000 kW sets, but there is room for extensions though the site is restricted. An unusual feature of the boiler-house is the provision of a warm air duct extending the full length of the building. This is of reinforced concrete, and through it air is forced into the boiler furnaces.

The LIVERPOOL AND SOUTHPORT electric line was opened in 1904. It consists of 85¾ miles of line, and is operated on the third rail system at 630 V. Energy is supplied from a generating station at Formby. This is in process of reconstruction, and will eventually contain three 6 500 kW turbo-alternators. Current is generated at 7 500 V three-phase, and is transmitted at that voltage to four sub-stations, where it is converted to the operating voltage. The rolling stock consists of 72 motor and 92 trailer cars.

In the evening the Lord Mayor and Lady Mayoress of Liverpool held a reception at the Town Hall, Water Street.

Wales and Water Power.

Friday, June 8th.

On Friday, June 8th, those taking part in the visit left Liverpool by special train for Llandudno Junction, where motor char-a-bancs were in waiting for alternative tours in the beautiful surrounding country. These tours were given a technical tinge by halts being made to inspect the hydro-electric power station of the North Wales Power Co. and the works of the Aluminium Corporation at Dolgarrog, the Cwm Dyli power station of the North Wales Power Co., and the famous Penrhyn slate quarries. Unfortunately the weather was very wet.

The water power development in this area is the result of the joint enterprise of the ALUMINIUM CORPORATION and the NORTH WALES POWER CO., and was fully described by Mr. J. B. C. Kershaw in THE ELECTRICIAN of July 21st, 1922. The aluminium works of the former company have been in operation since 1909, and produce aluminium in all its various forms. In the early days the reduction of alumina to aluminium was carried out in Héroult type furnaces, but the works have gradually been extended to produce and work the metal in all its stages. The works comprise: A power house of 5 500 kW capacity, a carbon factory, producing electrodes for the furnaces; reduction works; recast department, with electric furnaces of the resistance type; rolling mill; powder factory; foil works. And in addition the various works departments, such as fitters' shop, smithy, joiners' shop, stores, despatch, transport, etc.

The Dolgarrog works are supplied from a reservoir at Eigan, which impounds 160 million cu. ft. of water. The water flows through a tunnel to the Du.yn River, the water of which is used in conjunction with the surplus from Llyn Cowlyd. A total drainage area of over 10 square miles is thus controlled, and is brought by an open leet to the forebay and penstock above the Dolgarrog works, the fall being 1 030 ft.

The power plant at Dolgarrog consists of four 1 600 H.P. Pelton wheel coupled to Bruce Peebles generators, electrical energy being delivered direct to the furnaces at 125 V. In addition there are two 600 kW motor generator sets, which are driven by a 1 000 V induction motor supplied from the 20 000 V three-phase system of the North Wales Power Co. Two 1 200 kW three-phase alternators which supply power to the North Wales Power Co. are also installed. One 150 kW alternator and one 30 kW d.c. set supply lighting and power to the works.

By building dams at Cowlyd and Llugwy a total storage of over 600 million cub. ft. is available for power purposes with a catchment area of nearly 20 square miles.

Under the scheme for supplying in the North Wales area, in conjunction with the North Wales Power Co., there is now being built at Dolgarrog a new power station of at least 30 000 kW. Three 5 000 kW sets will be installed at first, and a new pipe line of about 4 ft. 6 in. diameter will be laid. These sets will generate at 6 600 V, stepping up to 35 000 V for the transmission lines along the coast, and to supplement the existing supply of the North Wales Power Co.

Proposals are also in being to step up to 110 000 V in an outdoor sub-station to form part of a main 110 000 V ring system, connecting Dolgarrog power station with the proposed Maentwrog station, and transmitting power in bulk to the eastern area of the North Wales and Chester district.

The Cwm Dyli power station contains four 1 000 kW and one 1 500 kW Bruce Peebles alternators, which are driven by Pelton wheels. The smaller alternators generate at 10 000 V and the larger at 4 800 V, the voltage in each case being stepped up to 20 000 V and 34 600 V for transmission by Ferranti self-cooled transformers.

The water power necessary for operating the station is obtained from Llyn Llydaw and Llyn Glaslyn, which drain some 1 100 acres of the wettest spot in the United Kingdom, the average rainfall being 155 in.

Transmission is by overhead lines on steel and wooden poles, the total length being 110 miles. The company have in hand a new scheme at Maentwrog with a plant capacity of 24 000 kW.

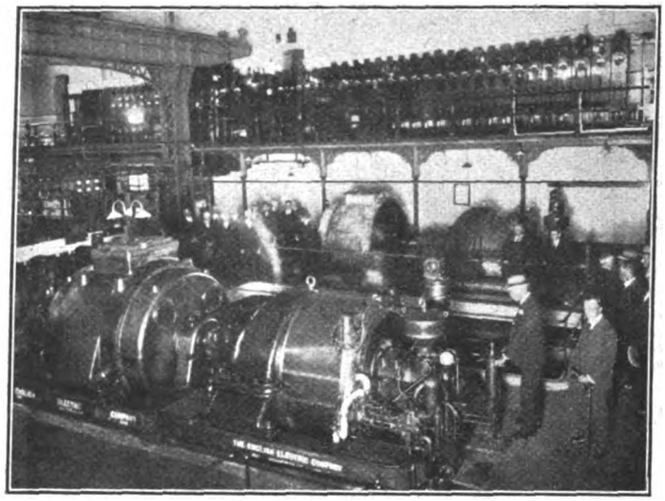
Those visiting Dolgarrog were entertained to lunch by the Aluminium Corporation and in the evening a reception and dance were given by the London, Midland and Scottish Railway Co. at the Grand Hotel, Llandudno.

Australian Electrical Enterprise.

The First Home-Built Turbo-Generator Put to Work.

One of the most interesting and suggestive features of electrical progress in recent years is the way the British Dominions have undertaken the manufacture of electrical plant required for their development. A striking instance of this has recently come to hand from Australia in the shape of a photograph (which we reproduce herewith) of a 2 500 kW turbo alternator built by the ENGLISH ELECTRIC CO. OF AUSTRALIA for the New South Wales Government Railways. The photograph shows the Chief Commissioner starting the set which provides the Sydney tramway system with power for traction and lighting. As the Company remark, this is an event of some importance as the set is the first of its kind to be manufactured in Australia.

After starting the set and putting it on load, the Chief Commissioner made reference to the progress of engineering generally, and the tramway power house particularly, during the last twelve years. He traced this progress from the time



THE FIRST AUSTRALIAN-BUILT TURBO-ALTERNATOR BEING STARTED.

when owing to the courage and foresight of the Chief Electrical Engineer, Mr. O. W. Brain, steam turbines were first adopted in place of reciprocating engines. This was considered at that time to be a very bold step and he referred to the increased size of individual units from 1 500 kW to the one which the English Electric Co. of Australia are now building for his Department—i.e., 18 750 kW.

He pointed out that the set which he had just started up showed the progress which had been made in Australian engineering and was noteworthy on that account.

Subsequently the Chief Commissioner, the chief electrical engineer, with several other well known engineers and business men by invitation visited the Clyde works of the company, where special attention was drawn to various heavy portions of the large 18 750 kW turbo alternator now going through the shops to the order of the N.S.W. Railway Commissioners.

The company ask us to state that Mr. J. B. Nicholson, Chairman of the Company, will be in London about the middle of June. His address will be care of The English, Scottish and Australian Bank, Gracechurch Street, London.

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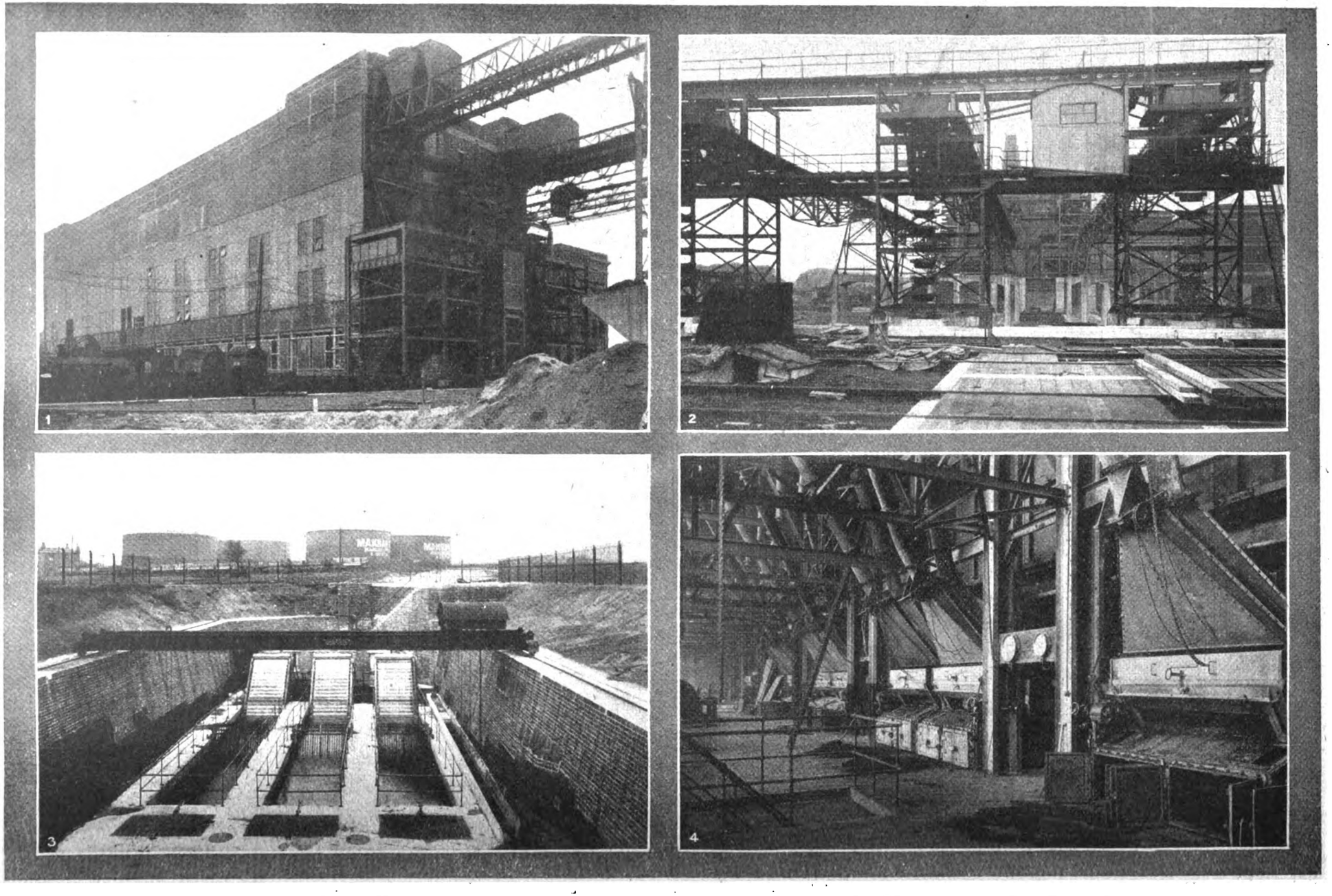
BARTON IN PICTURES.



1. External View of Boiler House.
2. Coal Conveyors for Rail Borne Coal.
3. Intake Chamber and Circulating Water Screens.
4. A View in the Boiler House.

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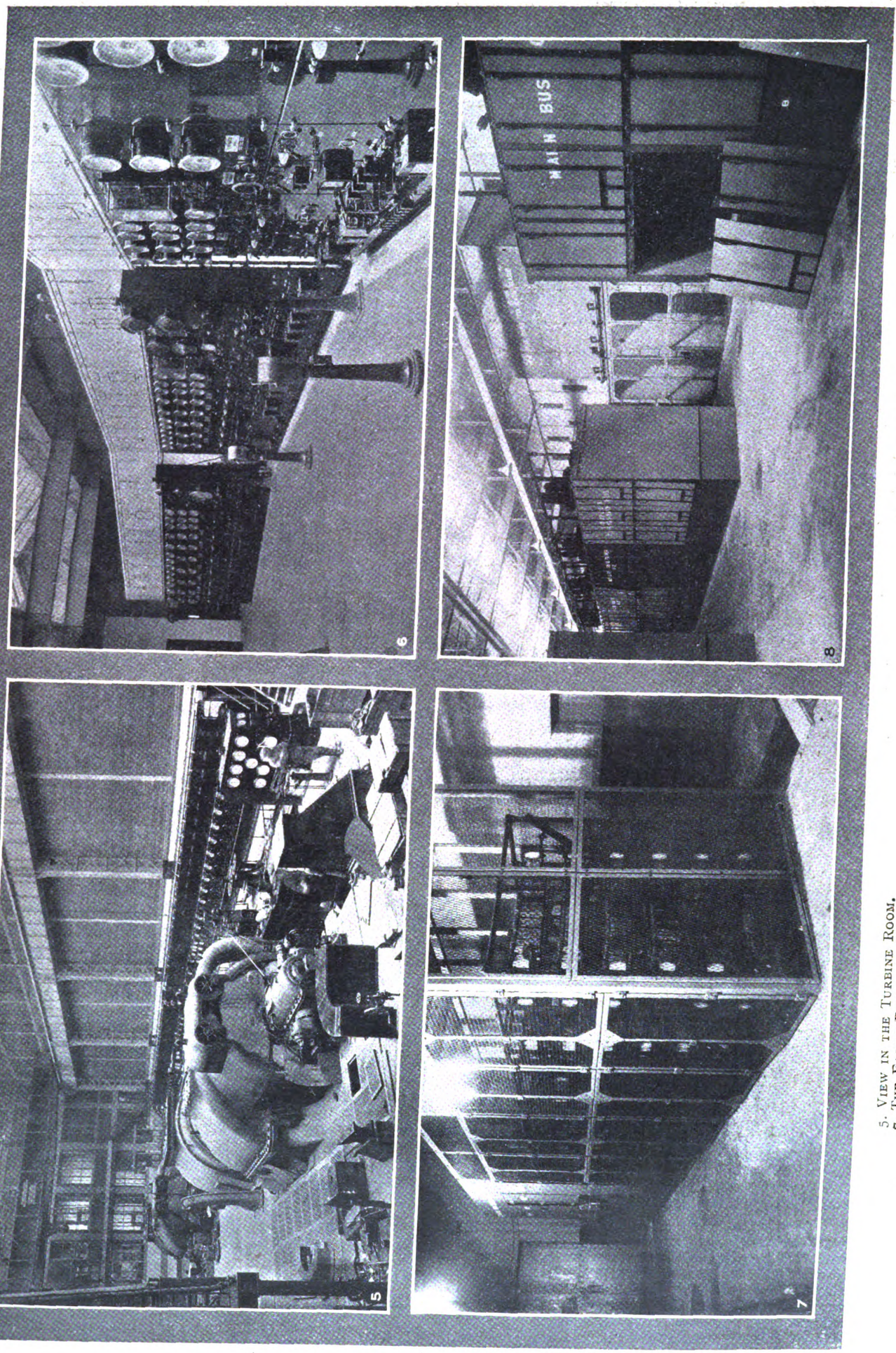
Where the Current is Generated and Controlled.



6. The Control Room.
8. A View on the Main Oil Switch Floor.

5. View in the Turbine Room.
7. The Earth Resistances.

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Ten Years of Switchgear Manufacture.

The Works of Ferguson, Pailin—A Novel Tripping Device.

An interesting chapter in the history of switchgear manufacture could be compiled from the consideration of the development of FERGUSON, PAILIN, a firm which commenced operations towards the end of 1913 with two workmen, and which now has 731 employees, not to speak of several branch factories and offices. The firm has throughout gone in for specialisation, and after numerous extensions had been made on the original site, a new factory at Openshaw, near Manchester, was opened last year, with a floor area of 16 000 sq. yds. and room for future development. A large amount of space is given up to the drawing office, and the administrative section is divided from the shops by broad passages with glazed roofs which serve as emergency exits and storage places for fire-fighting appliances. The works are arranged to secure continuity of motion for the raw materials until they emerge as finished articles, and full use is made of modern production methods on a strict cost basis.

Some Interesting Machines.

Special mention may be made of a machine for twisting copper connection strips, whereby eight pieces of copper, 6 in. by ¼ in., are twisted through 90 deg. *en bloc* in a length of 4½ in. without fracture; a small portable hydraulic press for bending copper busbars to any angle, including a double right angle bend or joggle as close up as 2 in. from bend to bend; a jig or jump saw built to overcome the difficulty of cutting out rectangular slots in slate and marble panels; a cropping machine for angle and flat irons which will take 3 in. by 3 in. angles or 3 in. by ½ in. flats and crops off clean without the slightest distortion; a hydraulic press with special indicating device for testing the cantilever strength of porcelain insulators, giving accurate readings from 56 lb. to 15 000 lb., the record being of a permanent character; and a machine for testing the speed of breaking of oil circuit breakers on disc or polar diagrams. This form of diagram was chosen as giving extremely accurate records as the chart can be run at a very high speed.

The works are electrically driven throughout, power being received at 6 600 V from the Manchester Corporation mains. It is stepped down to 420 V in the firm's sub-station for use on the various motors. Distribution is by four-core cables, which are provided with overload and leakage protection devices.

The Firm's Speciality.

Ferguson, Pailin are now specialising in the generating station switchgear of the cellular type for breaking capacities up to 1 000 000 kVA, and in armour-clad compound fitted switchgear, in sub-station and factory switchgear of various designs in transmission line apparatus and outdoor sub-station apparatus up to 110 000 V. A special feature on this gear is that the current transformers are oil immersed, so that they can be easily got at and the same accessibility is noticeable in connection with the relay contacts, which are mounted on the fronts of the switchboard. We recently described one of the firm's ironclad switches.

Details of the New Tripping Device.

A feature of interest in connection with the large oil-immersed circuit breakers now being manufactured by this firm is the new tripping device which can be operated directly with a lower fault current than is ordinarily required to operate protective relays. By the use of this device it is hoped that the relays, batteries and auxiliary contacts which are used in these systems can be dispensed with, and the fault current made to operate directly on the circuit breaker tripcoils. Usually this fault current is not sufficient for tripping purposes, and the relaying arrangements that have to be introduced are sources of weakness. If the auxiliary supply is taken from the mains, a fault may cause its pressure to drop, while the contacts, being light, require constant attention. The new system, which is illustrated herewith, is claimed to be simple, reliable and robust. It is also self-contained, and can be calibrated as a unit independent of the breaker it has to operate. By providing a toggle lever inside the operating mechanism it is possible to eliminate the toggle mechanism on the breaker, and so quicker operation can be obtained.

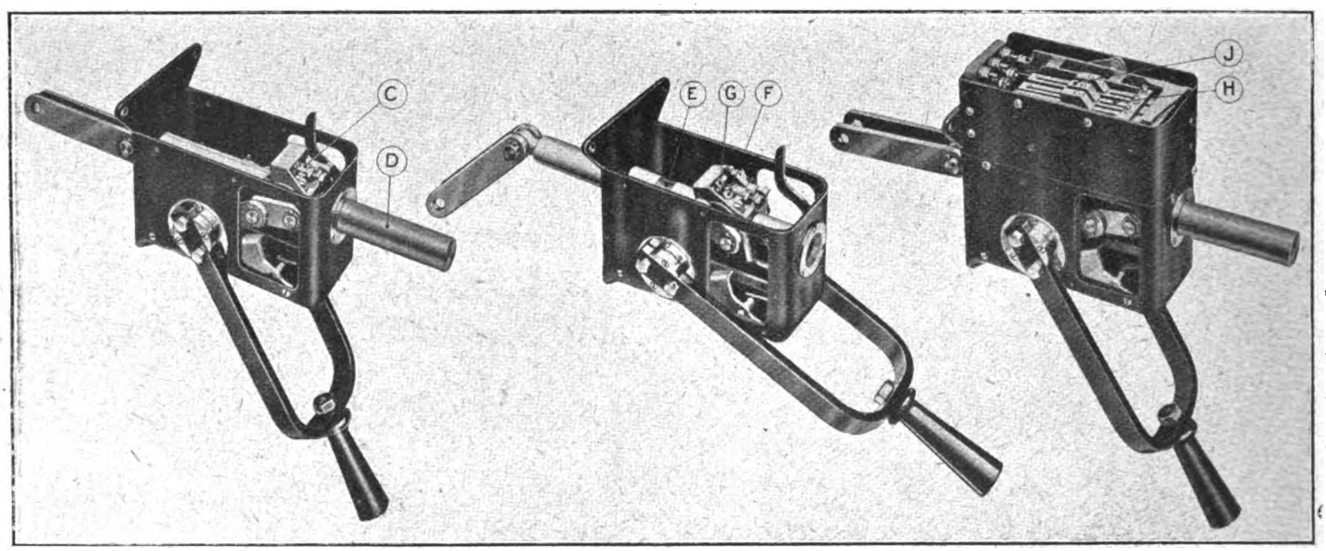

FIG. 1. FIG. 2. FIG. 3.

VIEWS OF THE NEW FERGUSON-PAILIN TRIPPING DEVICE.

The whole of the mechanism is contained in a steel dust-proof case which is made in two parts, the upper part *A* containing the tripcoils and the energy storing mechanism, and the lower part *B* containing the toggle mechanism and clutch device.

Referring to Fig. 1, the mechanical arrangement is a toggle mechanism actuating through a steel ball clutch *C* on to a steel bolt *D*, which is connected direct to the circuit breaker lever. The bolt is of hardened steel with an annular groove *E* to receive the ball clutch, as shown in Fig. 2. The engaging ball is of ⅝ in. diameter standard, as used in ball bearings, and forms a very efficient means of resisting the shearing strain when closing the circuit breaker. The ball *F* is held in the groove *E*, the depth of which is slightly less than half the diameter of the ball, by a hardened steel roller *G*, carried by a lever with the force practically on dead centre.

A Quick Break Ensured.

When the operating handle is moved to the top or engage position, a re-setting roller attached to the ball carriage engages with a re-setting arm storing energy in a spring. When tripped there is ample energy to release a tripping hammer which strikes a tripping arm, the latter throwing over the roller bridge into the position shown in Fig. 2, thus releasing the ball from the annular groove and leaving the main bolt quite free. The weight of the moving contacts plus the powerful accelerating spring then ensure a quick speed of separation of contacts.

Into the end of the bolt *D*, an adjustable steel eye-bolt

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is screwed for coupling to the circuit breaker lever by means of links, thus allowing for accurate adjustment between the operating gear and the breaker. The operating bolt is connected to the oil switch lever through an adjustable coupling, so that to set the apparatus it is merely necessary to have the switch in the full " on " position and the lever in the full " on " position, and adjust the coupling until it is taut. Whether the breaker is " on " or " off " is indicated by the respective positions of the bolt, the end of which projects from the operating gearbox front when the breaker is " on," but the bolt end is inside the box front when the breaker is " off."

The electrical tripping device consists of three or more U-shaped electromagnets with their respective armatures, which are carried in the upper portion *A* of the case as shown in Fig. 3. To the armatures are attached calibration arms *H*, to which balance weights *J* are fitted.

The various settings are obtained by varying the position of the balance weight, the whole of the settings being obtained without variation of air gap, and thus the impedance of the tripcoil circuit is constant. The attraction of any of the armatures causes the calibration arm to strike a metal shutter attached to a freely rotating spindle, which is the restraining member (through levers having a multiplying ratio of the stored mechanical energy). The trip coil can be detached for connecting in series with other instruments during calibration.

No Alteration of Air Gap.

It should be noted that the overload settings, namely, 40 to 300 per cent. normal full load, are obtained without alteration of air gap, and consequently do not affect the accuracies of instruments which may be connected in series. The limits of direct tripping are as follows: With ring type transformers the minimum fault or overload tripping current is 30 primary amperes; with a wound type current transformer having 600 At, the minimum tripping value is 10 per cent. of the rated primary current.

In the case of generator protection, where it is desired to interrupt the field of the machine only when the automatic protective gear is functioning, this can be affected by means of the electrical tripping device, as the latter is independent of the hand release.

Low Operating Power Required.

The power required to operate the tripping device is approximately 1·5 VA at commercial frequencies. The whole of the tripping mechanism is automatically reset when the operating handle is raised to the top or engage position. The closing of the breaker is affected by the downward motion of the handle and the angular movement being 140 deg., thus ensuring ease of operation. When required for synchronising purposes, a half-cock position can be arranged for the operating handle, thus facilitating the rapid closing of the circuit breaker. An important feature in the design is the impossibility of opening the circuit breaker slowly by hand. Means are provided to prevent the operator drawing an arc on the switch contacts, as any backward motion of the operating handle will trip the breaker quickly and return it to the " off " position.

Locking attachments can be provided, arranged to lock in either the " on " or " off " position, the automatic functioning of the tripping device not being interfered with.

A valuable feature of the mechanism is the loose-handle device, the tripping arm being operative throughout the whole of the travel of the breaker. It is therefore impossible to close the circuit breaker completely on a faulty circuit, as immediately the current transformers are energised the tripping gear automatically functions and opens the breaker, any possibility of welding the main contacts being minimised. A simple electrical interlock for use in conjunction with starting devices and other such apparatus is very readily arranged, all that is necessary being a trip coil which, when energised, renders it impossible to re-engage the operating handle.

The summer meeting of the INSTITUTION OF MECHANICAL ENGINEERS will be held in Glasgow, commencing on June 25th. An extensive programme of visits to works has been arranged, and the following Papers will be presented as time permits: " Water-Tube Boiler and Crane Construction," by Sir James Kemnal; " Modern Dock Appliances at Glasgow Harbour, including the Handling of Grain in Bulk, and Dredging Plant," by Mr. D. Fife; " Sugar Machinery," by Lord Invernairn; " Clyde Marine Oil Engines," by Prof. A. L. Mellanby: " Improvements in Mechanical Contrivances in Connection with the Storage and Distribution of Water," by Mr. E. Bruce Ball.

Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

"ALL-ELECTRIC" HOUSES AND CONTROL.

To the Editor of THE ELECTRICIAN.

SIR,—As control of lamps from *two* and *three or more* positions are now, respectively, about 35 and 32 years old, it was with some surprise that we found no provision for either one or both of these controls in the scheme of the competitor awarded the first prize in your " Wiring an 'all-electric' house " competition. We have for many years past done our best to make known the advantages of convenient control, and naturally expected that the occupier of an £1 500 house would have been considered from this standpoint.

As the first prize scheme is likely to be taken by some as the best manner in which the lighting of such a house should be arranged, the absence of such controls on the staircase, bedrooms, etc., appears to us to be a serious omission, and we think that an excellent opportunity has therefore been lost to make the advantages of convenient control better known.

Such controls, which electricity as a lighting agent can alone provide, should have been boomed for all they were worth immediately they were originated. Had such controls been available with gas supply we think that every consumer would have been notified of the fact, and the advantages given such prominence on all occasions, with the result that electric lighting would have been far less in evidence than it is to-day. Convenience in control for electric light users becomes a talking point when the advantages of electric lighting are being discussed by the consumer and his visitors, and results in an extension in the number of house installations, in this manner benefitting the industry in general, and the supply company and installation contractor in particular. Single-point control in bedrooms, staircases, passages, etc., should undoubtedly belong to the " dark ages," for reasons which we need not elaborate.

In the first prize scheme as at present arranged the client might find out later that his neighbours were better provided for, while his own installation had been starved. It would necessitate alterations being made before he could be looked upon as a " satisfied consumer."

It is curious that such advantages, which have been so long available, should be kept in the background, or, as appears to be sometimes the case, almost introduced with apologies, instead of as essential features. The attitude of the contractor should be rather that of surprise should the client think their inclusion unnecessary.—We are, etc.,

A. P. LUNDBERG AND SONS.

[We quite agree with Messrs. Lundberg that full advantage should be taken of the flexibility of electricity supply in designing the " All-electric " house.—ED. E.]

THE INSTITUTION AND ATOMIC STRUCTURE.

To the Editor of THE ELECTRICIAN.

SIR,—If I understand your editorial note on my letter of May 23rd aright, you suggest that the remedy for my trouble is for me to obtain all the various proceedings and accounts of lectures, etc., dealing with the research work on the electrical structure of matter, and to read them from time to time. If so I would respectfully suggest that this is no solution for people like myself or for the very considerable body for whom I am speaking. We neither know where to obtain all the necessary current matter nor have we the time to read it, nor the ability to understand it presented in such form.

However, the best answer to your suggestion came a few days afterwards in the announcement in the papers that Sir Ernest Rutherford had chosen for his subject to the British Association on September 12th " The Electrical Structure of Matter," and, as your contemporary " The Electrical Times," this week puts it, " We impatiently await September 12th." This, I think, is very clear and strong evidence that such periodical summaries by first class men are necessary.

You suggest that a lecture once a year would be too frequent, and that there would be " Vain repetition." I cannot think this was meant seriously; I believe myself that a summary lecture on this matter in London by, say, Sir Ernest Rutherford or Prof. Soddy once every three months, at a charge of, say, 5s. a head, would prove a continuous success and attract several hundred regular attenders.—Yours, etc.,

Derby. J. SAYERS.

June 8th.

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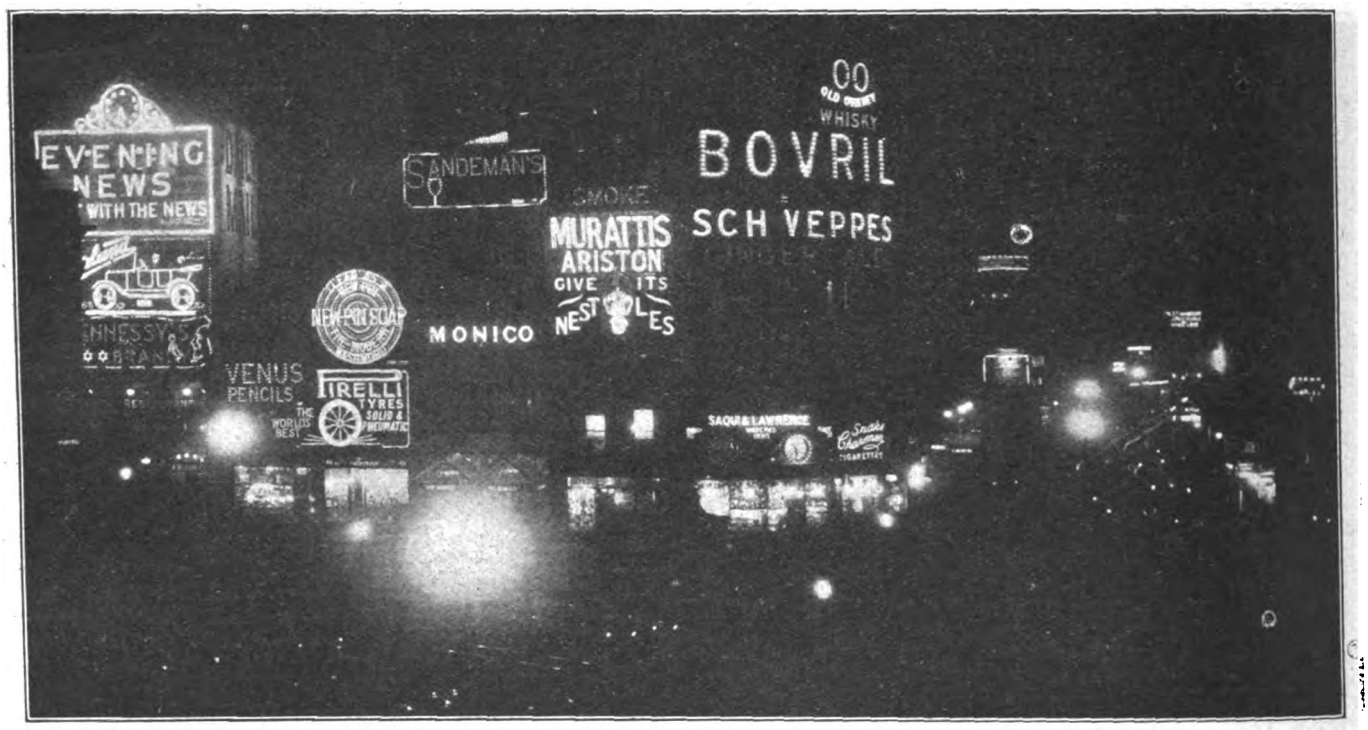
Street Advertisements.

By Lieut.-Col. E. F. STRANGE.

The Royal Institute of British Architects is seriously troubled by certain recent developments in the matter of street advertisements and has "recently approached the London County Council with a suggestion that it should take steps to obtain powers to control street advertising generally, including the use of flashing and other illuminated signs upon the exterior of buildings, and the disfiguring apparatus connected therewith." The few persons who care whether or not our streets and buildings have any pretensions to beauty, will sympathise with the Royal Institute; but one cannot refrain from doubts as to whether this is the right way to get it. The "control" of any branch of trade is a serious matter nowadays, and the present writer is not without intimate experience of the machinery required to render it effective. In this case it would mean, to begin with, the inspection of sites, plans and specifications, with all the filling up of forms, delays, conferences and correspondence thereby entailed; the drafting and promulgation of regulations to cover a singularly varied, elusive and intangible business; further inspection to ensure compliance with regulations—and then the terrible question of enforcement. And the matter will be for the handling, not only of the London County Council, but of every Local Authority throughout the kingdom. The architects might be well-advised to consider whether it would indeed be best that King Stork should rule in this matter.



The Question of Taste.

Then, there is the question of taste. Who is to decide whether or not an advertisement is ugly? One may, with deep humility, submit that even a committee of architects, painters and sculptors might not agree. It is pretty certain that engravers, lithographers, colour-printers and printers generally would approach the subject from a standpoint, not entirely that—for instance—of the Royal Academy or the New English Art Club, or even of the Royal Institute itself. Who is to be the Controller of Design? What sort of staff will he need—and who is to pay for it? All these points must be considered.

The Tradesman's Point of View.

Then there is the question of individual rights. For several centuries, tradesmen have announced their names and their wares by displayed signs and labels. These used to be beautiful. We cannot, however much some of us may desire it, get back to that condition of things by Act of Parliament or County Council regulations. I doubt if we can even get as far as a definition—well remembering the storm of adverse criticism that was aroused by such pioneer posters as Beardsley's design for "Arms and the Man"; and other work of that period. We have progressed since then—and artistic posters which are good advertisements from the business point of view, are not now uncommon. The individual tradesman will fight to retain his right to advertise his goods in his own way. It is deplorable that the way should so often be so bad; but one finds a difficulty in seeing how a man is to be prevented from putting up an advertisement in the front of a house or in a garden or a field if he can persuade the tenant to allow him to do so. We have seen the beauty of a country side destroyed by other means—by ugly (as we consider them) and pretentious "residences," by factories, by rows of mean and squalid cottages. Is the "control" to be extended to these?

Artists and Electric Signs.

The Royal Institute of British Architects refers particularly to the illuminated signs which are springing up around us. That trouble began years ago when the finest view of London, by night, was defaced by something of the sort. But the recent displays in Piccadilly Circus and other places indicate a new offensive which was bound—and is, indeed, designed—to attract attention. Those displays are admired every night by hundreds of people who stop and gaze at them—that fact has to be reckoned with. Also, they effect their object. Now the daily problem of architects who accept commissions for commercial buildings, is to harmonise the requirements of trade with their own ideals of art—with what success, in most cases, we need not now consider. I suggest that no less is wanted in this case. Wide advertisement has become an essential factor in business. It remains for architects to provide for it in their plans; for designers to persuade the business man that a good design will do his work as well as, if not better, than a bad one. This flash-light business should give young designers the chance of their lives. They have a new technique to play with, and a splendid audience to acclaim their success. Instead of the childish toys and devices in crude colours which now—let us not shirk the fact—delight the crowd, why should we not have co-ordinated design and fine decoration? The thing cannot be suppressed or "controlled"—it may be improved. But artists must recognise the business man's needs.

I can imagine Mr. Anning Bell doing something fine in this style, and Mr. Bateman giving us undiluted joy by the same means—if they cared. But I cannot imagine the business men submitted their advertisements to the "control" of any Local Authority or the ratepayers peacefully paying for the cost of it.

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Municipal Tramway Finance.

Figures for the Past Financial Year.

Details are given below of the accounts of certain municipal tramway undertakings for the past financial year. The period has, on the whole, been a successful one, and in many cases profits have resulted after fare reductions.

Keighley Position "Not Satisfactory."

There are, however, one or two undertakings which appear to be causing their proprietors some anxiety. The report of the general manager of the KEIGHLEY Tramways Department for the year to March 31st last states that although there is a profit on the year's working, the position is not satisfactory. The receipts amounted to £19 851, and although this figure is a record, the net profit is only £1 429, after paying off all sinking fund and interest charges. This margin, it is stated, is too small to pay off capital charges on the money which would have to be borrowed to meet the requirements for re-laying of track, etc. The number of passengers carried during the year was 3 792 054, as against 4 059 788 in the previous year. The railless service which operates outside the borough, showed a loss on the revenue account of £1 710, the debit balance being £218 on the actual working.

The year has not been too successful so far as the BURNLEY tramways were concerned. It is true that passengers carried numbered 21 349 624, as against 19 164 508 in the previous year, but it is reckoned that the coal stoppage in that year brought about a loss of 2 589 861 passengers, so that this year's figure really represents a decrease of 404 745. Revenue for 1922–23 amounted to £37 500 net. Of this interest and sinking fund absorb £17 096, rent for tramways owned by outside authorities £1 546, and income tax £2 385, leaving £16 473 to be transferred to reserve, renewals and depreciation fund. During the year it has been found necessary to call upon the borough fund for £10 020, and the total indebtedness to that fund is now £30 737.

The accounts of the LINCOLN Corporation tramways show that during the past three years there has been a net loss of £1 489, towards which a contribution of £1 000 is to be made out of the current year's rates.

A definite loss of £2 255 is reported on the working of the municipal tramways at NELSON for the year ending March 31st last.

Wiping out Deficits.

From other parts of the country, however, really excellent results are reported. In THE ELECTRICIAN of April 20th, brief reference was made to the successful year of the LEEDS tramway undertaking, which sustained a loss of £43 266 in 1921–22. This was more than compensated for by a net surplus of £91 491 for the year ending March 31st last. The financial statement showed that the total receipts for the year which are increased by £1 805, amount to £961 508. The whole costs of operation, not including interest, sinking fund, and income-tax, amount to £599 982, as against £702 250 the previous year. This shows a reduction in operating costs of £102 268. After deduction of interest, amounting to approximately £59 000, income tax £35 949, redemption fund £75 000, permanent way renewals £105 653, and other minor matters, the net surplus works out at £91 491, from which is deducted the previous year's loss, leaving £48 224. Of this amount, as already intimated, £20 000 goes to rate relief, leaving £28 224 for the reserve fund, which is brought up to £65 000. The total number of passengers carried during the year was 134 926 924, an increase of over five millions.

Another undertaking which is aiming at wiping out former deficits is that of ACCRINGTON. The chairman of the Tramways Committee hopes to have a revenue balance at the end of the year of some £4 000 to £5 000, and has suggested passing a sum equal to a rate reduction of 2d. or 3d. in the pound towards extinguishing the debt of £4 500 owing by the tramways to the rates in the past.

At BLACKBURN it has been found possible, as the result of the past year's working to wipe out the deficiency of £2 555 standing to the accounts at March, 1922, and to allocate £8 000 to rate relief, leaving a surplus of £10 802. The profit for the year was £21 358, against £1 646 the previous year.

As the result of the past year's working the NOTTINGHAM Corporation tramways are making a contribution of £10 000 to the rates. The receipts amounted to £400 109, an increase of £44 229.

Manchester's £500 000 Gross Profit.

Big figures are involved in the annual report and accounts of the MANCHESTER tramways department. The total revenue for the year, which includes £1 810 039 for traffic revenue, £11 415 for other revenue, £8 397 net revenue from the parcels department, and £1 813 net revenue from the motor-omnibuses, amounts to £1 831 666, compared with £1 994 576 the previous year.

Deducting the working expenses, which amount to £1 321 347, as against £1 519 838 last year, there is a gross profit on the year's working of £510 319, compared with £474 738 last year. With the addition of interest on investments, less bank interest, there is a final available sum of £515 590, as against last year's figure of £477 704. Out of this sum the following charges have been met:—Interest on capital, £96 716; redemption of debt, £99 394; street improvements, £10 119; rent of tramways, £43 783; and income tax, £33 903; making a total of £283 917, as against £258 862 last year. The balance which has been appropriated under renewals account amounts to £231 673, compared with £218 842 in 1922.

Reconstruction Work at Birmingham.

BIRMINGHAM Corporation Tramways Committee will not be able this year to make any contribution from profits to the relief of the rates. The working of the Department last year shows however, a gross profit of £450 000, and after paying interest and sinking fund and other charges there is a net profit of £240 000. Of this, £200 000 has been used in payment for reconstruction work, which has been undertaken during the year, a good deal of it in excess of the actual requirements, but carried out in order to provide relief work for the unemployed. The balance of about £42 000 is carried to the reserve fund. For the previous year the net profit was allocated as to £71 524 to a suspense account, and £121 017 was placed to the Renewals Fund Account.

Decreased Traffic at Glasgow.

At GLASGOW, where the financial year closed on May 31st, the returns show considerable decreases both in revenue and in the number of passengers. There are 205¼ single miles of track open, compared with 197⅛ in the preceding year, and the car mileage run was 26 957 721, a decrease of 66 808. The revenue totalled £2 252 204, a decrease of £95 014, the traffic revenue per car mile being 20 051d., a decrease of rather over three farthings. Passengers carried totalled 417 769 122, compared with 431 372 473 in the previous year, a decrease of 13 603 351. The passengers carried per car mile were 15·49 against 15 96 last year, a decrease of nearly one-half passenger per car mile. During the year 85 000 000 tokens were purchased, compared with 81 000 000 during the previous year.

Electricity Consumption in Shanghai.

A 25 per cent Increase in 1922.

Mr. T. H. U. Aldridge, engineer-in-chief and manager of the Shanghai municipal electricity undertaking, is to be congratulated on his annual report for 1922, which is now to hand. During the year, sales amounted to no less than 232 457 361 kWh, an increase of 25·4 per cent. on the previous year, and the load factor remains at the same exceptionally high figure as last year, namely 51·5 per cent. The whole of the power is generated by steam. A table is included in the report in which the above figures are compared with the results achieved by the undertakings at Manchester, Glasgow, Birmingham and Sheffield in 1922; Shanghai is well able to stand the comparison. Manchester sold 158 489 732 kWh, the load factor being 21·65 per cent.; Glasgow sold 131 341 783 kWh, load factor, 21·45 per cent.; Birmingham and Sheffield sold 111 038 406 kWh and 103 170 062 kWh respectively, their load factors being 20·65 per cent. and 18·69 per cent.

Of the total energy generated during the year at Shanghai, 6·86 per cent. was used for auxiliary purposes. In 1921, 8·44 per cent. of the gross production was used in this way, and in 1920, the figure was 8 05 per cent., so that a substantial improvement in station power efficiency has been brought about. The Municipality of Shanghai has two stations, the large one at Riverside with a plant capacity of 121 000 kW, and an old one at Fearon Road which contributes less than 1 per cent. of the total output, and would have already been shut down but for its convenience in connection with the traction supply. A new "superstation" is being erected at Fearon Road, the building being now practically completed and much of the e.h.t. switch gear erected.

An analysis of the kilowatt-hours sold during 1922 shows that private lighting accounted for 24·8 millions, an increase over the previous year of 10·39 per cent. Street lighting absorbed 1·8 millions an increase of 7·82 per cent. Heating and cooking took 1·7 millions, an increase of 27·48 per cent. Power increased by 28·18 per cent. to 198·5 million kWh, and current for traction increased by 12·29 per cent. to 5.6 million kWh.

The financial results for the year are eminently satisfactory, though it seems a questionable policy to take £103 500 as a contribution to municipal funds out of a total net profit of £183 271. Since 1916, the undertaking has contributed a total of £429 000 for municipal purposes. The report does not seem to indicate what price consumers in Shanghai pay for their current, but the price should be a low one, or they should know the reason why. The anticipated net profit for 1923 is £209 842.

British Standard Generators and Motors.

Standardisation Comes into Line with Actuality.

A number of British generator and motor manufacturers have issued a circular explaining the position of the new B.E.S.A. specification No. 168/1923 in comparison with the old B.E.S.A. standardisation rules No. 72/1917. It will be remembered that the old rules stated that on continuous maximum rating a temperature rise of 50 deg. C. was not to be exceeded, but no margin for sustained overload was allowed. The new specification calls for a 40 deg. C. temperature rise at the rated load with a margin for sustained overloads of 25 per cent. for two hours for all continuous rated machines, except the smallest and those totally enclosed. This rating is the only one which has been in general use in Great Britain and the Colonies for the past twenty to twenty-five years, and it now becomes the official as well as the actual working standard. No industrial motor or generator with a continuous rating of 50 deg. C. rise can therefore any longer be considered a British standard machine. This is a move towards real standardisation, and we hope that all specifications will in future call for British standard machines only.

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Merchandise to Sell and Profit By.

In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

A "Belling" Business Puller.

We illustrate a piece of cooking apparatus manufactured by BELLING AND CO. which will pull business. This is a commonplace, because any apparatus manufactured by Belling will pull business if it is marketed on sound and proper lines. Space prevents our enlarging on this point, but most assuredly this Belling "Cookerette" is one of the best lines of "merchandise to sell and profit by" on the market to-day.

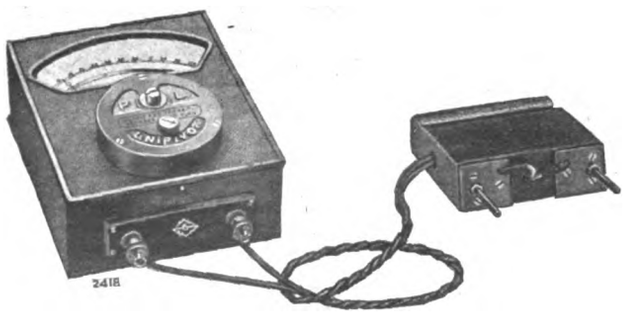
The cookerette is a complete electric cooker and has been specially

THE BELLING "COOKERETTE."

designed to deal with all the cookery required by two or more persons. It is just the thing for use in flats and small houses. The inside measurements of the oven are 11½ in. wide by 11½ in. by 14 in. high, and it is heated by 1 200 W elements, one at the top and one at the bottom, each controlled separately by three-heat switches giving perfect heat control. The cooker is made in two parts, the oven being detachable, and the bottom portion can be used separately as a griller and multiple heat boiler. The oven is supplied complete with one rod shelf and one solid shelf, one griller boiler with one grill pan and grid, and one reflector. The complete oven is made in highest grade steel, with cast iron top, is finished in best bright black and is listed at £7 10s.

A Useful "Cambridge" Accessory.

Contractors and retailers who are catering for the needs of the public in accumulator charging have in their turn to seek efficient and reliable apparatus so that this "service department" can be run at the lowest possible expense. Therefore, any device which will help to that end is welcome and is assured of careful considera-



A TESTING INSTRUMENT FOR THE SERVICE DEPARTMENT

tion. Particularly is this so with the accumulator tester offered by the CAMBRIDGE AND PAUL INSTRUMENT CO., which we illustrate.

This instrument provides a convenient means of detecting short circuits between the adjacent plates of an accumulator. It consists of one of the Cambridge unipivot galvanometers, together with a pair of suitably mounted contact points. The galvanometer scale is usually divided into 110 equal divisions; the approximate current sensitivity for full scale deflection is 240 micro-amperes. An extra range can be fitted which enables the instrument to be used as a voltmeter. The tester is robust and compact; it is easily and quickly operated.

A Dominating Sign for 57s. 6d.

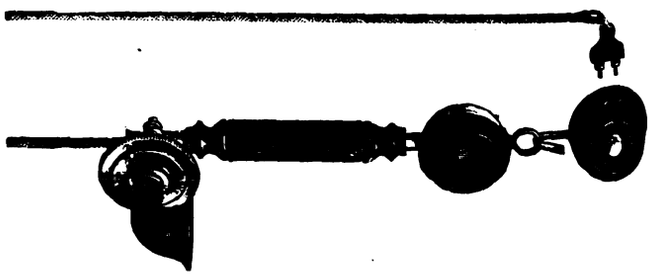
What is the price which will attract shopkeepers and other traders to purchase a simple, but none the less dominating, outside sign? Opinion varies, but surely a sign complete ready for wiring and fixing at £2 17s. 6d. is a proposition with which to attract this

A SIMPLEX SIGN TO SELL.

business. This is the offer of the SIMPLEX CONDUITS CO. to the contractor. We show an illustration of this sign, which is made in iron, finished black or grey. The dimensions are 24 in. by 12. in.

The Possibilities in Domestic Telephones.

Speaking relatively, the development of simple telephones for domestic use is very limited. Much would result from a boost to popularise the installation of these 'phones because there are a large number of late Victorian houses in this country which, judged by modern standards, are "workhouses" rather than homes. The housewife could be easily persuaded that the installation of a telephone in the basement kitchen (as is usual in this type of house) to the upper floors would save both time and temper.



A DOMESTIC LABOUR SAVER.

There are a number of reliable instruments on the market with which to cater for this business, and among that number is the range manufactured by GENT AND CO. We illustrate their No. 2016 domestic telephone.

The "Winter" Interlocking Switchplug.

One of the greatest difficulties in the purchasing of small wiring accessories is the large variety of sizes and types that are offered. This statement sounds like a paradox, because it is usually considered that the greater the variety the easier the choice, and certainly keener the price. In such a case the greatest care and judgment has to be exercised, however, when the purchaser is faced with this

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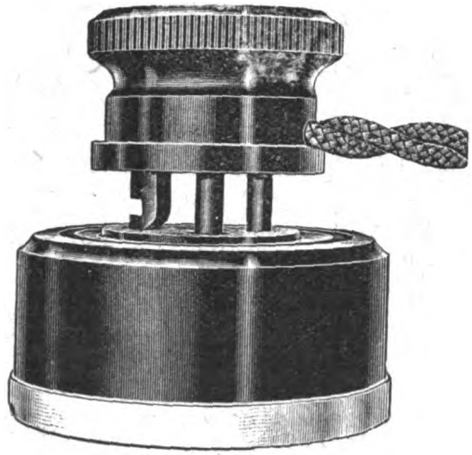
seemingly happy state of affairs, and particularly is this so with interlocking switchplugs. The types now offered are many and diverse, and several makers in their anxiety to serve the market have not studied the electrical and mechanical requirements which must form the basis of a really good interlocking switchplug. Several makers have overlooked the B.E.S.A. standard, both in capacity ratings and dimensions, which is a fact to be deplored, because it only adds to the prevailing confusion. Probably makers will come into line as soon as possible, particularly if the

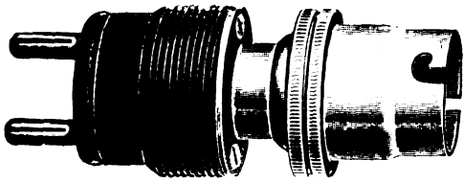


THE LATEST INTERLOCKING SWITCHPLUG.

device is otherwise satisfactory and is one of to-day's "best sellers." We illustrate the "Winter" switchplug manufactured by the NORTHERN ELECTRIC CO. The device merits the study of buyers and a study of the manufacturer's list will reveal the fact that both sunk and surface patterns are supplied, each in 7 to 10 A, 15 A and 20 A capacities.

A Small Device with a Large Market.

We illustrate a small device manufactured by DAVIS, KENT AND STEWART, and distributed by most factors. The simple nature of the device is at once patent from the illustration, and as is the case with many small devices, its simplicity and usefulness is at once the keystone round which good sales can be built. There is a larger market than is realised for such a device. A large amount of domestic equipment is fitted with a bayonet adaptor (often



A NEW BAYONET ADAPTOR.

without any regard to the loading of the device), but it is not always convenient to "plug in" on a lampholder. Therefore there is a possibility of a sale of one of these adaptors with each piece of domestic apparatus that is sold. It is a "home comfort" which women buyers will appreciate, and will further prove the convenience of the "electrical idea." Sell them therefore for propaganda purposes, if for no other purpose.

The "Hellesen" H.T. Dry Battery.

It is questionable whether there has ever been a time in the field of electrical merchandising when retailers have had to give so much thought and attention to the selection of dry batteries. This state of affairs has been created by the wireless boom. The wireless enthusiast is quite a different buyer from the man in the street of but a short while ago who wanted a dry battery for some purpose. To-day the wireless enthusiast has a smattering of knowledge of what performance a battery should make. It will ill serve the reputation of the "electrical shop" to market batteries that do not prove value for money in the terms of a service device. Therefore buying batteries comes down to buying a battery with a known name and reputation proved by the years.

The "Hellesen" batteries marketed by A. H. HUNT, LTD., come in this category. The high tension 60 V battery is supplied complete with two wander plugs.

A Useful "Walsall" Voltmeter.

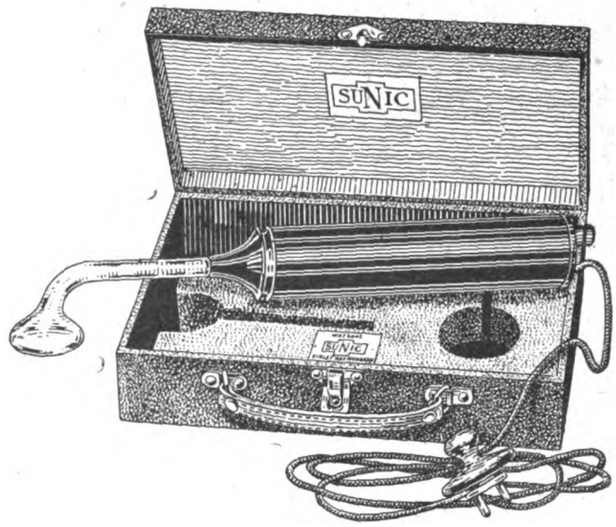
We illustrate a useful little instrument which is manufactured by the WALSALL ELECTRICAL CO. This should prove a ready seller. The particular feature which will make it sell readily to "listeners-in" is the fact that it is a double range voltmeter, or, expressed in amateur terms it is an instrument for both the l.t. circuit and the h.t. circuit. It is obviously quite impossible to check the voltage of the l.t. accumulators on a voltmeter having a range suitable for testing a h.t. dry battery, and in the ordinary course two instruments are required. A brief explanation of the method of using the instrument will reveal how this "double-faced" function is achieved. By placing one terminal to the end of the battery or accumulator to be tested and the spear point to the other end, the 100 V scale is in operation. If the deflection is below 10V, the push button is pressed, and the 10 V scale comes into operation and enables any reading below 10 V to be read clearly. These instruments are individually calibrated against standard instruments, and the scales are hand marked.

A DOUBLE RANGE VOLTMETER FOR "LISTENERS-IN."

The instrument which we illustrate is listed at the attractive price of 20s. A "switchboard" surface type is also made and listed at 25s.

Watson's "Sunic" High Frequency Apparatus.

We have previously stressed the fact (a fact which is not so obvious to retailers as it would appear) that there is a large business to be done in high frequency sets for violet-ray treatment. Probably there is still a temptation to regard this apparatus as too technical and scientific to allow it to come within a programme of domestic apparatus for merchandising. This is a fallacy. With a little study of the apparatus and the statement of a few facts in a homely way will make many buyers.



A NEW HIGH FREQUENCY APPARATUS.

We illustrate the "Sunic" apparatus, which is one of the several reliable makes on the market. We use the word reliable, with great deliberation, commonplace and misused as it is. There is, however, hardly any other word to use, to indicate the fundamental basis on which apparatus of this kind must be bought and sold. This "Sunic" set is manufactured by WATSON AND SONS, and is listed at five guineas. It is a light and portable set suitable for all purposes where a true, smooth high frequency current is required for treatment of muscular, nervous and dental disorders. It is suitable for either a.c. or d.c. circuits.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

"The Miracle of Radio" is the title of a publication recently issued by STERLING TELEPHONE AND ELECTRIC CO., LTD.

"Small A.C. Motors with a Big Reputation" is the attention-compelling slogan on a pamphlet recently published by THE ELECTRIC CONSTRUCTION CO.

The ENGLISH ELECTRIC CO. announce the issue of two new price lists (*a*) List 1021 describing squirrel-cage and slipring induction motors, and (*b*) List No. 1510 describing small induction motors.

Readers of THE ELECTRICIAN who have to seek the best markets for armoured cables and accessories will be wise to secure a copy of a recent catalogue issued by the BRITISH INSULATED AND HELSBY CABLES, LTD. The list describes Prescot armoured cables and accessories.

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Parliamentary Intelligence.

Swanage Gas and Electricity Bill.

The Unopposed Committee of the House of Lords ordered the SWANAGE GAS AND ELECTRICITY BILL to be reported for third reading on June 5th. It provides for the transfer of the undertaking of the Swanage Electricity Supply Co. to the Swanage Gas Co. and for the change of name of the latter to the "Swanage Gas and Electricity Co." To the existing area of supply (the urban district of Swanage) have been added the parishes of Langton, Matravers and Studland. The usual powers are given for the continuance of the existing generating station and the erection of a new one, subject to the approval of the Electricity Commissioners. A clause, added since the introduction of the Bill, gives the Minister of Transport the right to revoke the powers as to the supply of electricity in the added area of supply if suitable and sufficient distributing mains are not laid within three years from the transfer. As the Bill was originally deposited, it contained a clause enabling the company to charge for electricity by any method selected by them and approved by the Minister of Transport. This, however, has been struck out of the Bill. The maximum prices are set out in the Schedule:—for the quarters ending March and December, 15s. for any amount up to 15 units, and for each unit over 15, 10d. if the consumer's premises are in the urban district of Swanage and 1s. outside; for the quarters ending June and September, 10s. for any amount up to 10 units and for additional units 10d. inside the urban district and 1s. outside.

As to capital, originally it was proposed to take powers to raise an additional £80 000 by new ordinary or preference shares or stock. This figure has been reduced to £40 000, and it is provided that, with the consent of the Electricity Commissioners, further capital may be created and issued for the purpose of the electricity undertaking. The maximum dividend on the new ordinary capital is to be 8 per cent., unless a larger dividend is necessary to make up a deficiency on a previous dividend, and on the preference capital 7 per cent. Borrowing powers to the extent of one-half of the paid-up additional capital are included. Separate capital and revenue accounts are to be kept of the two undertakings.

Oakham Gas and Electricity Bill.

The Unopposed Committee of the House of Commons considered the OAKHAM GAS AND ELECTRICITY BILL on June 6th. The objects of the Bill were dealt with in our issue of May 4th, p. 488, when the Bill was before the House of Lords. Owing to the fact that the generation of electricity and the manufacture of gas is to be mixed together, there is a clause in the Bill providing that if the local authority exercise their rights under the Electric Lighting Act to purchase the electricity undertaking—which they are entitled to do at the end of 42 years or subsequent periods of 10 years—they shall also purchase the gas undertaking. The promoters' view is that the Company should not be in the position, after 42 years, of having to face competition from an undertaking which they themselves had developed.

Mr. A. H. SEABROOK (Sir Charles Bright and Partners, Ltd), the electrical engineer advising the Gas Co., replying to questions as to why the electricity undertaking should not be bought separately by the local authority in 42 years if they desired, said that the gas works plant, which made gas for supplying the ordinary consumers, would also make gas for the engines driving the electricity plant, and if the electricity undertaking were separated from the gas undertaking, then the Gas Co. would be left with idle plant which had been used previously for the electricity undertaking. Again, the local authority would have to go to extra expense to provide plant for the electricity undertaking.

The Committee finally decided in this exceptional case to pass the clause, but held that it should be indicated in the preamble that the clause was allowed owing to the exceptional circumstances. Oakham was a small place, and could not carry on two large competing undertakings, and therefore this clause was not to be taken as a precedent where the situation was quite different. This course was adopted, and the exact form of the words to be used is to be settled at the next meeting of the Committee.

Shropshire, Worcestershire and Staffordshire Bill.

The House of Lords Committee on Unopposed Bills, presided over by the Earl of Donoughmore, considered the SHROPSHIRE, WORCESTERSHIRE AND STAFFORDSHIRE ELECTRIC POWER BILL on June 5th. The preamble was passed, and the Bill ordered for third reading.

Forty Years Ago.

"The Electrician," June 16th, 1883.

A NEW JOURNAL.—It is announced that a new journal, devoted to electricity, will make its appearance towards the end of this month. The title of this latest addition to the ranks of electrical journalism will be "Révue Générale d'Electricité."

MAGNETIC LINES OF FORCE.—The method of ascertaining the distribution of the lines of force by placing over a magnet and sprinkling iron filings on the paper is probably known to all our readers. It may be useful, and perhaps new to some of them, however, to learn how to fix the iron filings in the positions they take up with regard to the magnet. Substitute paraffined paper for ordinary paper, and when the filings are in position pass a piece of heated metal over them so as to melt the paraffin, and then withdraw it. The paraffin will cool and the filings be permanently held in position.

Wimbledon.

Debate on Electricity Employee's Dismissal.

A point of importance affecting employees of electricity undertakings was raised at the meeting of Wimbledon Borough Council last week. It was reported that communications had been received by the Mayor protesting against the termination of the engagement of Mr. F. T. Jenkins, an employee at the electricity works, who gave evidence on behalf of Mr. H. Tomlinson, Lee, the late electrical engineer, in his recent slander action against Alderman Peel.

The Town Clerk reported that the Council, at its meeting held on April 1st, 1914, confirmed a resolution of the Electricity Committee (in similar terms to that passed by other committees) that "the Borough Electrical Engineer be and is hereby given sole control of the employees in the electricity department, and that he be empowered to engage and dismiss employees at his discretion and settle the rates of wages and conditions of employment of such employees," and stated that the Borough Electrical Engineer, in exercise of the power conferred upon him by that resolution, had given notice terminating the employment of the employee above referred to and also that of another employee.

The Committee, after fully discussing the matter, decided not to pass any resolution.

Ald. Bathgate, in moving the adoption of the Committee's report, said the resolution empowering the chief officials to employ and dismiss employees at their discretion was passed some years ago. It was intended for the very purpose of preventing what was happening at the present time, because in the old days the Council used to get petitions from all classes of people when an employee was dismissed, and this made it absolutely necessary for the chief of departments to have the right to discharge or engage men.

In reply to Councillor James, Ald. Bathgate said, so far as he was aware, the other employee was dismissed for the same reason as Mr. Jenkins—because there was no work for them.

When the matter came up for discussion there were only a few minutes left in which to conclude the business.

Ald. Stuart said it was little use discussing this matter in view of the resolution they had passed some years ago. Until they lost confidence in their officials they could take no notice of things like this.

Councillor Stone was objecting to the principle of officials having sole control of the employees under their charge, when

Ald. Wiggins proposed, and Councillor Penman seconded, that the question be now put, and although Councillor Hickox suggested that this course was out of order, he was overruled, and the Committee's minutes were approved by 16 votes to 7.

At the same meeting of the Council, the proposed increases in the salary of Mr. A. E. McKenzie, who succeeded Mr. Tomlinson Lee as Borough Electrical Engineer, were adopted. These increases were outlined in THE ELECTRICIAN of May 11th, p. 519.

British Association Programme.

Sir Ernest Rutherford on the "Electrical Structure of Matter."

A preliminary programme of the Liverpool meeting of the BRITISH ASSOCIATION, to be held from September 12th to 19th, under the presidency of Sir Ernest Rutherford, has been issued. The railway companies have agreed to supply return tickets at a single fare and a third to all members who obtain vouchers from the offices of the Association, at Burlington House.

The president is to deliver his address at the opening meeting on the first evening, taking as his subject the "Electrical Structure of Matter," on which, as is well known, he has made some of the most remarkable discoveries of modern science. He will probably be able to describe recent successes in the experimental transmutation of elements.

In accordance with the innovation made since the war, the thirteen addresses of the sectional presidents are to be distributed over the week, five being taken on the Thursday, five on Friday, and three on Monday. In these the applied side of science is to be given full scope, Prof. Ashworth discussing the bearing of zoology on human welfare; Dr. Vaughan Cornish, the opportunity of the British Empire; Dr. Crowther, science and the agricultural crisis; Sir H. Fowler, science and transport; Mr. C. Burt, the mental differences of individuals with special reference to industry; and Sir William Beveridge, employment and population. The presidents of the geological, physiological, botanical, chemical and mathematical sections are to deal with pure science. Prof. Nunn is to discuss the education of the masses, and Prof. Newberry is to devote his address to Egypt as a field for anthropological research.

The two most important discussions are to be held by the physicists, chemists, and engineers on cohesion and molecular forces, and by the chemists and physiologists on the physical chemistry of membranes and its relation to human physiology. The oddest item is a discussion on the origin of domestic animals by geographers and anthropologists, the zoologists and geologists, who might have been expected to have some contribution to make to the subject, apparently being otherwise engaged.

The Lord Mayor of Liverpool is to give a reception on the Thursday evening, on Friday evening Prof. Elliot Smith is to lecture on the study of man, and on the Tuesday evening there is to be a scientific soirée. The more important industrial works in or near Liverpool are to give opportunities to members to inspect them and excursions of a varied nature are being arranged.

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The Prince at Birmingham.

Ceremonies at Nechells and Witton.

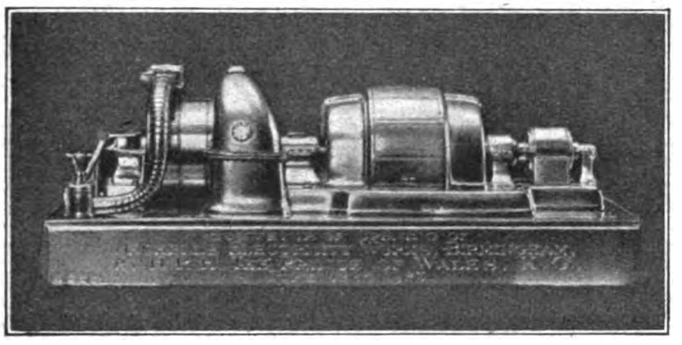
The PRINCE OF WALES visited Birmingham on Tuesday, when, after being presented with a civic address of welcome, he laid the foundation-stone of the Hall of Memory and inaugurated the new Nechells power station of the Birmingham Corporation. Everywhere there were scenes of intense enthusiasm.

The approaches to the Corporation's new electricity works were lined by 350 ex-service men employees, and wives and families of the employees.

As His Royal Highness entered the station the companion set to the 15 000 kW turbo-alternator, which he was to start, was hushed. The Prince was accompanied to the small raised platform by Alderman J. B. Burman (chairman of the Electric Supply Committee), who had been presented by the Lord Mayor at the entrance, and who had presented Mr. R. A. Chattock (City Electrical Engineer) and Col. J. W. Danielson (who is chairman of the Finance Sub-Committee as well as being in charge of the ex-service men).

Alderman Burman presented the following members, officials and advisers of the Committee: Councillor C. T. Appleby, Alderman A. G. Ellaway, Alderman A. R. Jephcott, M.P., Councillors H. K. Beale, P. H. Carter, N. G. C. Dean and J. Fryer, Messrs. E. J. Jennings, F. Forrest, L. S. Carr, W. E. Groves, P. R. Boulton, C. P. Sparkes, J. Alfred Harper, J. S. E. de Vesian, and Lieut.-Col. Anthony Rowse.

Mr. Chattock then directed the attention of the Royal visitor to the telegraph indicator which stood on the platform, with which he was to give the signal to start up the set. The Prince turned the



THE PRESENTATION MODEL.

indicator to "Stand-By," and then sounded the "Start Up" bell, whereupon the set was started up.

His Royal Highness was then presented by Alderman Burman with a silver gilt model of the set he had started. He commented upon its accuracy and detail, and the Alderman suggested that it would make a good paperweight. The model is illustrated on this page.

A souvenir booklet descriptive of the undertaking was handed to the Prince by Miss Winifred L. Chattock, daughter of the engineer.

The Prince inspected the set with interest, and asked a number of questions concerning it. Before leaving he signed the visitors book and concluded his formal task by unveiling a bronze plaque commemorating his visit. He made a more detailed review of the ex-service men as he passed to his car.

Later in the day he paid a visit to the great works of the General Electric Company, Ltd., at Witton. The approaches to the works were most effectively decorated; indeed, the works were in festal garb.

The Royal visitor's arrival was half an hour behind the scheduled time, as he had spent a longer period than was allotted to the inspection of the men of the British Legion and Cadets at Handsworth Park. The Royal party entered the gates at the main entrance in Electric Avenue, passing the administration buildings and engineering works along the main drive, thence crossing the Tame Valley Canal Bridge to the Magnet Club House. The Lord Mayor (Alderman David Davis) presented Mr. H. Hirst, chairman and managing director, who in turn presented Mr. M. J. Railing, director and general manager, Witton Works; Mr. W. H. Heaton, works manager, engineering shops; Mr. W. E. Simmons, inspector, switch-gear works, an employee of 39 years' service; Mr. J. Gibson, foreman, carbon works, 28 years' service; Mr. G. E. Goodison, operative, engineering works, 27 years' service; Mr. W. Hulme, operative, engineering works, 29 years' service; Mr. W. Kilner, engineering works, 26 years' service; Mr. E. G. Oten, superintendent of the winding department, engineering works, 28 years' service; and Mrs. Matty, operative, carbon works, 20 years' service.

The staff and workpeople of the company were assembled along the route and in the vicinity of the Club House, and a welcome, marked by great patriotic favour, was accorded to the Prince. The visitors included many engaged in the electrical industry, and the Mayor and Town Clerk of Sutton Coldfield. The Prince made an inspection of 1 000 ex-service men employed by the firm, who were ranged on a platform in front of recreation ground.

His Royal Highness had a few minutes' chat with Mr. Hirst, to whom he expressed his regret that he had not had an opportunity of making an inspection of the works. He hoped to do so on some future occasion, as he had seen that day much to impress him regarding the general organisation of the works, and the good feeling existing. The Prince added he was delighted to find that the company employed so many ex-service men; he was impressed, too, by their smart and healthy appearance. He was, moreover, interested to know that the activities of the company extended to

THE PRINCE STARTING THE SET. WITH HIM IS MR. R. A. CHATTOCK, CITY ELECTRICAL ENGINEER.

the outposts of the Empire. The Royal visitor made a particular inquiry as to the condition of trade in electrical engineering, and was obviously pleased to learn that, so far as the G.E.C. was concerned, it was improving.

Association of Consulting Engineers.

Hopes of Increased Membership.

Mr. A. M. Sillar, chairman of the ASSOCIATION OF CONSULTING ENGINEERS, presided at the annual meeting of the Association on May 28th. In presenting the report, he expressed regret that the membership only showed a net increase of two, and hoped that such of the older established consulting engineers who had not yet joined the Association would do so. In the annual report, the committee expresses the hope that all its members will, as far as possible, make a practice of using the Association's standard general conditions of contract; and a set of standard general conditions for export orders has now been approved and circulated to members. No action was taken in the matter of joining the proposed International Federation of Consulting Engineers and sending a representative to the conference at Warsaw. The committee has taken up the question of the taxation of expert witness's fees and has communicated with the Law Society on the matter. The committee of the Association has been approached by the Associated Municipal Electrical Engineers with a view to defining the relationship between the engineer of a local authority and a consulting engineer called in by the authority or by its engineer. A satisfactory settlement of the points raised when a deputation from the Associated Municipal Electrical Engineers met the Association of Consulting Engineers' committee is recorded.

Mr. Sillar paid a tribute to the work of the hon. secretary, Mr. A. H. Dykes, and also expressed the Association's indebtedness to the hon. treasurer, Mr. Lowcock, for his services.

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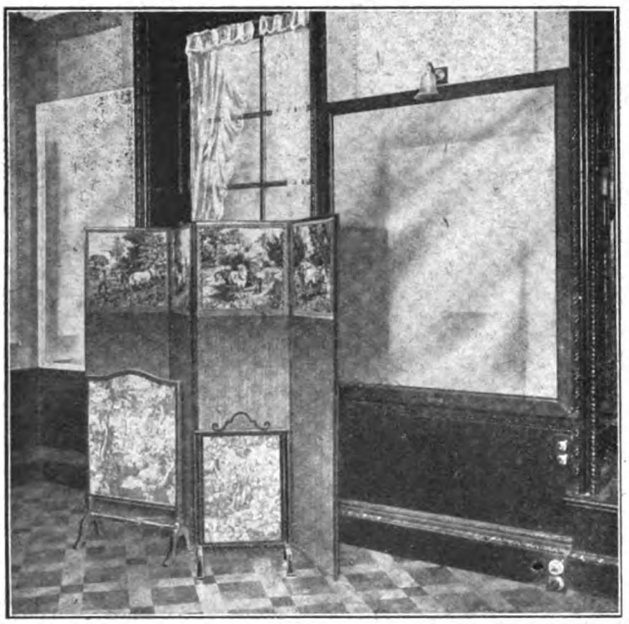
The Economy of Panel Heating.

Application for Domestic Purposes.

The success of what may be called the hot water panel system of heating has recently inspired GRIERSON, LTD., to discover whether an electric panel system could not be applied for domestic purposes generally. A demonstration which we recently attended at the firm's showrooms indicates that at least some success has been attained in this direction. Furniture into which low temperature electric heating elements have been introduced has been designed, and the effect is to heat not the surrounding air but the occupants by means of radiation. In this way, it is claimed, considerable economy is obtained. For instance, a tapestry screen with four wings each 5 ft. by 2 ft. is equipped with elements loaded to about 0·75 kW and



SCREEN EQUIPPED WITH ELECTRIC HEATING ELEMENTS.

their temperature raised to 95-105 deg. F. The effect is pleasing, and with an outer air temperature of 50 deg. F. the heat obtained from such a screen is sufficiently comforting to the occupants of an ordinary size room. In heating efficiency it is stated that such a screen is equivalent to a 2 kW radiator, and that by such even distribution rather than by " hot spots " a considerable economy is possible.

The system is also being fitted to mirrors, panels, sheets for operating theatres, and other apparatus, and claims for safety, convenience, and flexibility are being confidently put forward.

E.D.A. and the British Empire Exhibition.

An Appeal to Electricity Supply Authorities.

The BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION is taking its share in the arrangements for making the British Empire Exhibition at Wembley next year a success. As is well known, electrical manufacturers have already undertaken a responsibility in connection with this exhibition amounting to about £500 000, and it is felt that electricity supply undertakings would do well to co-operate if only to secure advantages to themselves and the areas they supply.

The Idea.

The idea is that a space of about 10 000 sq. ft. adjacent to the general exhibition of electrical apparatus should be occupied on behalf of the British Electrical Development Association by a joint display supported by all supply undertakings throughout the country. In this way it will not only be possible to indicate what is being done in developing domestic and small power appliances, but to associate electrical progress with mental and bodily comfort. The main effect in fact to be aimed at will be to make visitors realise how much they have to gain both in their business and their domestic life from letting electricity work for them.

The effect on town development of the increasing use of electricity will be stressed, and the whole argument will be topped up by the electric restaurant, where visitors will be able to taste and see what electric cooking can do to make them more comfortable.

For the Good of the Cause.

So important is this that we hope all supply authorities will take speedy heed to B.E.D.A.'s appeal, as it is necessary that the space should be booked very shortly owing to the increasing demands which are being made on the exhibition authorities and in order that matters may be put in train without delay. It may be emphasised that this display will contain no trading features in the ordinary sense nor offer any advertisement of particular firms. It will simply be for the good of the electrical cause, which is yet another reason for supporting it.

Diesel Engine Users Association.

Reducing Losses in Heat Engines.

AT the June Meeting of the DIESEL ENGINE USERS ASSOCIATION, Engineer Commander W. P. Sillince, R.N. read a paper on " Losses in Heat Engines and Means of Reducing Them." The author referred to the present insistent and pressing demand amongst users of power for economy. Every avenue leading in this direction was carefully explored by those responsible for the generation and distribution of power in order to reduce their working costs and to increase the output of, and the revenue from, their plant.

The B.H.P. of an engine was the measure of output most generally adopted, but in electrical undertakings the power was more usually measured as electrical units at the switchboard. This introduced a factor involving the efficiency of the electric generator at various loads, for which the engine could not be held responsible. Every engine functioned upon some cycle of operations and for any particular cycle there existed a maximum value of the efficiency which could not possibly be exceeded. The large heat losses in the case of steam plant were due to the change in state of the working medium, to the large latent heat of steam and to the impracticability of feeding the boiler with exhaust steam. With steam turbine machinery of high class, working under high pressure, and a good vacuum, provided with super-heaters, economisers, and all modern heat-saving appliances, the efficiency might reach 20 per cent. Such results were rarely attained in practice except in very large installations and under most favourable conditions.

Exhaust Gases in Steam Raising.

Several successful tubular heat boilers having good efficiencies were on the market generating steam under pressure from the exhaust gases of internal combustion engines. By means of these boilers from 1½ to 3½ lbs. of steam might be generated per hour per B.H.P. of the engine at full load, the amount depending upon the thermal efficiency of the engine, and the percentage of its heat of combustion rejected to the exhaust. It was essential, however, that if the process was to be efficient, the exhaust gases should be led into the boiler with as little loss of radiant heat as possible. This meant that the boiler should be placed in the closest possible proximity to the engine, and this important point was at times overlooked. It should be borne in mind in connection with the use of exhaust heat boilers that if the fuel contained appreciable quantities of sulphur, the exhaust would contain sulphurous oxides which in the presence of moisture would form sulphuric acid. Although cast iron was fairly immune from attack, wrought iron or steel would be subjected to rapid corrosion.

Certain generating stations using mixed internal combustion engines and steam plant applied the exhaust from the former to heat the feed water for the latter. This made a simple and inexpensive arrangement and enabled about one-third to one-half of the exhaust heat at the economiser inlet to be recovered in the economiser. It might perhaps not be out of place to mention that what was usually termed " loss to jacket water " frequently included heat which should be debited to the " loss of exhaust " since the jackets received heat not only during combustion and expansion but also during the exhaust stroke.

The " Still " Engine.

In the case of the " Still " engine it was claimed that all the heat usually lost through the jackets was recovered as well as a large percentage of that which passed with the exhaust. The recovered heat was used to increase the output of the engine and to improve its efficiency without the use of additional fuel. The engine was being manufactured as a four-stroke single piston heavy-oil engine in sizes up to 1 000 B.H.P. for land purposes and for marine propulsion it was being built as a two-stroke single piston engine of about 350 B.H.P. per cylinder. The principle was also being applied for locomotive purposes and in connection with semi-Diesel heavy-oil engines.

Commander Sillince concluded his paper with a general description of the four-cycle " Still " engine together with some particulars concerning its method of operation, constructional details and data of tests.

Books Received.

" Le Correnti Alternate Industriali." By T. Jervis. (Torino-Genova: S. Lattes and Co.) Pp. 261.

" Elektrische Schaltvorgange." By R. Rudenberg. (Berlin: Julius Springer.) Pp. 504. 16s. 8d. net.

" A Test of Intermediate Physics." By H. Moore. (London: Methuen and Co.) Pp. 824. 22s. 6d. net.

" A Fair Wage." By Edward Batten. (London: Sir Isaac Pitman and Sons). Pp. 90. 2s. 6d. net.

" Practical Wireless Sets for All." By P. W. Harris. (London: The Wireless Press, Ltd.). Pp. 77. 1s. 6d. net.

" Radio Télégraphie Telephonie Concert." By E. Reynaud-Bonin. (Paris: Gauthier-Villars et Cie.). Pp. 176.

" Electric Lift Equipment for Modern Buildings." By Ronald Grierson. (London: Chapman and Hall). Pp. 179. 15s. net.

" A.C. Protective Systems and Gears." By J. Henderson and C. W. Marshall. (London: Sir Isaac Pitman and Sons.) Pp. 108. 2s. 6d. net.

" Alfred Yarrow. His Life and Works." By Eleanor C. Barnes (Lady Yarrow). (London: Edward Arnold and Co.). Pp. 320. 10s. 6d. net.

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The Liffey Power Scheme.

Dublin Corporation to Go Ahead.

The report of the Electricity and Public Lighting Committee in reference to Mr. J. Buchi's report on the utilisation of the Liffey water power for the production of electrical energy was considered at a meeting of Dublin Corporation last week, Ald. Sir Andrew Beattie presiding. A letter was read from the Ministry of Local Government stating that the Corporation should act on their own responsibility in the matter. It was presumed that the contract entered into with Mr. Buchi was necessary for the due discharge of one or more of their statutory powers and duties. A letter was also read from the Ministry of Industry and Commerce stating approval of the expenditure of £1 200 incurred by the Corporation. Mr. J. Farren, moving the adoption of the report, said the report was only to give the Council authority to go to the Government and try what could be done with the water power. Ald. Shields, seconding, said this attempt on the part of a public body to explore the electrical possibilities of the Liffey should get all possible help. Ald. Hubbard Clark moved as an amendment that consideration of the report be postponed, and that a conference be called of all power-using authorities in Dublin and district for the purpose of discussing the Liffey project, exploring its possibilities, and deciding to what extent the various authorities could co-operate in the carrying through of the scheme. The Council some time ago passed a sum of £1 000 to obtain the opinion of an expert on the question of harnessing the Liffey for electrical purposes, and apparently the project was feasible. It seemed to him unwise to spend more money until the authorities had decided who were to be in control of the project. Mr. O'Callaghan, seconding the amendment, said he thought that the scheme should be purely a municipal undertaking. Mr. Stritch reminded the Council that there were two companies registered for the purpose of working a similar scheme, the promoters in one case including members of the Senate. It would be a serious matter if the Council jeopardised their own chance, and he held that they, as the Corporation, had first right to the harnessing of the Liffey. The amendment was defeated and the report adopted.

Institution Notes.

The FEDERATION OF BRITISH INDUSTRIES has been granted a Royal Charter of Incorporation by the King.

A ten-year index (1912-1921) to volumes 48 to 59 of the "Journal" of the INSTITUTION OF ELECTRICAL ENGINEERS will shortly be ready. Members of any class may obtain copies at the rate of 2s. 6d. each by applying not later than July 1st.

The summer meeting of the NEWCOMEN SOCIETY will be held on June 21st and 22nd. The programme includes visits to fabric printing works at Dartford, Chatham Dockyard, and paper mills at Tovil. The headquarters of the meeting will be at Rochester.

Organised by the INDUSTRIAL LEAGUE AND COUNCIL, a week-end conference will be held at Blunt House, Oxted, Surrey, the residence of Sir Ernest J. P. Benn, from June 30th to July 1st. Sir Alfred Mond will open a discussion on "The Legitimate Rights and Uses of Profits."

The summer meeting of the INSTITUTION OF HEATING AND VENTILATING ENGINEERS will be held at the Grand Hotel, Folkestone, on Tuesday next, June 19th, at 9.30 a.m. A Paper is to be read by Mr. J. Roger Preston, on "The Cooling of Air, with a few notes on Air Filters." A discussion will follow.

The BATTI-WALLAHS' SOCIETY has decided to revive its association with the sea, so the hon. secretary informs us. As a preliminary, a visit to the motor boat racing and regatta above bridges on the Thames has been arranged for June 30th. A launch will leave Westminster Pier at 1 p.m., luncheon and tea being served on board. Full particulars may be obtained from Mr. M. Whitgift, 7, Coulter Road, Hammersmith, London, W.6.

At the last meeting of the Board of the INSTITUTE OF PHYSICS, the following corporate members were elected: *Fellows*, J. H. G. Monypenny, J. H. T. Roberts, R. C. Richards, G. C. Simpson; *Associates*, A. Adderley, W. T. Astbury, F. G. C. Bratt, P. A. Curry, G. A. R. Foster, A. E. Owen, J. H. Smith. The preliminary arrangements in connection with the regular publication of the "Journal of Scientific Instruments" have now been made by the Institute in co-operation with the National Physical Laboratory. The special attention of those workers who have new designs for instruments is called to the fact that the "Journal" is to serve as a medium of publication of detailed descriptions and critical surveys of the behaviour of such instruments. Original papers or laboratory and workshop notes dealing with the practical or theoretical aspects of scientific instruments should be sent to the editor, Dr. John S. Anderson, The National Physical Laboratory, Teddington, Middlesex.

The Upper House of the Irish Free State Parliament has requested the Government to establish UNITY OF CONTROL IN THE DEVELOPMENT OF WATER POWER, and to establish a hydrometric survey of Ireland.

In the Chancery Division, last week, Mr. Justice Russell granted an injunction on the undefended application of the BRITISH THOMSON-HOUSTON Co., restraining Smith, Owen and Co. from infringing patents granted to the British Thomson-Houston Co. for improvements in incandescent electric lamps.

A Great Electrical Concern.

The Rise and Growth of the Metropolitan-Vickers Electrical Co.

As we mentioned last week, one of the most interesting visits paid by those attending the summer meeting of the Institution of Electrical Engineers was that to the works of the Metropolitan-Vickers Electrical Co., at Trafford Park. In the course of an all-too-short afternoon, the various groups into which the party was divided were able to see the whole gamut of heavy electrical engineering practice, to study more than one phase of modern works organisation, and to learn what is being done in those most important fields of education and research.

But the works themselves are so vast and the time available was so short that any one may be forgiven for feeling a little confused when the time came to say goodbye. The company themselves evidently recognised this, and very wisely provided a souvenir booklet which can, and we hope will, be studied with interest by all concerned. In this way they will not only obtain a great deal of useful information, but will refresh their memories about what they saw on this occasion.

A Light on the Unknown.

For the booklet itself we have nothing but the highest praise. It is principally concerned with a description of the Trafford Park and other works of the Company and their products, but we are bound to confess that what intrigued us most were the illustrations and the names of the heads of the organisation. It has been said

INSTITUTION OF ELECTRICAL ENGINEERS—SUMMER MEETING.

Group No. 1 at the Metropolitan-Vickers Works.

Front Row:—Left to Right: Dr. de Ferranti, Mrs. de Ferranti, Mrs. R. S. Hilton, Mrs. G. E. Bailey, Mrs. Peck, Mr. F. Gill.

Back Row:—Left to Right: Mr. J. N. Bailey, Mr. G. A. Juhlin, Mr. G. E. Bailey, Prof. F. G. Baily, Mr. J. A. Robertson, Mr. Ll. B. Atkinson, Mr. A. P. M. Fleming, Ald. Dagnall, Mr. J. S. Peck.

with a good deal of truth that the world knows little of its greatest men. It is equally true that the electrical industry knows little hardly even the names, of those who are striving hard year in and year out to improve its methods and to turn out its products economically. As far as the Metropolitan-Vickers Electrical Co. are concerned, this ignorance will no longer be blameless, for the names of the heads of the departments are set out in the booklet, and in some cases their photographs have also been added.

In our last issue we gave some account of the genesis and growth of the Trafford Park works, and it is unnecessary therefore to add anything further on this subject here. The company's activities are not, however, confined to Trafford Park, for other factories are in full operation at Brimsdown, Birmingham and Sheffield. In all these works every care is taken to keep close contact between the designing, administrative and manufacturing departments, to ensure accurate costing and to encourage the employees to discuss outspokenly matters connected with the firm. Special care is taken of the women workers and the apprentices, the latter being given instruction in a works school. Each year a large number of young men are admitted from the universities and technical schools to train for administrative and technical posts in the firm. The social side of the workers is well looked after, and there is a large canteen for their human wants. In this way, it is claimed with justice, high-class workmanship and economic production are secured. We might say that the booklet we are reviewing is a good example of what the firm can turn out, and Mr. A. E. du Pasquier is to be congratulated on what is in every way an excellent effort.

We may add that during the progress through the works each group of visitors was photographed, and we reproduce the photograph of Group I. We are asked to say that any of the visitors may obtain a copy of the photograph in which they are particularly interested by applying to the Publicity Department of the Metropolitan Electrical Co. at Trafford Park. Applicants should state the number of their table at the lunch and write their names clearly.

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Foreign Notes.

EUROPE.

Dutch Tramways and the Government.

Tramways in the Netherlands, says Mr. R. V. Laming, Commercial Secretary at The Hague, have been run at a serious loss ever since the beginning of the war, but owing to legislation in 1917 the managements were forced to maintain their services. The Association of Tramway Lines, of which the Netherlands railway companies are also members (on account of the tramway lines under their management and included in their services), have now approached the Minister of Transport with a view to the transfer to the Netherlands Government of the responsibility for all tramway services in the country in the same manner as it has already guaranteed the railways. It is proposed that a separate holding company should be formed, of which the Netherlands Government takes the majority of the shares, and that shareholders in the existing tramway companies should exchange their holdings for shares in the new company.

Germany and the Norwegian Electrical Market.

Reporting on the industrial and economic conditions in Norway during the year ending February, 1923, Mr. C. L. Paus, Commercial Secretary at H.M. Legation, Christiania, remarks that throughout 1922 German manufacturers held, as in 1921, and continue to hold, owing to depreciation of the mark, a dominating position in the market for all kinds of electrical machinery and cables. A small proportion of the trade has, however, been secured by Sweden and a certain amount of business in transformers and domestic heating and cooking apparatus has been done by Norwegian manufacturers. The demand for new supplies for industrial purposes remains inconsiderable owing to the continued depression, but there is a fair demand for small transformers and motors and for heating and cooking apparatus in connection with the development of municipal power distribution. No relaxation of the competition to be faced from Germany is at present anticipated.

Swedish Railway Electrification.

The Swedish press announces that the Swedish State Railway Board has requested the Government to grant permission to commence the electrification of the railway from Stockholm to Gothenburg, for which purpose an amount of 23 million kr. was voted by the Riksdag of 1920.

The total costs are estimated at about 39 million kr., of which 18 million kr. would be utilised for transformer stations, conduits, etc., 10 million kr. for electric locomotives, 4 200 000 kr. for low tension cables and other equipment for telephone and telegraph circuits for the State Railways, and 6 800 000 kr. for similar equipment belonging to the Telegraph Administration. The State Railway Administration suggests that 5 million kr. should be taken from the renewals account of the railways, leaving 34 million kr. to be obtained by Parliamentary votes in the form of a capital increase of railway property.

In connection with this application much controversy has been aroused, and the "Dagens Nyheter" has devoted much space to demonstrating that the saving involved by conversion to electric running on a line with no greater frequency of traffic than that in question would be problematic when the large expenditure necessary for the realisation of the scheme is taken into account. Telephone and telegraph interests are also opposed to the line, on the grounds that the proximity of a high tension electric system close to their lines will render them unusable and necessitate their removal from the vicinity of the railway at a heavy cost, which would have to be added to that of the railway electrification scheme. It remains to be seen, therefore, whether the Government will sanction the application of the State Railway Administration.

LATIN AMERICA.

Electricity Supply in Uruguay.

The "Montevideo Times" states that a Bill has been presented to the Uruguay Legislature amending the law creating a State monopoly in the supply of electric light and power throughout the Republic. Its object is to allow the Departmental or local Governments to grant "precarious" concessions to private persons for the supply of electric light or energy in places where a national electric power house has not yet been established. The journal says there is little room for doubt that the State monopoly has been and is contrary to public interests and progress. Experience has shown that the national power house is unable to meet the continually growing demands for electric supply in the capital alone, to say nothing of the interior of the Republic.

Electric Traction Amenities in Argentina.

Following the rejection by the Buenos Aires Municipal Council of the application of the Anglo-Argentine Tramways Co. for permission to continue charging the twelve-cent tariff, the company has decided to suspend the combination tickets over its underground system in connection with certain surface lines. The Municipal Intendent has requested the city's legal adviser to report as to the legality of this action, and has inflicted another pinprick by requesting the company to present a statement showing the progress made with the construction of 30 km. of new lines which, in terms of an Ordinance of January 10th, 1920, had to be added to the company's system. Meanwhile the Ministry of Public Works has declared lapsed the concession accorded to the company on April 25th, 1922, for the construction of a line in Calle Pedro Mendoza for the transport of materials consigned to the company by river steamer.

The Tramway Company's Annual Report.

The foregoing information is rendered the more significant by the fact that in the annual report of the company, just issued, no hope is held out of any dividend on the ordinary shares, which have received nothing since 1913. The gross receipts for 1922 were £4 529 978 (against £4 277 600 for 1921), while working expenses, including £150 402 carried to renewals reserve, amounted to £3 346 985. After deducting annuity to City of B.A. Tramways Co., debenture interest, and sinking funds, and preference and ordinary share redemption sinking fund, totalling in all £666 371, there remains a balance, including interest, etc., (£10 675), of £527 298. The sum of £6 031 brought forward gives a total of £533 329 to be dealt with. The dividend on the first preference shares for the year absorbs £176 000, and it is proposed to pay one year's arrears to December 31st, 1918, on the second preference shares, requiring £137 500. After placing £175 000 to a contingencies reserve, and writing down the value of investments by £32 000, a balance of £12 829 is carried forward.

U.S.A.

Universal Electrification Report.

At New York, on June 6th, a plan for electrifying every industry of any size in the United States at a cost of £1 000 000 000 was reported to the Convention of the Electric Light Association by General Guy E. Tripp, chairman of the Board of Directors of the Westinghouse Electric and Manufacturing Co., on behalf of the designer, Mr. Frank G. Baum, a San Francisco hydro-electric engineer.

A system of 220 000 V transmission lines a few hundred miles apart, spreading over the entire United States, is proposed. The system to be used, according to the inventor, is a constant voltage one, the voltage control and regulation being accomplished by means of synchronous regulators or condensers placed every 100 or 200 miles along the transmission lines. This is calculated to relieve the power stations of the system's voltage control, and to permit power to be supplied to, or taken from, a line at the regulating stations so that a constant voltage may be maintained, and uniform transformers used. The water-power from Canada to Mexico and from the Atlantic seaboard to the Pacific will be used to generate the electricity. It is estimated that the scheme would save 200 000 000 tons of coal and the labour of 500 000 men, while providing a gross revenue of £200 000 000.

Imperial Notes.

AUSTRALASIA.

Hydro-Electric Developments.

The possibilities of hydro-electric power development from the Snowy River are being considered by the New South Wales Parliament. It is estimated that 200 000 H.P. could be produced by constructing a dam, a 20-mile aqueduct, pipe lines with a total fall of 1 600 ft. carry water to the turbines and transmission lines to convey energy 80 miles to the point of utilisation. The dam which would be erected below Jindabyne, and would (according to the "Industrial Australian") have a capacity of 23 500 000 000 cu. ft.

The Murray Waters Commission is investigating the possibility of using water discharged from the Hume Weir for the generation of electricity. The Victorian State Government propose that the matter shall be considered by a body composed of representatives from Victoria, New South Wales and South Australia.

The Premier of Western Australia, Sir James Mitchell, has granted, provisionally, certain water rights to the Yampi Sound Electrical Power and Smelting Syndicate, who propose to develop electric power for the exploitation of the iron deposits at Yampi Sound, in the North-West Territory.

INDIA.

Increased Profits on Delhi Tramways.

The net revenue of the Delhi Electric Tramways & Lighting Co. for 1922 was £30 783, compared with £22 669 in 1921. The profit, after charging general expenditure in London and Delhi, debenture interest and loss on exchange, amounted to £24 967, plus £530 brought in. Depreciation of plant and equipment absorbs £10 000, reserve for British and Indian taxation £2 500, and renewals reserve account £2 500. Dividends, less tax, recommended of 8 per cent. per annum on the preferred and participating shares, and of 1s. 6½d. per share on the ordinary shares, carrying forward £292.

Electrical Progress in Mysore.

During 1922 electrical activity in Mysore was mainly confined to the new sixth installation at the Cauvery Power Works at Shivsamudram. The construction of the new transformer station was completed, the total outlay during the year incurred on the work being Rs. 23 lakhs. The total energy generated at Shivsamudram amounted to 125 million kWh, which is an increase of 11 millions over that for the preceding year. At the close of the year there were in service 4 603 street lights, 6 457 lighting, and 204 power installations, excluding the supply of power to the Kolar Gold Mines. The increase in the demand for power continues, in spite of increased rates for power and lighting.

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Electricity Supply.

Extensions and Developments.

HACKNEY (London) Electricity Committee has fixed October 25th as the date for the formal opening of the extension at the electricity works.

NEWPORT (Fifeshire) Town Council has appointed a special committee to consider the provision of electric light. It is possible that the Council will take over the Wormit Station of the Tayside Electric and Gas Light Co.

TORQUAY Town Council has applied to the Commissioners for a loan of £90 143 for the purchase of land, trunk mains, power station buildings, and foundations. The engineer has been authorised to expend £200 in providing electric cookers for letting out on hire.

MAIDENHEAD Town Council has applied to the Commissioners for a loan of £8 000 for mains and £700 for services. An extension of the order authorising the increase in the maximum charge for electricity from 8d. to 10d. per kWh, which expires in August, is not to be applied for.

BIRKENHEAD Town Council has applied to the Commissioners for a loan of £1 700 for the purpose of giving a supply of electricity to the gasworks. The Council has received an inquiry from Moreton Parish Council as to terms for the supply of electricity to Moreton and District. The electrical engineer is to interview representatives of the Parish Council and report.

Alterations in Charges, Proposed and Actual.

CREWE Town Council has decided to reduce the charges for electricity from 75 per cent. above the pre-war rate to 60 per cent.

STAFFORD Town Council has reduced the charge for electricity for cooking and heating from 2d. to 1½d. per kWh as from June 30th next.

ALDERSHOT Town Council has decided to apply to the Commissioners for an extension of the Temporary Increase of Charges Act, which expires on August 31st.

LIVERPOOL Electrical Engineer has reported to the Electricity Committee that price reductions as from the end of the March quarter are justified in view of the increasing demand for electricity for all purposes.

CANTERBURY Town Council has added to the tariff the following scale of charges for electricity for lighting:—Not less than 10 000 kWh per quarter, 5½d. per kWh; not less than 15 000, 5⅛d.; not less than 20 000, 5d.

TONBRIDGE Urban Council has made the following reductions in the charges for electricity as from April 1st:—Private lighting, 8d. to 6d. per kWh; power, a reduction of 2d. per kWh on sliding scale, and of 1d. on the M.D. 5d. rate; public lighting, 10 per cent. decrease.

CAMBRIDGE Electric Supply Co. has reduced the charges for electricity as follows after the June reading of meters:—Lighting, from 8d. to 7d. per kWh; power and heating, 4d. per kWh for the first 100 kWh per quarter and 1½d. per kWh beyond, the additional 10 per cent. now charged being deleted.

New rates to come into force at the end of the current quarter at BIRMINGHAM are as follows:—Lighting, 5d. per kWh for less than 1 000 kWh per quarter, with a graduated scale down to 3½d. per kWh for 25 000 kWh and upwards; power, heating and cooking, 2d. per kWh up to 300 kWh per quarter, and 1¾d. per kWh beyond.

The City of LONDON Retail Traders' Association and other retailers carrying on business within the confines of the City are petitioning the City Corporation to secure a reduction in the existing charges for electricity. The present maximum charge in the City is, the petition states, 8d. per kWh, as compared with about half that price before the war, and compares unfavourably with rates in other parts of London and in the country.

Tapping New Areas.

HORNSEA Council has discussed the advisability of applying for an electricity order, and has deferred consideration until its August meeting.

HOLYWOOD (Ulster) Urban Council has instructed the Town Clerk to interview the owners of three possible sites for the proposed electric power station.

DEVIZES Rural Council has decided to consent to the application of the Western Electric Distributing Corporation for a special order to supply electricity within the Council's area.

MALLING Rural Council, having consented to Maidstone Corporation supplying electricity to a residence at Newhythe, has decided to ask the Corporation whether they can supply electricity to a much larger area in the district.

BLACKROCK (Co. Dublin) Urban Council has been informed by Electricity Concessions (Ireland), Ltd., that the Electricity Finance Corporation were prepared to form and launch the necessary company to provide all the capital required for the Blackrock electric lighting scheme.

ULVERSTON Urban Council on June 5th adopted a recommendation by the Electricity Committee to obtain a bulk supply of electricity from Barrow-in-Furness Corporation, as recommended by the consulting engineer, Mr. Wordingham. A canvass showed a reasonable demand for electricity.

The Chairman of BIRMINGHAM Electric Supply Committee informed the Council that by the early autumn supplies would be available to Northfield, parts of King's Norton, Warley Park, Selly Oak, Cotteridge, Alcester, Lanes End, Hall Green, Acock's Green, South Yardley, and Stechford, while they were hoping also to supply Ward End, Little Bromwich, and Yardley Wood, although that must not be taken as a promise.

Inquiries, Orders and Miscellaneous.

Notice has been given by the Commissioners of their intention to open an inquiry on July 10th at NOTTINGHAM to determine finally the area of the proposed East Midlands Electricity District.

The chairman of the BOOTLE Electricity Committee last week told the Town Council that the transfer of the Bootle electricity undertaking to Liverpool would yield an equivalent of £10 000 a year in perpetuity to the Bootle ratepayers.

Arising out of a prolonged discussion, BLACKBURN Electricity Committee has authorised the chairman, vice-chairman and engineer to negotiate for the supply of electricity over 100 H.P., but no contracts are to be sanctioned without the authority of the Committee. The original resolution on the subject was referred back by the Town Council (see THE ELECTRICIAN, May 11th, p. 519).

NEWPORT Electricity and Tramways Committee have strongly protested against the composition of the representatives of local authorities on the Electrical Supply South Wales and Monmouthshire Area Advisory Committee, and expressed the opinion that the three engineers of the Cardiff, Newport, and Swansea Corporations electricity undertakings should be members of such a committee.

No agreement has yet been reached between the Keighley Corporation and the Yorkshire Electric Power Co. with regard to the supply of electricity in bulk to SKIPTON. It will be remembered that the Electricity Commissioners insisted on the supply being given by Keighley through the Power Company, who have certain rights in the area. It is understood that the difficulties in the way of a settlement are with regard to two outstanding clauses. As far as the actual transmission of the electricity is concerned everything is ready.

At HUDDERSFIELD on Friday and Saturday last, Col. Ekin, on behalf of the Commissioners, concluded the adjourned inquiry into rival applications for Provisional Orders, made by the Huddersfield Corporation and Electrical Distribution of Yorkshire, Ltd., for the supply of electricity to Marsden, Meltham, and other districts round Huddersfield. Mr. W. B. Woodhouse, manager of the Distribution Company and the Yorkshire Electric Power Co. (from which the Distribution Co. gets its current), contended that the Corporation competition at "dump" prices was not fair competition, and that it was rate-aided. He did not think the Corporation could afford to supply at the rates proposed. Mr. Miller, for the Corporation, contended that it could and was willing to supply the districts more cheaply than the company.

Personal Items.

Lieut.-Col. C. F. HITCHENS has been appointed general manager of the Elswick works of Sir W. G. Armstrong Whitworth & Co.

Prof. H. A. LORENTZ was entertained at dinner on June 6th at the Langham Hotel, London, W., by the Anglo-Batavian Society.

Edinburgh Town Council has increased the salary of the tramways manager, Mr. R. S. PILCHER by £300, in three annual increments of £100.

Mr. A. HERBERT, who is in business as an electrical engineer at Reading, has been elected a member of the Reading Chamber of Commerce.

Alderman D. L. WINTER, for many years Chairman of the Electricity Committee of Rotherham Borough Council, has been presented with his portrait in oils, in recognition of his 36 years of public service.

Mr. E. M. MUNRO has resumed his independent consulting practice at Finsbury Pavement House, London, E.C., in railless electric traction, with which he has been associated since the introduction of that system into this country. During this time he has been closely identified with nearly all the railless installations in this country and abroad. Mr. Munro is specialising also in electric haulage and freight handling.

Mr. R. H. PEET, on the completion of fifty years' service with Siemens Brothers and Co., has been presented with a gold watch bearing the following inscription:—"Presented to Reginald H. Peet, Esq., by his colleagues as a mark of appreciation on completing his fiftieth year on the staff of Siemens Brothers and Co., Ltd. March, 1923." The presentation was made by the general manager, Mr. Hird, and the directors of the company supplemented the gift by a substantial cheque.

Mr. SYDNEY EVERSHED, who recently retired from the position of managing director, has accepted the office of Chairman of Evershed and Vignoles, Ltd., and will in addition act as consultant to the company. It will be remembered that the first chairman was the late Prof. W. E. Ayrton, who held the position till within a few months of his death in 1908. Since that date the chairmanship has remained vacant. Mr. E. B. Vignoles and Mr. A. Vines remain managing directors of the company.

OBITUARY.—The death has taken place at the age of 54 years of Mr. JESSE COLEMAN, mains superintendent at the Hastings Electricity Works, where he had been engaged for upwards of thirty years. He was a member of the Durwent Lodge of Freemasons, and was formerly an engineer in the Fire Brigade.

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Tenders Invited.

GREAT BRITAIN.

STEWARTON TOWN COUNCIL, June 16th.—Electric lighting installation throughout the streets of the Burgh. Specification, etc., from the Burgh Surveyor.

GLASGOW CORPORATION, June 18th.—Wiring and fitting houses in connection with the Hawthorn Street housing scheme. Specifications from the City Electrical Engineer.

LAMBETH (LONDON) BOARD OF GUARDIANS, June 19th.—Electric light wiring and fitting at the Hospital, Brook Street, Kennington, London, S.E. Specification, etc., from the Clerk, Mr. James L. Goldspink, Brook Street, Kennington Road, S.E.11.

ERITH URBAN DISTRICT COUNCIL, June 19th.—Horizontal air-type compressor, electric motor, etc. Particulars from the Council's Engineer and Surveyor.

HOVE CORPORATION, June 20th.—Twenty c.i. electric light columns. Particulars from the Borough Surveyor.

LEEDS EDUCATION COMMITTEE, June 20th.—Electric wiring and fitting of schools. Particulars from the Education Offices (Architect's Section), Calverley Street, Leeds.

AYLESBURY PARISH CHURCH, June 26th.—Wiring and fitting the church for electric light. Specification from Cheadle & Harding, architects, Aylesbury.

LEYTON EDUCATION COMMITTEE, June 26th.—Electric light wiring and fitting (about 90 points) at Canterbury Road boys' school. Tender forms from Mr. J. H. Jacques, 61, West Ham Lane, Stratford, London, E.

WARRINGTON CORPORATION, June 26th.—High and low tension lead covered cable. Specification from the Borough Electrical Engineer, Howley, Warrington.

PORTSMOUTH GUARDIANS, June 27th.—Three months' supply of electrical fittings, ironmongery, etc. Forms from the Clerk, St. Michael's Road, Portsmouth.

SOUTHAMPTON CORPORATION, June 29th.—One 8 in. centrifugal pump, charging set and electrical equipment for Portswood sewage farm.

BIRMINGHAM CORPORATION, July 2nd.—Electric light wiring and fitting at new salvage works, Brookvale Road, Witton, also supply and erection of five-wire balancer sets, one at Brookvale Road salvage works and one at Montague Street destructor works. Specification, etc., from the Superintendent, Salvage Department, 161, Corporation Street, Birmingham.

SALFORD CORPORATION, July 2nd.—(1) Supply and laying of 33 000 V cables between Agecroft power station and Frederick Road works; (2) nine s.p. transformers and one spare of 6 000 kVA each; (3) coal conveying and ash removal plant. Specifications, etc., from Mr. J. A. Robertson, 20, Brazennose Street, Manchester.

PORTSMOUTH CORPORATION, July 3rd.—Twelve months' supply of materials and stores to the Tramways Department, including insulating materials, lamps and motor windings, overhead line materials, oils, paints, varnishes, ironmongery, etc. Specification from the engineer, Mr. V. G. Lironi, Vivash Road, Fratton, Portsmouth.

AUSTRALASIA.

NEW SOUTH WALES PUBLIC WORKS DEPARTMENT (renewed invitation of tenders), July 23rd.*—Pumping machinery for Glen Innes water supply. The machinery is to be in two units, each capable of lifting 15 000 gallons per hour, and the pumps are to be driven through gearing by electric motors, three-phase current, 50 cycles, 415 V being supplied at the pumping station.

POSTMASTER-GENERAL'S DEPARTMENT, MELBOURNE, August 7th.*—Telephone switchboards.

POSTMASTER-GENERAL'S DEPARTMENT, PERTH, August 8th.*—Galvanised tubular poles, 1 430 in all, or, alternatively, rolled steel girders.

CANADA.

Mr. Chris. Spencer of DAVID SPENCER, LTD., VANCOUVER, has consulted H.M. Trade Commissioner at Vancouver with regard to the provision of an electric lighting and power plant for the firm's large departmental store, and it is suggested that general proposals should be sent by British contractors to Mr. C. Spencer as promptly as possible, mentioning H.M. Trade Commissioner as the source of the information. The generating plant is to be about 1 000 kW.

IRELAND.

DUBLIN CORPORATION, June 26th.—Wiring 332 houses at Fairbrothers' Fields. Specification from the City Treasurer, Exchange Buildings, Lord Edward Street, Dublin.

NEW ZEALAND.

HUTT VALLEY POWER BOARD has received the ratepayers' sanction to borrow £200,000 for an electrical distribution system supplied by the Mangahao hydro-electric station. Tenders for plant and material will be invited as soon as it is possible to proceed with the scheme. Templin & Toogood, 11, Grey Street, Wellington, are the consulting engineers.

* Particulars from the Department of Overseas Trade.

Tenders Accepted.

The tender of Johnson and Phillips has been accepted by POPLAR (LONDON) BOROUGH COUNCIL for switchgear, £573 10s.

The English Electric Co.'s tender, £3 553, for a 1 000 kW rotary converter has been accepted by STAFFORD CORPORATION.

The tender of the English Electric Co. has been accepted by DOVER CORPORATION for plant for the electricity works at £24 838.

CAMBERWELL (LONDON) GUARDIANS has accepted the tender of X-Rays, Ltd., for supply of transformer for X-ray apparatus, £371.

CANTERBURY CORPORATION has accepted the tender of H. C. Fullar and Co., for a water intake at the electricity works, at £1 648.

For wiring and fitting the Council House for electric lighting, SALISBURY CORPORATION has accepted the tender of A. Higginbotham, £117.

For additional plant for the electricity works, the tender of the National Electric Construction Co., £6 345, has been accepted by CARNARVON CORPORATION.

MACCLESFIELD CORPORATION has accepted the tender of R. M. Carr for two dynamos, booster, switchboard and accumulators, for the sewage works, at £638 6s. 2d.

MARYLEBONE (LONDON) BOROUGH COUNCIL have accepted the following tenders: Enfield-Ediswan Cable Works, l.t. cable, £13 291; British Insulated and Helsby Cables, Ltd., e.h.t. cable, £2 336.

The tender of the English Electric Co. for motor generator and cables, £2 731, and that of the British Thomson-Houston Co. for switchgear, £605, have been accepted by YORK CORPORATION.

The tenders of Johnson and Phillips for underground cable, £264 12s., and Pirelli, Ltd., for overhead cable, £316 18s. 9d. and £115 8s. 4d., have been accepted by BASINGSTOKE CORPORATION.

C. A. Parsons and Co. have received an order from the VICTORIA FALLS POWER CO. for three 15 000 kW turbo-alternators and surface condensing plants, with one spare alternator, for their Witbank generating station.

SALFORD CORPORATION is recommended to accept the tender of W. T. Glover and Co. for 3 500 yards l.t. 3-core paper-insulated lead-covered cable and 500 yards l.t. concentric paper-insulated lead-covered cable, £870.

Tenders accepted by TORQUAY CORPORATION in connection with the power station at Newton Abbot include those of J. Smith, Ltd., for a 15-ton travelling crane, £465, and Matthews and Mumby, steel work and buildings, £8 898.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"Gothenburg Exhibition: Special Correspondent's Report on Swedish Furniture, with Illustrations."

THE CHEMICAL AGE.—"The Recovery of Fuel from Ashes," by Dr. H. A. Prager; "Conference on Industrial Oxygen."

THE GAS WORLD.—"A Pension Scheme for Small Gas Undertakings"; "Analyses of Some Gas Companies' Accounts"; "Corrosion in Pipes and Meters."

THE HARDWARE TRADE JOURNAL.—"Tool Adjustments—II," by Joseph Horner; "How to Sell More Tools," by S. A. Seller; "The Proofing of Foreign Guns."

THE FRUIT GROWER.—"Prospects for the Home Grower," by W. G. Lobjoit; "Merchandise Marks Bill in Committee"; "Fruit Plantation Statistics."

GARDENING ILLUSTRATED.—"Flowering Shrubs in Parks and Gardens"; "Summer Cucumbers"; "Flower Garden for Beginners."

THE EUROPEAN COMMERCIAL.—"Motor Trade Notes"; "Company Law in Italy"; "Rumanian Industrial Organisation."

Business Items.

Mr. WILLIAM BROWN has commenced business as an electrician in Barnes Street, Strathaven, with Mr. H. Mason as partner. They will trade under the style of Brown and Mason.

Price reductions are announced on all JOSEPH DIXON and Co.'s graphite specialities (with the exception of paint) on and after May 1st, 1923. This brings the prices down practically to pre-war level.

W. G. WATSON AND CO., Sydney, Australia, intimate that as from July 1st, Sanderson, Murray and Elder, Ltd. will represent them as buyers and shippers in this country, under the personal supervision of Mr. J. Maitland Jones, of Turnbull and Jones, Ltd., New Zealand, and Mr. Holliday.

The Department of Overseas Trade (reference No. 723) will supply to British firms interested the name of a firm in PARIS desirous of obtaining the representation of British manufacturers for the sale in France of electrical apparatus of all kinds, but particularly small fittings and accessories for private installations.

Mr. John A. Hood, sole partner of CLARKSON, HOOD AND Co., Glasgow, representatives for the Ateliers Constructions Electriques de Charleroi, has taken Mr. A. W. Kilpatrick into partnership. The name of Clarkson, Hood and Co. will be retained, and the firm will continue to act as Scottish representatives for Watsham's, London; Lind and Co., Liverpool; and Townshends, Ltd., Birmingham.

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Electric Traction.

Tramway Extensions and Developments.

An extension to the workshop at EXETER tramway depot was opened last week.

YORK Tramways Committee is considering an extension in the Poppleton Road district.

A special meeting of EDINBURGH Town Council is to be called at the end of this month, in view of the Parliamentary Orders necessary for the proposed tramway extensions.

WESTHOUGHTON District Council has received sanction from the Ministry of Health to the borrowing of £4 539 for the widening of Bolton Road, preparatory to the laying of tramlines.

LYTHAM ST. ANNES Council is applying to the Ministry of Health for sanction to a loan of £2 000 for extensions to the tramsheds at Squire's Gate. Ten new covered top tramcars are to be purchased at a cost of £1 538 each.

Fares, Receipts and Passengers.

WALSALL Town Council has reduced long-distance fares on the tramways.

For the week ending June 2nd the receipts on LONDON tramways under "Underground" control amounted to £38 560, as against £50 688 in the corresponding week last year.

READING Corporation tramways traffic returns show that from April 1st to May 3rd the receipts were £6 915 3s. 10½d., compared with £7 246 0s. 6d. for the corresponding period of 1922.

The Leeds Accident.

At the inquest last week on the persons killed in the recent tramcar disaster on the LEEDS Corporation system at Churwell, George William Knight, the driver of the car, told the Coroner that none of the brakes on the car would act, that suddenly he felt something giving way beneath his feet, and that when the car ran away he felt himself thrown into the road.

The Coroner: Is it your view to-day that you fell off the car or got off in the ordinary way?

Witness: I can't say.

The Coroner: In view of the condition of your arm, were you tempted to use the hand-brake as little as possible?

Witness: Having my arm in such a condition, I could not put on the brake as strongly as could another man.

A verdict of accidental death was returned, the jury finding that the accident happened as the result of the driver losing his nerve when he found that the hand-brake would not act, he forgetting to apply the other brakes.

The jury added that they did not think his conduct amounted to criminal negligence, although they were of opinion that he failed in his duty in leaving his post as driver.

The Bristol Strike.

Many employees of the Bristol Carriage and Wagon Co., who ceased work on June 3rd, causing a partial stoppage of the BRISTOL tramway service, returned to work at the end of last week, and a full service is now reported to be running. The "Daily Herald" of Monday last stated that the men were on strike "for a full recognition of their union" and had decided on Sunday "to continue the struggle."

Electric Railway Items.

For the week ending June 2nd, receipts on the MERSEY RAILWAY amounted to £4 684, a total of £100 233 for the first 22 weeks of this year.

A start has been made with the laying of the sleepers and rails of the new LONDON UNDERGROUND extension line from Golders Green to Hendon (Central). About 315 ft. of track have been laid down, and a daily advance of 500 ft. is anticipated from now onwards.

Institute of Transport.

Varied Programme at Sheffield Congress.

The Congress of the INSTITUTE OF TRANSPORT opened at Sheffield on Wednesday, when the retiring president, Sir Sam Fay, held a reception at the Grand Hotel. Yesterday (Thursday), Papers were read by Mr. J. A. Jenkinson (assistant district traffic manager of the Grimsby Docks, London and North Eastern Railway) on "Railway Requirements of an Important Industrial Area," Major-General Sir W. S. Brancker on "Air Transport," and Sir Robert A. Hadfield on "Modern Trackwork and its Importance." This morning Mr. Brysson Cunningham is to read a paper on "Cargo Handling at Ports: British and American Practice Compared"; Mr. A. Dryland, the County Surveyor of Middlesex is to deal with comparisons of British and American methods in road construction and maintenance; and Mr. E. S. Rayner, general manager of the Hull City tramways is to discuss tramways from a traffic point of view under existing conditions.

The programme includes visits to Hadfields, Ltd., Tinsley; the River Don works of Vickers, Ltd., and Metropolitan-Vickers, Ltd.; Steel, Peech and Tozer, Ltd., and the Parkgate Iron and Steel Co., at Rotherham; the Applied Science Department of Sheffield University; Cammell Laird and Co., Penistone; the Staveley Coal and Iron Co.; John Brown and Co., and Thos. Firth and Sons, Sheffield; Craven, Ltd., Darnall; the locomotive works of the London and North Eastern Railway at Doncaster; the London and North Eastern Railway's docks at Immingham; and the docks of he Aire and Calder Navigation at Goole.

Wireless News.

The Broadcasting Inquiry.

The new Postmaster-General, Sir L. Worthington-Evans, has publicly expressed his interest in the broadcasting question, and his hope of finding a solution of the present difficulties satisfactory to all concerned. The Broadcasting Committee continued its inquiry on Thursday, June 7th, when evidence was given by Mr. A. A. CAMPBELL SWINTON, past president of the Radio Society of Great Britain, who explained the views of his society on the broadcasting problem, mainly as it affects experimenters, amateurs, and members of wireless societies throughout the country.

On Tuesday, the Committee took evidence from representatives of various Government Departments concerned in wireless communication, as well as from Mr. SAMUEL LANDMAN and Major J. H. BEAUMONT, representatives of the Radio Association.

Wireless in the Irish Free State.

The Postmaster-General of the Irish Free State, Mr. J. J. WALSH, was questioned in the Dail on June 7th with regard to the importation of wireless apparatus. He said that he had not entered into communication with any British firm or firms giving privileges respecting the supply or use of wireless apparatus within the State. The importation and sale of wireless apparatus was at present prohibited in the State, but permission had been given to certain fete committees to hold demonstrations in connection with the reception of wireless broadcasting. Such permission had not conferred any privileges upon the firms giving the demonstrations. He was at present in negotiation with the representatives of Irish companies on the subject of broadcasting and the manufacture and sale of apparatus.

In reply to a supplemental question, Mr. Walsh said they would certainly give the same facilities to an Irish company as to the Marconi Co., but they had not received any such application.

The "Freeman's Journal" quotes a "High official of the Post Office" as saying that a scheme is on foot for the establishment of a broadcasting station in Dublin by private enterprise. Licences for the installation and use of receiving sets are not at present issued, and the same official is reported to have said that the re-issue of licences was "entirely a military question."

Questions in Parliament.

On Monday, Mr. ORMSBY GORE informed Sir H. Brittain that it was contemplated that the question of wireless communication within the Empire would be considered in the first instance by the Imperial Economic Conference. Any questions of principle requiring the intervention of the Imperial Conference would be referred to that body.

In a written reply to Captain Terrell last week, the POSTMASTER-GENERAL stated that the estimated revenue and expenditure of the Post Office wireless stations for the year was as follows: Cairo (11 months), revenue, £6 500, expenditure, £45 000; Leafield, revenue, £31 200, expenditure, £36 000; Northolt (7½ months), revenue, £4 500, expenditure, £5 500; Stonehaven, revenue, £3 500, expenditure, £9 200. Expenditure in all cases includes interest, depreciation and overhead charges. The Postmaster-General points out that the Government traffic, if not transmitted by means of these stations, would have had to be transmitted by other routes at equal or greater charges than those credited for it. Several of the services carried on from these stations have only recently been instituted, and the revenue may be expected to increase as the service is developed.

Foreign Items.

Our Indian correspondent states that arrangements are being made for the improvement of the wireless station at COLOMBO which will enable it to receive messages direct from Leafield, or via Cairo.

The CHINA ELECTRIC CO. is now installing a wireless telephone system between Peking and Tientsin. The company has an understanding with the Ministry of Communications that if the project proves successful, it will sell the system to the Ministry.

The annual sports of the London establishments of the GENERAL ELECTRIC CO. will be held at Herne Hill Track, S.E., on June 23rd.

As reported from time to time in these columns, much opposition has been shown in Ulster to the BANN HYDRO-ELECTRIC POWER SCHEME. The "Northern Whig" now states that the scheme has been postponed.

An anonymous donor has given £20 000 for founding an undergraduate scholarship and a number of post-graduate scholarships at SHEFFIELD University. The post-graduate scholarships are intended to encourage scientific research in ferrous or non-ferrous metals.

The ventilating installation in the Manchester Royal Exchange deals with 2 800 000 cub. ft. of air space, and maintains the atmosphere not only in a state of freshness, but at a suitable temperature. This is effected by electrically driven fans supplied by MATTHEWS AND YATES, which draw the air through jets of water and over heating batteries, the air circulated amounting to 7 250 000 cub. ft. per hour. Extraction is by other fans which withdraw the air on the ground level.

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Companies' Reports, Dividends, etc.

ARMSTRONG, WHITWORTH AND CO.—The available profit for 1922, after charging £224 345 for debenture interest, is £467 550, against £438 888 for 1921, when debenture interest absorbed £2 827 more at £227 172. With £832 091 brought forward the total available is £1 299 641. Two interim dividends, each of 6d. per share, were paid during the year, leaving £771 516, which the directors propose to carry forward. The reserve fund stands at £1 400 000, and the share premium and debenture redemption account at £328 307. The report states that the hydro-electric and civil engineering departments have secured large orders, and these orders are also giving work to the other departments.

Supply Companies' Results.

ALTRINCHAM ELECTRIC SUPPLY CO.—The profit for 1922 amounted to £20 244, from which debenture interest, premiums on debenture redemption policies, bad debts and bank interest, amounting to £6 462, have to be deducted, leaving a balance of £13 782, which, added to the balance of £726 brought from last year, amounts to £14 508. Deducting therefrom the directors' fees for the year 1921 and the dividends on the preference shares due September 1st, 1922, amounting together to £3 408, there remains a sum of £11 099, out of which £1 000 has been added to reserve for depreciation of plant, leaving a balance of £10 099. Dividend recommended of 7½ per cent on the ordinary shares, carrying forward £4 599.

SOUTH WALES ELECTRICAL POWER DISTRIBUTION CO.—The report for 1922 states that there is no detailed revenue account to be submitted, the commercial side of the undertaking being operated by the Treforest Electrical Consumers' Co. The results for the year appear in the accounts of that company, but so far as the South Wales Co. is concerned there is a credit balance from the Treforest Co., after payment of all working expenses, of £27 104, making, with £3 653 brought in, £30 757. Deducting therefrom the interest on prior lien debenture stock and debenture stock, there remains a balance of £708 17s. 5d. to be carried forward. This unsatisfactory result was due in a great measure to the breakdown through overload, which took place at the company's power station and caused a serious interruption to the supply, necessitating the putting into use of every item of plant available, much of which was out of date and uneconomical in working. The new turbine set then in process of erection could not be got to work in time to take up the load. In order to facilitate the raising of fresh capital, arrangements have been made to terminate the working agreements with the Treforest Electrical Consumers' Co., and to re-vest the administration of the undertaking in the South Wales Co. The Treforest Electrical Consumers' Co. has changed its name to the South Wales Power Co., and will be carried on in association with this company as a development company.

Cable, Telephone and Telegraph Company.

GLOBE TELEGRAPH AND TRUST CO.—Dividend declared of 5s. per share net on the ordinary shares, making 10 per cent. for the year.

New Companies.

NORTHERN LIGHT AND POWER CO., LTD.—Private. Cap., £2 000 in £1 shares. To carry on at Kilkeel and district the business of an electric light company. Reg. office: Kilkeel, Co. Down.

SOUTH YORKSHIRE ELECTRIC WELDING CO., LTD.—Private. Cap., £2 000 in £1 shares. To carry on business as indicated by the title. Reg. office: 25, Market Place, Mansfield.

S. MULLINER, LTD.—Private. Cap., £2 000 in £1 shares Electricians, heating and ventilating contractors, electrical and mechanical engineers, etc. Reg. office: 72, Harrow Road, London, W.

SUTHERLANDS (ELECTRICAL ENGINEERS), LTD.—Private. Cap., £5 000 in £1 shares. To acquire the business of electrical engineers now carried on by Sutherland and Co. at Trinity Street, Bolton, and Ainsworth Road, Radcliffe.

E. TURNER AND CO. (MANCHESTER), LTD.—Private. Cap., £1 000 in £1 shares. To take over the business of an electrical engineer, plumber, and contractor, carried on by E. Turner at 20, Marsden Court, Fennel Street, Manchester.

ELECTRICAL OHMS, LTD.—Private. Cap., £1 000 in £1 shares. Makers and sellers of all wireless instruments and accessories, manufacturers and factors of and dealers in cycles, motors, tools. Reg. office: 7, Bridge Street, S.S. Glasgow.

WILMORE'S WIRELESS, LTD.—Private. Cap., £1 200 in 1 000 participating preference shares of £1 and 4 000 ordinary shares of 1s. Manufacturers of wireless instruments, etc. Reg. office: 108, Victoria Street, Wetminster, London, S.W.1.

ELLESMERE FORT ELECTRICAL CO., LTD.—Private. Cap., £500 in £1 shares. To take over the business of an electrical and general engineer and contractor carried on by G. Hodder at Ellesmere Port. Reg. office: 24, Whitby Road, Ellesmere Port.

T. B. AND J. A. MATHIESON, LTD.—Private. Cap., £1 000 in £1 shares. To acquire the business of T. B. and J. A. Mathieson, mechanical and electrical engineers, armature winders, agents and dealers in electrical accessories of 114, Trongate, Glasgow.

CARPAX CO., LTD.—Private. Cap., £500 in 490 ordinary shares of £1 and 200 founders' shares of 1s. Engineers, founders in ferrous and non-ferrous metals, machinists, manufacturers of electrical and other plant, etc. Reg. office: 312, Deansgate, Manchester.

LIVERPOOL ELECTRICAL ENGINEERING CO. (1923), LTD.—Private Cap., £2 000 in £1 shares. To acquire the business of electrica engineers, contractors and agents carried on at 18 and 20, Vauxhal Road, Liverpool, as the Liverpool Electrical Engineering Co.

FRED ELLISON AND CO., LTD.—Private. Cap., £1 500 in £1 shares. Electrical and mechanical engineers, textile and other machinists, manufacturers, merchants and patentees of and dealers in all kinds of metals and metallic wares, etc. Reg. office: 96, Harris Street, Bradford.

BELL BATTERY AND ACCESSORY CO., LTD.—Private. Cap., £1 000 in £1 shares. Manufacturers of dry and wet electric cells, electricians, manufacturers of and dealers in electrical appliances and apparatus, etc. Reg. office: 39, Wilson Street, Finsbury Square, London, E.C.

H. N. SHORROCK (MORECAMBE), LTD.—Private. Cap., £2 000 in £1 shares. To acquire the business of an electrical engineer and contractor, now carried on at Morecambe and Heysham, Lancs, as "H. N. Shorrock." H. N. Shorrock, 73, Marine Parade, Sandylands, Morecambe, is a director.

COBB, WEBB AND CO., LTD.—Private. Cap., £3 000 in £1 shares (2 000 6 per cent. cumulative preference and 1 000 ordinary). Electrical engineers and contractors, suppliers of electricity, manufacturers of wireless apparatus, etc. Solicitors: Waterhouse and Co., 10 and 12, Bishopsgate, London, E.C.

ELEFACTORS, LTD.—Private. Cap., £100 in £1 shares. Electricians, factors, suppliers and distributors of electricity and electrical energy for lighting, heating, telegraphic, telephonic, acoustic and wireless communications, traction and motive power, mechanical, electrical, wireless or other engineers, etc. L. Waterhouse, 24, Maida Hill West, London, W., is a director.

JOHNSON AND TURNER, LTD.—Private. Cap., £2 000 in £1 shares. To acquire the business of electrical and mechanical engineers and contractors and patent projector lantern manufacturers now carried on by H. E. Johnson, M. C. Turner and J. E. Lord at Manchester Road, Hyde, Ches., as "Johnson and Turner." Reg. office: Manchester Road, Hyde, Ches.

AUTOMATIC COIL WINDER AND ELECTRICAL EQUIPMENT CO., LTD.—Private. Cap., £10 000 in £1 shares. To acquire from S. H. Rawlings the benefit of certain existing inventions relating to an automatic coil winding machine and an instrument for registering electrical current and resistances to be called an "Avometer." Reg. office: 9, Victoria Street, London, S.W.1.

LACY PATENTS HOLDING CO., LTD.—Private. Cap., £1 000 in 1s. shares. To acquire from H. Lacy the benefit of the rights of and turn to account certain existing inventions relating to improvements in electro-magnets in the U.K. and Ireland and the Isle of Man, and to adopt an agreement with the said vendor and J. C. Snow. Reg. office: 48A, Gillingham Street, London, S.W.1.

BOSTON AND DISTRICT ELECTRIC SUPPLY CO., LTD.—Cap., £20 000 in £1 shares. To acquire a transfer from R. A. Smith of the undertaking authorised by the Boston and District Electric Lighting Order, 1915, under the provisions thereof and to produce and supply electrical energy within the limits prescribed thereby. Reg. office: 62–3, Queen Street, Cannon Street, London, E.C.4.

WATERLOO ELECTRIC CO., LTD.—Private. Cap., £1 000 in 750 10 per cent. participating preference shares of £1 each and 5 000 deferred shares of 1s. each. Manufacturers, suppliers and/or erectors of all kinds of apparatus for transmitting, communicating or receiving music, speeches or messages by wireless telegraphy and telephony, etc. Reg. office: 129, Waterloo Road, London, S.E.1.

SMITH AND CO. (SOUTH SHIELDS), LTD.—Private. Cap., £10 000 in £1 shares. To adopt an agreement with E. Smith and J. Smith and to carry on the business of ironmasters, steel manufacturers, electric, hydraulic, mechanical and general engineers, manufacturers and founders of and workers in metals of all kinds, shipowners and builders, carriers, etc. Reg. office: The Iron Foundry, Nile Street, South Shields, Durham.

MAGNUS VOLK, LTD.—Private. Cap. £5 000 in £1 shares. To acquire the undertaking and all or any of the assets and liabilities of Magnus Volk, Ltd. (incorporated in 1901); to adopt an agreement between the said old company and R. Carpenter, the liquidator thereof of the first part, M. Volk of the second part, M. H. Volk of the third part, and this company of the fourth part; to operate the electric railway at or near Brighton. Solicitors: J. K. Nye and Donne, 58, Ship Street, Brighton.

C. J. FERGUSON AND SONS, LTD.—Private. Cap., £5 000 in £1 shares (2 500 7 per cent. cumulative preferred and 2 500 ordinary). To take over the business of an electrical engineer, founder, metal worker, manufacturer and broker of, agent for and dealer in, electrical dynamos and apparatus, internal combustion engines, agricultural implements and other machinery carried on by C. J. Ferguson in London as C. J. Ferguson and Sons and all or any of the assets and liabilities connected therewith. C. W. Ferguson, 237, Essex Road, London, N.1., electrical engineer, is a director.

UNITED ENGINEERING AND MANUFACTURING CO., LTD.—Public. Cap., £50 000 in 10 000 10 per cent. preference and 35 000 ordinary shares of £1 and 100 000 deferred shares of 1s. Founders, mechanical and electrical engineers, manufacturers of agricultural and garden implements and other machinery, tractors, traction engines, road rollers, engines and engine parts, motor and general machinery, tools, dies, jigs, fixtures and mechanically and electrically operated equipment, ship smiths and wrights, shipbuilders and repairers, woodworkers, timber merchants, etc. Reg. office: Charles Street, Louth.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

BUNDY AND CO., LTD., Premier Works, Granville Road, Childs Hill, N.W., electrical factors. £43 11s. 5d. April 17th.

CUNNINGHAM SLATER, LTD., 146, High Street, Kensington, electricians. £17 9s. 10d., April 23rd; and £13 8s. 4d., May 2nd.

MIDGLEY, J. AND B., 26, Caledonian Road, Kings Cross, electricians. £19 10s. April 11th.

STONE ELECTRICAL CO., 55, High Street, Stone, electrical engineer. £21 11s. 6d. March 29th.

STOODLEY, P. W. AND CO., 60, London Road, Camberley, electricians. £15 1s. 2d. April 30th.

WILLESDEN ELECTRIC, LTD., Wilsden Works, 843, Harrow Road, manufacturers. £22 7s. 9d. April 12th.

Receiverships.

BAILTON MAGNETOS, LTD.—J. E. Jordan, of 79, Lichfield Street, Wolverhampton, was appointed receiver on May 18th, 1923, under powers contained in debentures dated February 18th, 1923.

BATTISCOMBE AND HARRIS, LTD. J. M. Davies, A.C.A., of 18, Laurence Pountney Hill, E.C.4, was appointed Receiver and Manager on May 15th, 1923, under powers contained in instruments dated December 1st, 1922, and February 16th, 1923.

YORKSHIRE AND DISTRICT ELECTRIC LAMP REPAIRING CO., LTD.—H. Cawood, of 68, Eyre Street, Sheffield, was appointed receiver and manager on May 11th, 1923, under powers contained in debentures dated November 29th and 30th, 1922.

Mortgages and Charges on Limited Companies.

[NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary under the Companies Act, specify the total amount of debt due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt prior to the present creation, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

CENTRAL ELECTRIC SUPPLY CO., LTD., London, W. Registered May 29th, Land Registry charge, securing £300,000 and other moneys secured by Trust Deeds dated July 22nd, 1921, and April 4th, 1923; charged on land at St. Marylebone. *£1 000 000. February 27th, 1923.

CHIPPING NORTON ELECTRIC SUPPLY CO., LTD.—Registered May 18th, £6 000 debenture, to Branch Nominees, Ltd., 15, Bishopsgate, E.C.; general charge. *£4 000. April 4th, 1922.

FULLER'S UNITED ELECTRIC WORKS, LTD., Chadwell Heath. Registered June 4th, £200 000 debentures (secured by Trust Deed dated May 17th, 1923), present issue £180 000; general charge, excluding premises, etc., at Chadwell Heath. *£150 000. December 20th, 1922.

MAGNETIC TRANSMISSION CO., LTD., London, S.W. Registered June 6th, £750 debentures (sealed in blank and lodged with creditor as collateral security), part of £10 000; general charge. *Nil. June 21st, 1921.

NOX ELECTRIC LAMP CO., LTD., Leeds.—Registered May 28th, £662 13s. 4d. debenture, to W. Ellis, The Bungalow, Pudsey, wholesale clothier, and another; general charge.

RADIO, PHONOPHORE AND ELECTRICALS, LTD., Southall.—Registered April 14th, £3 000 debentures; general charge. *Nil. March 10th, 1923.

RE-ECHO ELECTRICAL MANUFACTURING CO., LTD. (late RE-ECHO WIRELESS MANUFACTURING CO., LTD.), London, E.C. Registered June 5th, £1 200 debentures, to W. Taplin, 187, Holland Road, Willesden; general charge.

TINGEY WIRELESS, LTD., London, W. Registered June 4th, £2 000 debentures, to W. Tingey, Castle Moat, Rochester, and another; general charge.

TRIUMPH ELECTRIC MANUFACTURING CO., LTD., Birmingham. Registered June 2nd (by order on terms). Deed varying rate of interest and providing for repayment of principal by instalments in respect of £5 000 (balance outstanding) debentures, dated February 19th, 1923, to W. L. Topple, Hermonho, Wylde Green; general charge.

VOLK (MAGNUS), LTD., Brighton, electrical engineers.—Registered May 26th, £5 000 debentures (filed under sec. 93 (3) of the Companies (Consolidation) Act 1908), present issue £4 200; general charge; also registered May 26th, £1 000 2nd debentures; general charge (subject to 1st debentures).

WAREHAM ELECTRIC SUPPLY CO., LTD.—Registered May 28th, £5 000 debentures; general charge. *Nil. March 6th, 1922.

Satisfaction.

WINSCOMBE ELECTRIC LIGHT AND POWER CO., LTD. Satisfaction registered June 6th, £4 000, registered June 19th 1914, to November 15th, 1921.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

RUSSELL ELECTRICAL APPLIANCES CO., LTD., manufacturing electrical engineers, Belfast Road, London, N. This company is in voluntary liquidation. At the statutory meeting of creditors, Mr. Alfred Neill, the liquidator, submitted a statement of affairs which showed liabilities of £340 (£307 due to the trade) and net assets estimated to realise £555, a surplus so far as the creditors are concerned. It was pointed out that if the stock on the premises was completed it might realise more than the amount at which it was set down. The liquidator added that he was endeavouring to dispose of the business as a going concern. A resolution was passed confirming the voluntary liquidation of the company with Mr. Neill as liquidator.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Bankruptcy Information.

SLATER, Thomas Gascoigne, carrying on business as SLATER BROS., 25, Dickinson Street, Mount Street, Manchester, electrical engineer. First meeting, June 19th, 2.30 p.m., Official Receiver's Offices, Byrom Street, Manchester. Public examination, July 13th, 10 a.m., Court House, Quay Street, Manchester.

Notice of Intended Dividend.

ROTHWELL, Peter, trading at 64, Higher Bridge Street, Bolton, in partnership with Peter Ashworth Rothwell (a minor), under the style of P. A. ROTHWELL AND CO., electrical engineers. Last day for receiving proofs, June 27th. Trustee, J. G. Gibson, Official Receiver, Byrom Street, Manchester.

Partnerships Dissolved.

SEFTON ELECTRICAL CO. (Harry DAVIES and Ernest MURRAY), electrical engineers, 310, Smithdown Road, Liverpool, by mutual consent as from June 7th, 1923. Debts received or paid by H. Davies, who continues the business.

WALKER AND HUTTON (Joseph HUTTON, Ernest THORP and Cecil HAWSON), electrical engineers, 1, Harcourt Place, Scarborough, and the warehouse in Bar Street thereto adjoining, by mutual consent as from January 1st, 1923.

Prices of Metals, Chemicals, etc.

TUESDAY, June 12.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£70 0 0	10s.	—
Electro Wirebars	,,	£74 0 0	—	—
H.C. Wire, basis	per lb.	10 7/16d.	—	—
Sheet	,,	10¾d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2 7/16d.	—	—
Brass 60/40—				
Rod, basis	,,	7¾d.	—	—
Sheet, basis	,,	10¼d.	—	—
Wire, basis	,,	10¼d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£6 2 6	—	2s. 6d.
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 10 0	—	—
Lead Pig—				
English	,,	£27 5 0	5s.	—
Foreign or Colonial	,,	£26 0 0	5s.	—
Tin—				
Ingot	,,	£197 5 0	—	—
Wire, basis	per lb.	2s. 7¼d.	⅛d.	—
Aluminium Ingots	per ton	£120 0 0	—	—
Spelter	,,	£30 17 6	—	2s. 6d.
Mercury	per bottle	£10 5 0	—	2s. 6d.

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2⅛d.
,, (Roll-Brimstone)—,, £8 5s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. ,, £26 10s. per ton, £7 10s.
Boric Acid (Crystals). ,, £50 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 2½d.; plantation 1st latex, 1s. 3d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

194 328 RADIO COMMUNICATION Co. and J. SCOTT-TAGGART. Transmitting signalling systems employing thermionic valves. (5/9/21.)
194 329 A. H. MIDGLEY. Switches or switchboards for controlling electric circuits. (10/9/21.)
194 331 WESTERN ELECTRIC Co. (WESTERN ELECTRIC Co., INC.). Electro-magnetic step-by-step mechanism. (12/9/21.)
194 340 H. BARDT. Manufacture of electrodes suitable for electrolytic operations. (10/10/21.)
194 341 H. BARDT. Storage batteries. (10/10/21.)
194 346 P. H. SHADE and W. HITCHMOUGH. Electric oven light. (24/10/21.)
194 362 H. SEFTON-JONES (C. LORENZ AKT.-GES.). High-frequency telephony with or without wires. (3/12/21.)
194 365 W. DORNIG. Wireless telegraphy antennae. (5/12/21.)
194 369 T. CHARLIER. Electric heating-devices and electric furnaces. (6/12/21.)
194 378 N. W. MCLACHLAN and A. W. LANGRIDGE. Wireless telegraph receiving apparatus. (7/12/21.)
194 379 C. A. M. BUCKLEY. Multi-pole electric switch. (7/12/21.)
173 220 WESTERN ELECTRIC Co. Production of high-frequency electric oscillations (22/12/20.)
173 495 WESTERN ELECTRIC Co. Hand combination telephonic apparatus. (24/12/20.)
194 394 ELECTRICAL APPARATUS Co. and W. M. MORDEY. Electricity meters. (9/12/21.)
194 395 A. P. STROHMENGER. Appliances for use in electric arc welding. (9/12/21.)
194 407 C. F. JOHNSTON. Electrically-operated clocks. (12/12/21.) (Cognate application, 4 723/22.)
194 417 L. MYNNE. Model electric motor. (14/12/21.)
194 419 E T. WILLIAMS. Marking and identifying conductors of electric cables, etc. (15/12/21.)
194 422 CABLE ACCESSORIES Co., F. H. REEVES and A. CRAWFORD. Electric fans. (16/12/21.)
194 424 A. F. SYKES. Electric apparatus for recording sound. (16/12/21.) (Cognate application, 25 141/22. Addition to 160 223.)
194 427 AUTOMATIC TELEPHONE MANUFACTURING Co. and C. GILLINGS Telephone systems. (17/12/21.) (Cognate application, 13 506/22.)
194 428 J. CRANSTON and W. D. LE BAR. Electrolytic cells. (17/12/21.)
186 886 K. HANSEN. Accumulator. (4/10/21.)
194 438 TELEGRAPH CONDENSER Co. and S. G. BROWN. Artificial lines for cable telegraphy. (21/12/21.)
194 449 A. RICKARDS, B. F. WADIA and F. O. READ. Electro-therapeutic appliances. (4/1/22.)
194 455 G. WILKINSON. Thermally-actuated valves and electric switches. (7/1/22.)
194 459 P. G. A. H. VOIGT. Attachment to low-frequency amplifiers for wireless telegraphy or telephony. (10/1/22.)
194 464 J. E. POLLAK (SIEMENS AND HALSKE AKT.-GES.). Telephone systems. (12/1/22.) (Patent of addition not granted.)
194 466 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co., N.Y.). Switches. (13/1/22.)
194 467 R. H. BARBOUR and R. AMBERTON. Electricity meters. (14/1/22.) (Cognate application, 27 914/22.)
194 475 CALLENDER'S CABLE AND CONSTRUCTION Co., LTD., and C. W. KAY. Fault localisation for underground cables. (20/1/22.)
194 480 P. J. GATES. Switchboards. (25/1/22.) (Cognate application, 23 823/22.)
194 501 CALLENDER'S CABLE AND CONSTRUCTION Co. and A. E. WILSON. Insulators for use on transmission lines. (3/2/22.)
194 507 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co., N.Y.). Tanks or containers for transformers and other electrical apparatus. (8/2/22.)
181 676 WESTERN ELECTRIC Co. Repeater circuits for telephone systems. (11/6/21.)
194 514 G PATE and J. H. MERCER. Electrically-driven haulage gears for use in collieries. (16/2/22.)
194 515 G. PATE and J. H. MERCER. Electrically-driven haulage gears for use in collieries. (16/2/22.)
194 521 METROPOLITAN-VICKERS ELECTRICAL Co., LTD., and G. A. CHEETHAM. Electric automatic regulators. (21/2/22.)
194 522 F. H. WATTS. Electrically-controlled direction-indicators for vehicles. (21/2/22.)
183 421 SINGER MFG. Co. Rheostats. (20/7/21.)
194 541 I. H. PARSONS. Electric horns. (11/3/22.)
177 512 AUTOMATIC TELEPHONE MANUFACTURING Co. Switching mechanism for use in telephone systems. (28/3/21.)

APPLICATIONS FOR PATENTS.

May 28th.

13 970 J. W. HOBLEY. Telephone receivers.
13 987 M. W. LAWRENCE. Shield for wireless valves.
14 000 J. F. WRIGHT. Electric distribution board.
14 021 S. S. AUSTIN and C. F. LADD. Crystal detectors.
14 026 PRITCHETT AND GOLD AND E.P.S. Co., W. PETO and H. M. GENESE. Batteries.
14 028 R. R. MCCLURE. Electrically operated oil-cups.
14 039 METROPOLITAN-VICKERS ELECTRICAL Co. Balancing machines. (5/7/22, U.S.)
14 045 W. J. MELLERSH-JACKSON (MATHIESON ALKALI WORKS, INC.). Electrolytic processes.
14 056 H. MCCLELLAND. Variable inductances.
14 066 FULLERS UNITED ELECTRIC WORKS and L. FULLER. Galvanic batteries.
14 081 E. A. GRAHAM. Telephone receivers.
14 083 A. G. L. PENNOCK. Selective controller for radio transmitters.

May 29th.

14 098 W T. BEALE. Safety catches for electric lifts.
14 113 F. RAWNSLEY. Electric fittings for pendants, switch plugs, etc.
14 115 A. HARRISON. Crystal detectors for wireless receiving apparatus.
14 122 S. P. SHAW. Radio-telegraphic variometers, etc.
14 123 A. A. LAWRENCE. Tuning device for wireless receiving apparatus.
14 124 H. W. HALSEY. Crystal detectors.
14 130 A. W. SHARMAN. Interference eliminator for telegraph apparatus.
14 132 R. O. KAPP (SCHERBIUS AND RITTER). Instantaneous switch.
14 135 D. BLENDIAUX. Suspension of electric light bowls, etc.
14 150 W. S. DOE. Renewable primary cells.
14 171 BRITISH SCIENTIFIC INSTRUMENT RESEARCH ASSOCIATION, SIR H. JACKSON, and A. J. PHILPOT. Regulating vacuum in X-ray tubes.
14 177 F. PASCALL. Wireless receiving apparatus.
14 182 H. W. PARKER. Telephone receiver.
14 183 H. W. PARKER. Telephone plug-holder.
14 184 H. W. PARKER. Sound-producing diaphragm.

May 30th.

14 194 T. HOUGHTON. Regulating resistances and switches therefor.
14 226 H. J. FARRELL. Wireless transmitter.
14 231 A. REYROLLE AND Co. and R. C. MINTON. Switches.
14 240 H. MCCLELLAND. Switches.
14 244 WESTERN ELECTRIC Co. Radio broadcasting equipment. (9/6/22, U.S.)
14 245 WESTERN ELECTRIC Co. Taping machines. (31/8/22, U.S.)
14 246 WESTERN ELECTRIC Co. Heat treating apparatus. (22/11/22, U.S.)
14 254 BRITISH THOMSON-HOUSTON Co. (GENERAL ELECTRIC Co., N.Y.). Dynamo-electric machines.
14 270 O. W. BRAIN. Testing faulty line insulators.
14 277 RELIANCE Co. Pressure rheostats. (13/7/22, U.S.)
14 291 FERRANTI, LTD., and S. Z. DE FERRANTI. Rotor bearings of electricity meters.
14 299 W. F. BUBB. Interrupters of wireless telegraphy, etc.

May 31st.

14 311 A. M. TAYLOR. Jointing electric cables.
14 313 A. M. TAYLOR. Electric power transmission by underground cables.
14 317 W. T. COLLINS. Inductance coils for wireless receiving sets.
14 324 W. SILLERY. Cable end connection.
14 342 WESTERN ELECTRIC Co. Heat treating apparatus. (20/11/22, U.S.)
14 343 WESTERN ELECTRIC Co. Heat treating apparatus. (15/11/22, U.S.)
14 346 P. H. DAWE. Apparatus for evaporation of liquids by electrical energy.
14 353 W. J. POLYDOROFF. Wireless receiving circuits.
14 368 RUTGERSWERKE AKT.-GES. Production of arc light electrodes. (9/6/22, Germany.)
14 361 B. ASSERSON. Wireless set combined with gramophone cabinet.
14 371 SIR P. DAWSON and F. W. FAWDRY. Supplying electric power to railways, etc.
14 372 SIR P. DAWSON and F. W. FAWDRY. Transformation of current on electric railways, etc.
14 378 M. KINOSHITA and W. W. NOBBS. Automatic voltage regulator.
14 379 J. BURKE. Electric generators. (15/6/22, U.S.)
14 395 L. H. PADDLE. Electric furnaces
14 397 BRITISH THOMSON-HOUSTON Co. Automatic reclosing circuit breakers (5/6/22, U.S.)
14 399 BRITISH THOMSON-HOUSTON Co. and A. S. FITZGERALD. Protective apparatus for a.c. systems.
14 402 D. MCERLANE. Radio receiving apparatus.
14 409 P. RAMBACH. Combined portable electric heater and lamp.
14 410 AUTOMATIC TELEPHONE MANUFACTURING Co., R. MERCER and F. TENCH. Telephone systems.

June 1st.

14 429 L. E. WOOD. Operating mechanism for switch gear for motors.
14 432 H. G. HARLEY. Magnetic and electro-magnetic thrust bearings, etc.
14 448 and 14 449. L. E. F. FERRETIE. Incandescent safety lamps for mines. (23/2/21, France.)
14 452 E. SCHRÖDER. Switches for electric welding machines.
14 459 L. A. BRISTOL. Electric terminal.
14 461 G. M. SOUTHAM, J. W. BONFIELD and W. J. EADE. Method of tuning coils for wireless receiving sets.
14 468 M. CHILD. Controlling thermionic valves.
14 484 METROPOLITAN-VICKERS ELECTRICAL Co. Moulds for reactance coil supports. (16/6/22, U.S.).
14 485 FULLERS UNITED ELECTRIC WORKS and A. P. WELCH. Microphone transmitters.
14 516 T. LENAGHAN. Automatic telephone systems.

June 2nd.

14 524 T. LENAGHAN. Automatic telephone systems.
14 548 F. G. RIDE and C. TUCKER. Wireless valves.
14 556 W. S. WORTHINGTON. Crystal rectification device.
14 560 METROPOLITAN-VICKERS ELECTRICAL Co., A. F. THOMPSON and T. W. ROSS. Electric substation systems.
14 561 METROPOLITAN-VICKERS ELECTRICAL Co., E. A. ALLARD and E. G. ROBINSON Vacuum electric tube devices.
14 562 H. R. SOAR. Combined terminal bracket and headphone hanger.
14 566 G. F. OSTINS and J. F. SMITH. Wireless apparatus.
14 582 FRANCO-BRITISH ELECTRICAL Co. Devices for advertising signs, etc.

Arrangements for the Week.

FRIDAY, JUNE 15th (To day).
ROYAL INSTITUTION OF GREAT BRITAIN.
9 *p.m.* At the Institution, Albemarle Street, Piccadilly, London, W.1. Discourse on "The Life History of an Alpha Particle from Radium," by Sir Ernest Rutherford.

SATURDAY, JUNE 16th.
ROYAL INSTITUTION OF GREAT BRITAIN.
3 *p.m.* At the Institution. Lecture on "Atomic Projectiles and their Properties," by Sir Ernest Rutherford. (Lecture VI.).

FRIDAY, JUNE 22nd.
PHYSICAL SOCIETY OF LONDON.
5 *p.m.* At the Imperial College of Science, South Kensington, London, S.W. Lecture on "The Excitation and Ionisation Potentials of Gases and Vapours," by Prof. F. Horton.

I.M.E.A. CONVENTION, SCARBOROUGH.

MONDAY, JUNE 18th.
8.30 *p.m.* Reception by the Mayor and Mayoress at the Town Hall.

TUESDAY, JUNE 19th.
10 *a.m.* Opening of the Convention at the Town Hall, followed by the Presidential address and by a paper on "Showroom and Sales Department in a Small Town," by Mr. T. Hall.

WEDNESDAY, JUNE 20th.
10 *a.m.* At the Town Hall. Paper on "Transmission and Distribution of Electricity by Overhead Lines," by Mr. J. E. Storr.
3 *p.m.* Informal meeting to discuss "The Development of Cooking Apparatus."

THURSDAY, JUNE 21st.
10 *a.m.* At the Town Hall. Paper on "Modern Generation Applied to Existing Distribution." by Mr. F. W. Purse.

FRIDAY, JUNE 22nd.
10.30 *a.m.* At the Town Hall, Annual General Meeting.

SATURDAY, JUNE 23rd.
Visits to the Scarborough electricity works and Mr. F. W. Plaxton's motor car works.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION CONGRESS, SWANSEA.

THURSDAY, JUNE 21st.
11 *a.m.* Annual General Meeting, on Mumbles Pier.
11.30 *a.m.* Paper by Mr. A. W. A. Chivers on "Tramways; and Some of To-day's Problems."

FRIDAY, JUNE 22nd.
10.30 *a.m.* Paper on "Tramway Rolling Stock," by Mr. W. E. Ireland, on Mumbles Pier.
2 *p.m.* Visit to National Oil Refineries.

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THE ELECTRICIAN

ESTABLISHED 1861.

THE OLDEST WEEKLY ILLUSTRATED JOURNAL OF

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CONTENTS.

Notes of the Week	669	Parliamentary Intelligence	686
Failures and Progress	671	The Future of the Tramcar	686
Permalloy. By H. D. Arnold and G. W. Elmen. Illustrated	672	Electricity Supply	687
Operating Experience on the Distribution System of the Rand Power Companies. By T. Howard Harris	675	Personal Items	687
Steel-cored Aluminium Cables for Overhead Lines. By H. Krautt	677	Imperial Notes	688
Reviews	678	Foreign Notes	688
Electrical Exhibits at the Gothenburg Exhibition. Illustrated	679	Electric Traction	689
Equivalent Temperature Tests of the Various Types of Electrical Machinery. By Dr. M. L. Kahn	680	Wireless News	689
Advertising in the Engineering Press. By Hugh M. Goody	681	Books Received	689
Engineer Stores in the Great War	682	Tenders Invited and Accepted	690
The New Director of Fuel Research	682	Companies' Reports, Dividends, etc.	691
Electrical Exhibits at the Leipzic Spring Fair, 1923	683	Company Meeting	692
Electrical Imports and Exports	683	Legal Intelligence	692
Institution of Heating and Ventilating Engineers	683	Forty Years Ago	692
Merchandise to Sell and Profit By. Illustrated	684	National Engineers' Association	692
		Commercial Intelligence	693
		Prices of Metals, Chemicals, etc.	693
		Patent Record	694
		Arrangements for the Week	694

Notes of the Week.

Electrical Engineers and Bill Posters.

It is rumoured that in the matter of conventions Scarborough is this year to exceed its century. Whether the actual figure is correct or not it is certain that the twenty-eighth annual convention of the Incorporated Municipal Electrical Association, which opened in that town on Monday, is only one among many and that the multitude is so great that the assemblies are perforce being held in parallel rather than in series. The I.M.E.A.'s companions are the United Bill Posters' Association. The conjunction is not without its significance seeing that the subject of the Presidential Address was publicity. Zola, as Colonel Vignoles pointed out, once said that "the day must come when electricity will be for everyone." Before that day dawns, as the President himself rightly insisted, much education of the public will be necessary. It is not inconceivable that in conducting that very necessary education the assistance of those who post bills may be of value. On the other hand, electricity supply engineers can in many ways help the bill posters. There are such things as illuminated hoardings and signs which give a dual advertisement—boots or patent medicines or whatever it may be—and electricity. We look upon the conjunction of these two bodies as the work of the Fates and as a favourable omen.

Publicity and the Public.

Another omen! The opening meeting of the Convention on Tuesday was held, owing to the large number present, in the Central Hall, Queen Street, instead of in the Town Hall. At an immediately previous meeting held in the same building the subject for discussion was the "Gospel of Power." Could anything be more appropriate? As is our usual custom, we shall give a full report of the proceedings at the Convention in our Annual Power Station issue next week. It is sufficient to say here that the Papers were of a high standard and the discussions well sustained. The Presidential Address in particular is a stirring call to arms. Taking as his text the passage from Zola we have just quoted, Col. Vignoles went on to point out the need for advertising in connection with electrical development. A certain amount of publicity work is being conducted, but nothing like sufficient. It is not sufficient because the possibilities of electricity are illimitable, and can be harvested if only the demand is created. In other words, we must become "lavishers" of electricity rather than sellers, and to do this publicity is necessary first, second and third. An opportunity for doing much more in this direction than has yet been done will be given next year at the British Empire Exhibition. Therefore it is the duty of all to support the B.E.D.A. scheme to which we referred last week, and so ensure that every visitor to Wembley next year will come away imbued with what electricity can do for him in his home, his factory, and his streets.

Permalloy.

On another page of this issue we publish an article dealing with the production, composition and properties of "permalloy." This material was shown at the Royal Society's Conversazione last week, and it may have the profoundest effect on electrical practice, not only in the weak current field, wherein it is to be more immediately employed, but in the construction of heavier machinery. As its name implies, it is a permeable nickel-iron alloy containing nearly 80 per cent. of nickel and rather over 20 per cent. of iron, with small quantities of carbon, silicon, sulphur, manganese, cobalt and copper. The presence of these materials is found to affect the permeability, carbon being specially harmful. Owing to the fact that slight changes in heat treatment produce variations large compared with those caused by small quantities of impurities, this is not so important a matter as might at first sight appear.

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Wonderful Magnetic Properties.

To ensure uniform treatment of the material for testing purposes it is rolled down from billets into tapes, but tests on rods and wire have also been undertaken. Temperature changes below 300 deg. C. have little effect upon the resultant properties of permalloy, but the rate of cooling from just above the magnetic transformation temperature down to 300 deg. C. is a controlling factor. The actual details of the heat treatment, which are of great importance, are given in the Paper. As regards magnetic properties, careful experiment has shown that an alloy with 80 per cent. nickel and 20 per cent. iron gives the highest initial permeability. This worked out at room temperature at 13 000, or more than 30 times the corresponding value for best soft iron. How extraordinary this is may be appreciated by considering that this material, although it has a saturation value of magnetic intensity comparable with that of iron, approaches magnetic saturation in the earth's field. Extraordinary precautions had to be taken to protect samples from the influence of strong magnetic fields. Its susceptibility is enormous, and the hysteresis loss at an induction of 5 000 gauss is only one-sixteenth that of soft iron. Its maximum permeability at this density, 87 000, though not exceptionally high for permalloy, largely exceeds the highest values obtainable with carbon steel. These are wonderful results and we shall look forward to hearing more about this material. As the authors say, the results obtained may "mean the accomplishment of results heretofore believed impossible."

Electricity Supply in Shanghai.

SHANGHAI is one of the few foreign places from which we learn regularly what is being done to develop electricity supply. This is, doubtless, because the electricity undertaking is controlled by an Englishman, and the results obtained are worth noting, if only to congratulate Mr. T. H. U. ALDRIDGE upon them. Last year the sales amounted to 232 457 361 kWh, an increase of 25·4 per cent. over the year before, a figure which compares favourably with Manchester's 158 487 732 kWh and Glasgow's 131 341 783 kWh. In fact, there are only two stations in this country which exceed that figure—namely, Carville and Lots Road, whose position is somewhat different. We wish, however, that Mr. ALDRIDGE had given us his thermal efficiency and pounds of coal per kWh generated so that we could have compared them with the figures obtained over here. We note that the load factor is the exceedingly high figure of 51·5 per cent. This is practically the same as last year, and far exceeds anything we can do over here

Results to be Emulated.

The domestic load is progressing satisfactorily, the heating amounting to 6 716 kW and the cooking to 715 kW. The latter, in spite of the handicaps imposed by the Chinese cook, is going ahead well, as shown by the fact that 111 kW were connected during the year. In all, 21 122 kW were added to the mains during 1922, and in particular all prior records for motors connected have been dwarfed by the results obtained, and an increase in consumption of 28 per cent. under this heading is noted. The plant and distribution network are gradually being modernised, and a large proportion of the latter has been changed over to 22 000 V, while 130 miles of overhead cable has been run from the supply of the outlying districts. Altogether, in spite of a slight diminution in output owing to the trade depression, the results are of a kind on which Mr. ALDRIDGE may be congratulated and which progressive station engineers in this country would do well to emulate.

Railway Electrification Postponed.

IT appears from the debate on the London and North-Eastern Railway Company's Bill, which took place in the House of Commons last week, that the electrification of the main line from York to Newcastle has been postponed, if not definitely abandoned. According to Col. J. M. WILSON the whole question of electrification of the suburban areas served by the Company has been referred to a Committee, and the York-Newcastle plan has been scrapped in order that the problem may be considered as a whole. This is bad news, but it is what we feared. Unlike Sir VINCENT RAVEN, the new chief mechanical engineer of the London and North-Eastern Railway is no advocate of electrification; indeed, he has on more than one occasion expressed the view that steam can still continue to be used successfully even for suburban working. That those who travel daily on the suburban lines served by the Company do not agree with him, as was clearly shown by Mr. BROAD, apparently does not seem to matter. We should suggest that the Committee take the heroic course of consulting Sir PHILIP DAWSON and other officials of the Southern Railway, who have an experience of how electric traction can solve the suburban traffic problem. It may surprise them, but it will do them good.

A Hint to the Prince.

ON June 12th the PRINCE OF WALES formally opened the Nechells station of the Birmingham Corporation and visited the Witton works of the General Electric Co. We hope His Royal Highness was interested by what he saw, for, as we have already pointed out, in his rôle as ambassador of Empire it is important he should realise the part that electricity can and must play in Imperial progress. It is a pity, therefore, that his visits on this occasion should have been so hurried. After recent experiences many members of the Institution of Electrical Engineers will admit that the best way of inspecting an engineering works is individually, and not by companies, and when ceremonial is added this truth is augmented. We therefore suggest to His Royal Highness that if he is interested in electrical progress, as we feel sure he is, he should take an opportunity of visiting certain works quite informally and of discovering what the electrical industry is doing and trying to do.

Turbo-Alternator Requirements.

A Paper by Mr. E. ROTH, published in a recent issue of "La Revue Générale de l'Electricité," should be of great interest to designers, manufacturers, and users of large turbo-generators. It deals, as did Mr. ROSEN in his Paper before the Institution of Electrical Engineers, with the increase in speed and size which has become general since 1913, when a 7 500 kVA machine was built to run at 1 500 revs. per min., until the present time, when a modern 20 000 kVA set operates at 3 000 revs. per min. Mr. ROTH also indicates the changes in rotor construction which has taken place and points out that the test speed for French generators is 10 per cent. above the running speed. He prefers thermo-couples for measuring temperatures, and considers that very high testing voltages insure reliable operation in service. For instance, at Gennevilliers the 45 000 kVA generator, whose working voltage is 6 000 V, have been successfully tested for one minute at 18 000 V, and he lays down that the rotor windings should stand ten times the normal pressure.

Electrical Hot Water.

We wish to remind our readers that next Friday is the last date upon which entries for our electric hot water competition can be received. On the receipt of the entries Mr. J. HORACE BOWDEN and Mr. C. G. NOBBS will get to work, and we shall hope within a few weeks to announce the names of the prize-winners of the twenty-five guineas, fifteen guineas and £5 rewards. But there is more in winning this competition than monetary recompense. The designs will, we hope, be criticised by others than the judges, but will also, we hope, form a foundation upon which further practice will be based. This week at Scarborough the members of the Incorporated Municipal Electrical Association have been discussing electric cooker design. On a future occasion they might well deal with the design of electric hot water equipment. Our competitors should see to it that when this occurs there is some data to go on.

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Failures and Progress.

If we study the lives of engineers from those immortalised by SAMUEL SMILES to that of SIR ALFRED YARROW, a review of whose biography appears in our issue to-day, we find a certain sameness, which, though it teaches a lesson, brings with it a feeling of disappointment. SMILES' theme was that these early pioneers passed gradually, sometimes slowly and sometimes quickly, from failure to success, and that their passage from the depths to the heights was due to character, self-help and persistence. In other words, though they failed at first they achieved success later on. But in STEVENSON'S words, "To travel cheerfully is better than to arrive," and for that reason we sometimes hanker after a biography which shall tell us of some one who strived but who did not succeed. It would be just as interesting and it might be even more useful. For now-a-days it is axiomatic, that we learn more from our failures than from our successes and the amount we learn is probably more when the failure is a real failure than when it is simply a prelude to success.

A Useful Report.

Failing the time when a biography of failures is written (and a compendious volume it will be) we must fall back, not on the lives of men, but on what they have done; in other words, on the reticent notices which from time to time appear in the technical journals and especially upon the annual report of the British Engine Boiler and Electrical Insurance Co., wherein shortcomings in design and performance are pitilessly criticised by independent observers who have the advantages of knowing about what they are talking.

The technical report of this company for 1922 is a reversion to type. Up to 1916 it was the practice of the chief engineer of the company, Mr. MICHAEL LONGRIDGE, to issue each year a review of the more interesting happenings in the company's operations, and though in the new series of which the volume under notice is the first, that personal touch which is so important in such matters will, to some extent, be impossible, the information given is no less useful and will equally repay close study. Sections are devoted to turbo-generators, steam engines and pumps, gas and oil engines, electrical machinery and inspection, and the whole forms an informative review of the present position of design, manufacture and performance in these fields.

Turbo-Generator Failures.

Under the heading of turbo-generators nineteen cases of failure are examined. In one case the rotor of a 5 000 kW turbo-generator running at 3 000 revs. per min. was examined after five months' satisfactory performance. A fine crack, 11 in. long, and originating in the keyway was found in the hub of the first wheel. The wheel was a medium steel carbon forging and had been examined for defects both during testing and after completion. It had evidently been running loose on the shaft. The defect is considered to have been due to insufficient allowance being made when boring the wheel to compensate for the increase in diameter at the eye, due to stresses set up by the centrifugal force of the wheel, to the absence of fillets at the corners of the keyway in the hub of the wheel, and to the key having been originally a bad fit. It is evident, therefore, that a bad accident was only prevented by luck.

Electrical Breakdowns.

On the electrical side several cases are reported. In one, a 15 000 kW 6 500 V alternator running at 1 500 revs. per min. broke down after having been in commission only two and a half months. The machine was seen to be on fire and the end turns were totally destroyed within the twenty minutes taken by the machine to come to rest. The heat of the fire cracked the stator yoke. It was found that the insulation had broken down between one of the stator core bolts and the core and that arcing had taken place along the full length of the bolt, welding together and badly burning the laminations. A similar alternator also broke down after running only a week. This machine was repaired and broke down again after a ten minutes' run. The trouble in each case was due to the vibration of the bolts which were insulated from the stator by micarta tubes, the frequency of their vibration corresponding with the frequency of the machine. Resonance was, therefore, set up, which damaged the insulation and the eddy currents generated in the bolts set up arcing. This failure was overcome by providing heavier end plates and dispensing with the use of bolts.

Dirt—and Dirt Only.

A second failure occurred with a 23 500 kVA machine generating current at 6 600 V and 50 cycles and running at 1 500 revs. per min. After this set had been in operation for eight months the rotor was found to be earthed. On dismantling, the windings were found to be exceedingly dirty, and this was ascribed to the air not being filtered. Cleaning put the matter right—a simple remedy which should have been unnecessary had due precautions been taken.

The Mechanics of High Speed Sets.

In a 12 500 kW set running at 3 000 revs. per min., probably the largest set running at this speed in this country, an earth in the rotor was found to be due to the mechanical collapse of the end turns of windings at both ends. The turns had slipped over one another and the coils had collapsed like a pack of cards. The failure was due to a constructional fault, some of the outside coils having been forced out of a radial position when their supporting wedges were fitted. Centrifugal force had thrust the turns further out of position, and this movement had ended in final collapse. New slot wedges had to be fitted and nearly the whole of the rotor coils had to be rewound. The failure shows the importance of rigid construction when such high peripheral speeds as 27 500 ft. per min. are attained.

Careless Handling.

Under the heading of "Other Electrical Machinery," seventeen cases of failure are described, which space will not allow us fully to deal with here. It is interesting to note, however, that of the failures recorded 38·3 per cent. occurred on armatures and rotors, 18·1 per cent. on stator windings and magnet coils, 12·1 per cent. on commutators, brush gear and slip rings, and 20·1 per cent. on starters. One case of failure may be mentioned as typical. A 10 H.P. 400 V d.c. motor, running at 560 revs. per min., was used for driving a telpher. This motor was fitted with an electric brake, which, becoming defective, was removed. Only a hand brake was left in operation, and this broke when a load was being raised. The result was that the armature of the motor attained an excessive speed and the windings flew out of the slots, the commutator burst, and the machine was wrecked.

The Moral.

An analysis of these failures shows them to be due to one or more of three causes—bad design, faulty workmanship, and improper use. Of these the last is by far the easiest to overcome, and with greater appreciation of what machinery of all kinds can do should gradually disappear. In any event such breakdowns are likely to occur where the equipment is looked after by unskilled staff, and its consequences are not likely to be so profound as in the other two classes. From the failures in the two first classes many useful lessons may be learnt. Good design is useless without efficient workmanship, and the reverse of that proposition is equally true. But if both can be obtained from the knowledge given by these breakdowns, satisfactory experience will have been gained which will make the loss of time and money that this report indicates quite worth while.

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Permalloy.

An Alloy of Remarkable Magnetic Properties.

By H. D. ARNOLD and G. W. ELMEN.

Some years ago it was discovered in the laboratory of the American Telephone and Telegraph Co. and the Western Electric Co. that certain nickel-iron alloys, when properly heat-treated, possess remarkable magnetic properties.* These properties are developed in alloys which contain more than 30 per cent. of nickel and which have the face-centered cubic arrangement characteristic of nickel crystals, rather than the body-centered structure characteristic of iron. The entire range above 30 per cent. nickel exhibits these properties to some degree and offers new possibilities to those interested in magnetic materials.† The most startling results, however, are obtained with alloys of approximately 80 per cent. nickel and 20 per cent. iron, whose permeabilities at small field strengths are many times greater than any hitherto known.

A Revolutionary Change.

For convenience we call these peculiarly magnetic alloys by the general name "permalloy," which serves at the same time to recall their characteristic capability of attaining high initial permeability. The development of permalloy has assured us a revolutionary change in submarine cable construction and operation, and promises equally important advances in other fields of usefulness. It also presents questions of great interest to the scientist and emphasises again the meagreness of our fundamental information about ferro-magnetism. The present paper is intended to give a general discussion of the preparation and testing of permalloy, with sufficient detail to indicate its unusual characteristics.

Manufacturing Details.

In making permalloy we use the purest commercial nickel and armco iron. Our samples for laboratory study are prepared by melting these metals in a silica crucible, using a Northrup high-frequency induction furnace. The particular furnace which we use will conveniently melt a charge of about 6 lb. An analysis typical of the resulting billets is as follows: Ni 78·23, Fe 21·35, C 0·04, Si 0·03, P trace, S 0·035, Mn 0·22, Co 0·37, Cu 0·10. The presence of other elements than nickel and iron is of course to be expected after any practical method of preparation. To determine their effects, samples were prepared in which the usual impurities were present in various proportions. It was found that their presence does affect the permeability of the alloys and that carbon is especially harmful. Since, however, the variations produced by slight changes in heat-treatment are very large compared with those due to small quantities of impurities we have found it necessary for most purposes to require higher purity than that indicated in the analysis given above.

Laboratory Studies of Properties.

In our laboratory studies we have made it a practice to reduce the billets through the forms of rod and wire to tape 3·2 mm. wide and 0·15 mm. thick. Accordingly test samples are available in a variety of forms and conditions. Thin narrow tape is particularly adapted to use in experiments involving heat-treatment, since it possesses a high ratio of area to volume and is easy to manipulate. Fortunately, the entire nickel-iron series can be mechanically worked if sufficient care is exercised, and we have thus been able to use samples of the same size, shape, and mechanical condition in all measurements upon which we have based comparisons between alloys. This practice has also made possible strictly comparable micrographic studies throughout the series.

Permeability Measurements.

Permeability is the magnetic characteristic of permalloy in which we first became interested, and we have used its numerical value as an index in establishing the effects of mechanical and thermal treatments. Most of the measurements have been made in a ring permeameter of special design. The ring sample is prepared by winding twenty or more turns of tape around a disc about 3 in. in diameter. The disc is then removed, leaving the material in the form of a spirally laminated ring with a rectangular cross-section approximately 3·2 mm. by 6 mm. A single massive copper conductor is linked with this ring, and constitutes also the secondary of a transformer whose primary winding forms one arm of an inductance bridge. From the bridge measurements and the dimensions of the ring the permeability of the latter may readily be computed. For most of the measurements 112 cycle alternating current has been employed, permitting the use of telephone receivers in adjusting the balance of the bridge. The ring is sufficiently well laminated so that no serious troubles are introduced at this frequency by eddy currents. This fact was verified by making a number of permeability determinations at alternating current frequencies both above and below that chosen for routine use, and also by comparing the results of ring permeameter tests with those of ballistic tests on specially wound ring samples. The bridge method is particularly well adapted to the measurement of permeability in very weak magnetic fields, since amplifiers may readily be used to increase the delicacy of the bridge adjustment to almost any degree desired. As a matter of conveninece we have usually included in our test programme measurements with fields of 0·002, 0·003, and 0·010 gauss, and on the graph of permeability against magnetising field strength the straight line through these points has been extended to field strength zero. We have called the permeability read from the graph at this point the "initial permeability" of the sample.

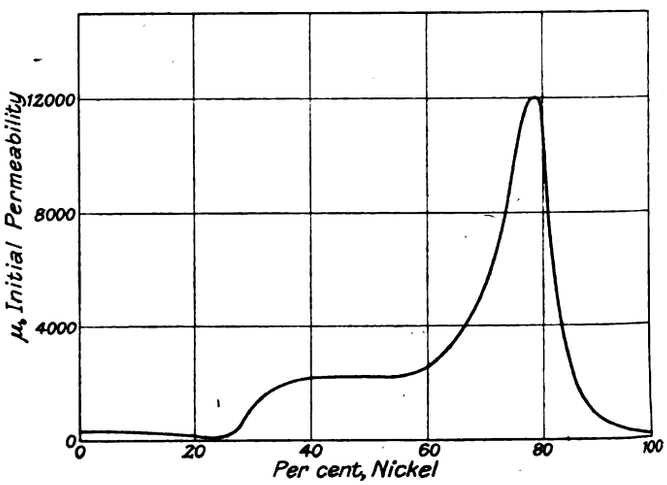

FIG. 1.

The form of permeameter used is especially adapted to making measurements quickly and with minimum handling of the sample, since it makes use of but a single magnetising turn. The ring is laid on suitable insulating supports in an annular copper trough, and placing the copper cover on this trough completes the electrical circuit. In a modified instrument, the "hot permeameter," provided with a heating device, permeabilities may be measured from liquid air temperatures up to about 1000 deg. C. without altering the position of the sample.

Heat-Treatment Important.

The heat-treatment of permalloy is of the utmost importance. To develop its maximum initial permeability it must be cooled not only through the proper temperature ranges, but also at the proper rates. It is obvious that only a small part of any sample can be given the most favourable treatment, since the interior portions of the sample cool at rates which are dependent upon the geometrical configuration and thermal properties of the material and are only indirectly under the control of the experimenter. For these reasons each shape and size of sample will have its own best heat-treatment, and

* The present paper deals with the scientific aspects of these alloys. Some of their important commercial applications have been disclosed in patents, among which may be mentioned the following: Canada, 180 539, November 20th, 1917; Japan, 32 331, March 7th, 1918; France, 533 432, December 9th, 1921; Great Britain, 188 688, November 17th, 1922.

† Permeabilities higher than that of iron have also recently been found at the lower end of this range by J. Würschmidt, "Phys. ZS.," 23, 499-500 (1922) and "ZS. f. Physik," 12, 128-164 (1922); low hysteresis, coercivity and remanence have been observed in the upper part of the range by T. D. Yensen, "J. Amer. Inst. Elec. Eng.," 39, 396-405 (1920); K. Zschiesche, "ZS. f. Phys.," 12, 201-214 (1922).

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it is obviously difficult to establish the correct heat-treatment for a small element of volume characteristic of permalloy as a material. By the use of thin tape, however, we secure fairly uniform treatment of the whole volume so long as the cooling is not too rapid, and fortunately the best cooling rate is not much different from the normal cooling rate of the tape in the open air. It has been found that temperature changes below 300 deg. C. have very little effect upon the resultant properties of permalloy, but the rate of cooling from just above the magnetic transformation temperature down to about 300 deg. C. is a controlling factor. By a long series of experiments a heat-treatment has been established which is especially well adapted to the permalloy test rings already described. They are first heated at about 900 deg. C. for an hour and allowed to cool slowly, being protected from oxidation throughout these processes. They are then re-heated to 600 deg. C., quickly removed from the furnace and laid upon a copper plate which is at room temperature.

Region of Highest Initial Permeability.

Not only does each size and shape of same require its own special heat-treatment, but samples differing only in composition also differ in their most suitable heat-treatments. In

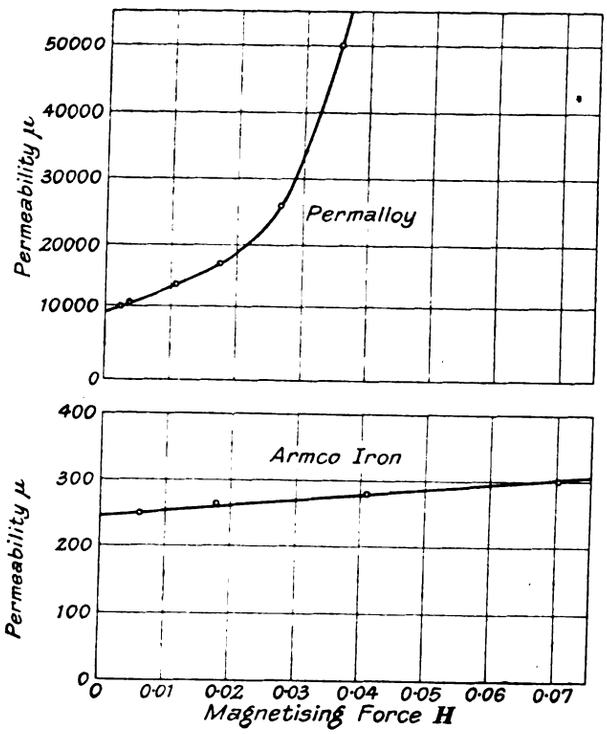

FIG. 2.

our investigation of the nickel-iron series we have not, however, attempted to determine the best heat-treatment for ring samples of each of the many alloys studied. By careful exploration we located the region about 80 per cent. nickel, 20 per cent. iron as the one promising the highest initial permeability and established the best heat-treatment for this composition. Keeping this treatment unchanged, we then re-located the best composition, finding it to be at about 78·5 per cent. nickel, 21·5 per cent. iron. There is a maximum temperature in the equilibrium diagram for this binary at about 70 per cent. nickel,* and it was natural to suspect that the maximum in initial permeability which we had found at 78·5 nickel might be displaced to 70 nickel by proper treatment. The 70 per cent. nickel alloy was accordingly subjected to a great variety of heat-treatments, but no method was found capable of producing in it an initial permeability as high as that readily obtainable in the 78·5 per cent. nickel alloy.

Variation of Initial Permeability.

Fig. 1 shows the general way in which initial permeability has been found to vary throughout the nickel-iron series, when the heat-treatment determined as best for the 80 per cent. nickel alloy is used. It is obvious from what has been said above that too much weight must not be given to the actual values recorded at any composition. Had the best heat-treatment been determined for each sample the curve might have been altered considerably in detail, particularly outside the permalloy range. We believe, however, that its general form is approximately correct. Alloys were made at 5 per cent. steps throughout the range except in the vicinity of 80 per cent. nickel where a great number of slightly different

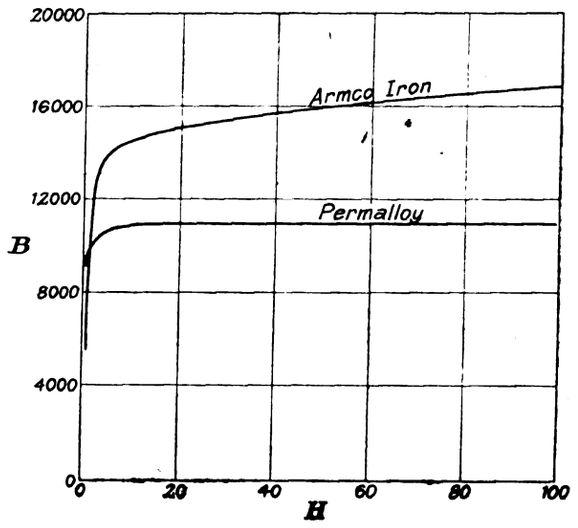

FIG. 3.

compositions were investigated. The chemical analysis rather than the intended composition was used in every case, although the difference was never considerable.

The largest value of initial permeability for permalloy at room temperature which we have so far found in the ring permeameter is about 13 000, more than 30 times the corresponding value for the best soft iron. How extraordinary this is may be appreciated by considering that this material, although it has a saturation value of magnetic intensity comparable with that of iron, approaches magnetic saturation in the earth's field. Unusual caution must therefore be exercised in measuring the properties of permalloy to protect the sample from the influence of stray magnetic fields. Fig. 2 shows, to different scales, the values of initial permeability in similar ring samples of permalloy and of annealed armco iron, and small portions of the corresponding μ-H curves from which these were obtained.

We have measured the magnetisation of permalloy at saturation and find that it is not sensitive to heat-treatment. The saturation values of magnetisation per gram-atom are

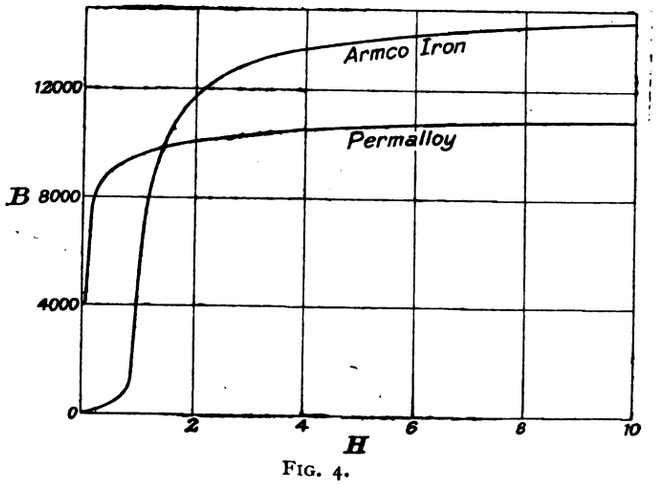

FIG. 4.

known to vary almost linearly with composition throughout the nickel-iron series, from 222 for iron to 59 for nickel.* The value 84 which we have found for the 78·5 per cent. nickel alloy is therefore not abnormal.

Magnetic Characteristics.

The magnetic characteristics of heat-treated ring samples of the same alloy have also been determined through a wider

* " Bureau of Standards Circular No. 58," April 4th, 1916.

* P. Weiss, " Faraday Society Trans.," 8, 149-156 (1912).

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range of field strengths by ballistic methods. Figs 3, 4, and 5 show B-H curves for such a sample of permalloy and for a sample of annealed armco iron. From Fig. 5 is apparent the enormous susceptibility of the former material in the weak fields so important in communication engineering. Fig. 6 shows for the same two materials hysteresis loops carried to a maximum induction of 5 000 gauss. The area of the permalloy loop is only one-sixteenth that of the loop for soft iron. Fig. 7 shows the μ-B curves for these materials. The

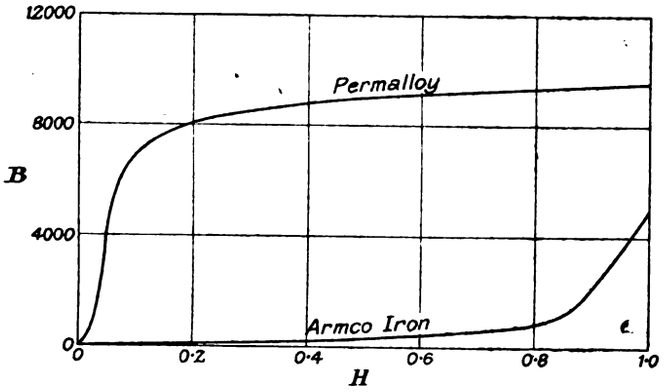

Fig. 5.

maximum permeability here shown, μ=87 000, which is not exceptionally high for permalloy, largely exceeds the highest values obtainable in silicon steel.*

Elimination of Strain.

Early in the investigations it was found that heat-treated permalloy is sensitive to strain, and the routine measurements were so conducted as to avoid this disturbing effect. Separate investigations of the effects of strain upon permeability and electrical conductivity in straight samples, and of the converse effects of magnetisation upon dimensions and conductivity were also undertaken. While these studies are not yet complete, it can be stated that all these effects are large in comparison with the corresponding effects in hitherto available magnetic materials. So long as the elastic limit of the material is not exceeded, the effects due to strain are reproducible and disappear when the strain is relieved. The effects

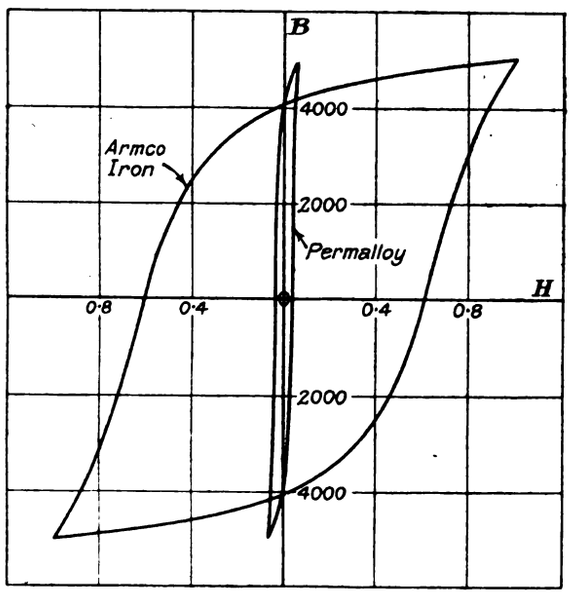

Fig. 6.

of magnetisation, however, show the expected hysteretic properties. As an example of the magnitude of the effects producible it may be stated that between its value in the unstrained condition and about one-tenth that value the initial permeability of a heat-treated strip of certain of these materials can, by the mere variation of strain, be adjusted to any value we may for the moment desire. The range through which the conductivity can similarly be adjusted by strain is much narrower, the maximum reduction being about 2 per cent., which, however, is a large effect compared with that found in other metals.

* T. D. Yensen, U.S. Patent 1 358 810.

Effect of Magnetisation.

The effect of magnetisation in reducing conductivity is as much as 2 per cent. for fields of the order of one gauss. This makes it easy, for example, to measure the earth's magnetic field to within about 1 per cent. by finding the strength of the opposing field necessary to give a permalloy strip its maximum conductivity. It will be noted that the conductivity change which we have mentioned as attainable by magnetisation is the same as that attainable by elastic strain. This is no mere coincidence, for we find that the maximum change due to either cause alone is not further increased by superposition of the other, although the effects of small tensions and magnetising fields are additive. This suggests, of course, that both causes ultimately produce the same change in the mechanism responsible for conduction.

Since the effect of tension upon permeability is in some of these cases so marked, it seemed surprising that the only reported study * of the converse effect, that is of magneto striction, indicated a zero value within the permalloy range. It appeared advisable, therefore, to study the magneto-striction of the series of alloys here available. Preliminary

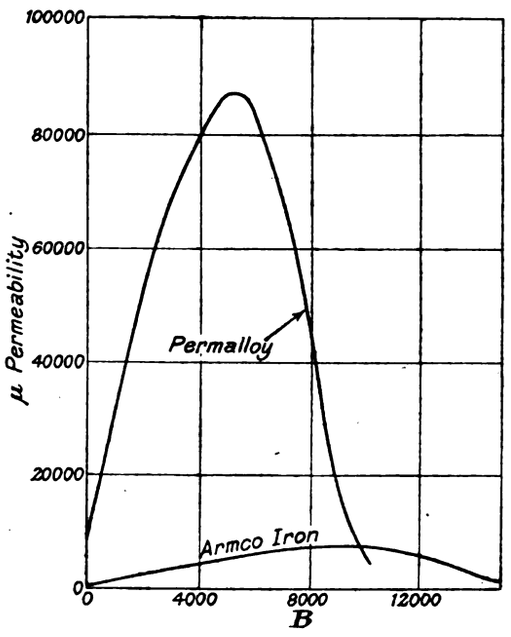

Fig. 7.

results indicate that, under usual conditions of experiment, heat-treated 78·5 per cent. nickel alloy exhibits larger magneto-striction than does iron.

No Mechanical Peculiarities.

With the remarkable ferro-magnetic behaviour of permalloy in mind one naturally looks for analogous peculiarities in its other properties. As has been shown, however, the equilibrium diagram does not point accurately to the composition exhibiting highest initial permeability. The conductivity curve is even less indicative of a peculiarity at this point, its minimum lying at about 35 per cent. nickel. The crystal structure is that of nickel and its type does not change until the nickel content is made less than 35 per cent. Even the mean spacing between adjacent atom-centres, and with it the density, varies continuously throughout the entire range. Our experience in working these alloys also indicates that the series has no mechanical peculiarities at or near 80 per cent. nickel. Not only do these characteristics indicate no abnormality as the nickel content is increased beyond 70 per cent., but, what is more surprising, they are little affected by the heat-treatments which so profoundly change the magnetic properties. So far as has been determined, therefore, it is only in connection with its magnetic properties that permalloy is unusual.

* K. Honda and K. Kido, "Tohoku Univ. Sci. Rep.," 9, 221-232 (1920). It should be noted, however, that their alloys had received different treatments from ours.

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Operating Experience on the Distribution System of the Rand Power Companies.*

By T. HOWARD HARRIS.

The system of the Rand companies includes two undertakings, the Victoria Falls and Transvaal Power Co. and the Rand Mines Power Supply Co. The maximum demand is 148 000 kW and the kilowatt hours generated 800 millions per annum. There are four generating stations of 216 000 kW total capacity; the three Rand stations at Vereeniging are connected by overhead distribution lines, to which three distributing stations are also connected. Transmission between Vereeniging to the Rand is at 80 kV. Most of the distribution is done at 10-20 kV, but for smaller supplies pressures of 2 000-6 000 V are used. There are 162 miles of 80 kV overhead line, 77 of 40 kV, and 107 at 20 kV besides smaller lengths at other prssures. There are also 95 consumers' sub-stations with a total transformer capacity of 311 000 kVA. Practically all the power load consists of induction motors (300-6 000 H.P.) and there are air-compressors driven by synchronous motors, totalling 24 000 H.P., which are very useful for phase control.

The region is semi-tropical and arid, situated 5 600 ft. above sea-level and the daily variation in temperature in winter attains 35 deg. F. During about five months violent thunderstorms are frequent, and a rainfall of 30 in. within a short period is common. Snow is rare but 15 deg. of frost may occur in winter.

The Paper is divided into four sections dealing respectively with overhead lines and cables, transformers, switchgear and general matters.

Overhead Lines.

As indicated, the length of overhead circuits operating at 6 000 V and over is about 400 miles, and of cables about 49 miles. The overhead system deals with about 40 000 kW, the cable system with 58 000 kW. Supports are entirely of steel. Tubular poles are used for low pressures, lattice towers, with spans up to 600 ft. for main circuits. The chief possible sources of breakdown are length failure of insulators, and damage to conductors or guard wire; hence the fewer the supports the better. For each set of loading conditions there is an economical span, but to avoid multiplication of types a double circuit of 0·2 sq. in. copper with 500 ft. spans has been mainly adopted. Spans are adjusted for lighter lines to coad up the tower to the safe limit and voltage of transmission lan be increased economically as demand rises.

Clearances to avoid arcing are highly important, and effects of wind, electro-magnetic effects and snow must be guarded against. The repulsion between conductors carrying a heavy short circuit current may lead to violent oscillations, the force acting being proportional to the square of the current carried and inversely as the distance between conductors. With 2 ft. spacing and 10 000 A (R.M.S.) there is a maximum force of 4·5lbs. perft. run. The author mentions instances of conductors being wrenched from their insulators and entangled by such forces and mentions cases where such trouble has occurred. Suitable spacings, which have proved satisfactory in practice, are also specified. Thus with 80 kV and 60 sq. mm. conductor 9 ft. 3 in., and with 10 kV and 70 sq. mm. conductor 2 ft. has been found to answer.

Horizontal Spacing the Best.

From the electrical standpoint there is no cogent argument for triangular spacing, though it is convenient; for safety the horizontal arrangement seems best. In a recent line conductors are arranged in a vertical plane, but on low voltage lines they are usually placed horizontally. Clearances to ground and tension on conductors are governed by Government regulations. For wind-pressure the assumed value of 30 lb. per sq. ft. seems satisfactory. Tests have been made to determine the width of guard nets necessary to trap broken conductors, and these are tabulated in the original paper. In order to trap a conductor falling from 26 ft. and meeting a conductor 10 ft. below it, a net about 16 ft. wide is necessary.

Insulator Problems.

Insulators are one of the most vital points in a transmission line and their breakdown may arise from (*a*) lightning discharges, (*b*) birds, (*c*) porosity of porcelain, (*d*) temperature effects and (2) mechanical damage (shooting, wire throwing, etc.). The first item is the most important, and it has been found necessary, owing to the severe storms, to work insulators at half the rated voltage specified by the makers. Failures of insulators are also recorded in tabular form, classified as puncture, flash-over, and mechanical. It appears that the failures per 1 000 due to these three causes range from 0·86 to 7·2 according to voltage. Cases of puncture are relatively rare, and most failures are either of the flash over or mechanical type. It is to be noted that the 80 kV lines give the best result (7·2 per 1 000). Over 50 per cent. of breakages in this case are due to destructive flashes; fully half the failures recorded occurred during two exceptionally severe storm seasons. Types of insulators used on other voltages show characteristic properties.

Shackle insulators are practically all of the Hewlett type and have equalled the pin insulators in quality. Porosity, a trouble in the earlier types, has now been overcome. These insulators are arranged in strings, the spacing being at intervals of 10 in., and the number varying from 2 to 6 for 10 to 80 kV. Lighting guard wires are used on all high voltage spans, and are supported on a cross arm. Lately the number has been reduced to two with good results. The guards are useful in damping transient currents, in improving earth-conditions, and affording longitudinal strength to the line. The contact earth resistance of the average mast is about 5 to 10 O.

Protection Against Lightning.

In regard to protection against lightning, the following points are of interest: (*a*) With as many as six conductors, i.e. two circuits, the outer insulators are not more prone to breakdown than the inner ones; (*b*) when the conductor is carried on pin insulators, mounted on the same cross arm as the guard wires, the number of breakdowns is no greater than the average for three conductors; (*c*) secondary 20 kV lines operate without lighting guards over conductors, but merely a steel wire clamped under the cross arm carrying the insulator, with quite normal results. Practically all breakdowns have occurred on lines when in commission, though instances of failures on lines out of commission have occurred. There are danger zones, and certain lines are specially prone to damage of insulation during storms. This is illustrated in the original paper by an analysis of a length of 40 kV line with Merz-Price protection. Lines with larger sections of copper also seem more liable to damage. Normally pilot cables are buried under tower lines to provide communication and also accommodate the pilot wires which are a feature of the Merz-Price system. But a few lines are not so protected, bare telephone wires being supported on the towers. Various precautions, such as careful jointing, use of insulators with large leakage surface, careful transpositions, use of drainage coils and use of fuses, links, spark gaps, etc., made as for 5 000 V power circuits, are enumerated. By the aid of such precautions good results have been obtained, when communication is over overhead lines alone. But when speaking takes place partly through overhead lines and partly through underground telephone cables, connected by a transformer, communication is greatly inferior. The electrostatic pressures induced respectively in 34 m. overhead 80 kV lines, and 17 m. 20 kV lines are 3 000 kV and 500 kV. The vertical distances between power and telephone circuits are 18 ft. and 6 ft. respectively.

Pilot Cable Troubles.

The 49 miles of 20 kV cables have worked well, and no case of breakdown due to faulty design of cable or joints has occurred for eight years. Pilot cables are now laid underground. They were originally mounted on masts 3 ft. high under the conductors, but much trouble was experienced through electro-magnetic induction. Cables suspended separately 200 ft. from the power line gave satisfactory electrical results, but other troubles arose through extremes of temperature, causing expansion and contraction of the lead sheath and crystallisation. Experience with cables buried in the ground has been good, except where organic acids exist in the soil.

Transformer Problems.

As regards transformers, demands of the consumer include chiefly reasonably steady voltage and frequency. At generat

* Abstract of a Paper read before the South African Institute of Electrical Engineers.

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ing stations the step-up transformers can have any desirable value of reactance as a protection against short circuits, but outside the station the voltage variation with load is out of control unless special regulation is provided. With a 0·7 lagging power factor there is an inducement to reduce the reactance as much as possible. The daily load factor on the system (76 per cent.) is good, and the impedance ratio per cent. of most transformers is 2·15. Most of the transformers are connected to overhead lines, and the duty imposed on them is arduous. The paper refers mainly to 260 transformers of capacity from 250 to 4 000 kW, of which 198 are of the shell type and the remainder core. Tests were originally made on both types of 1 000 kW capacity (21 000/525 V), thermo-couples being imbedded to determine temperatures. Figures, summarising the results of such tests, given in the original paper illustrate the superior oil circulation of the shell type. For shell and core transformers the maximum copper temperature was 100 deg. and 83 deg. respectively; in the iron the corresponding temperatures were 92 deg. and 89 deg. The permissible rating was fixed 35 per cent. higher for the shell form. Particulars are given of the oil now being used in transformers, which is of specific gravity 0·85 and viscosity of 40 per cent. at 15 deg. C. The puncture-voltage is 40 kV between ½ in. discs 0·2 in. apart. The design of the shell transformer provides for the sealing of the main transformer tank except for a connection by a small pipe. The expansion tank is fitted with a float covering the whole surface of the oil, and the amount of air in contact with oil is thus reduced to a minimum. At temperatures not exceeding 80 deg. C. the amount of sludging with these oils is negligible, but various points for consideration in this respect are mentioned. A good combination would seem to be: (1) A tank of mild steel with welded joints and expansion tanks, which stands transport and does not affect the coil; (2) the use of coils insulated solely with manilla paper overlapped with linen tape. Tanks should not be lined with a lead alloy, as lead oxide is apt to be formed. In dusty districts entrance of matter is liable to give rise to sludge unless the transformer is dust-proof. The shell type affords little lodgment for sludge, and the high rate of flow of oil prevents it depositing on coils, etc.

The rectangular coils of the shell type are well supported at the long sides of the rectangle by the surrounding magnetic circuit. At the short ends wooden packing pieces are arranged between phases for support. This arrangement has proved quite satisfactory. Typical load-curves of transformers are given in the original paper.

Maintenance of Transformers.

As transformers are bulky to transport and expensive to repair, maintenance is of great importance. The performance of the 260 transformers under consideration has been analysed over a period of seven years, and the total breakdowns have been 93—i.e., 5 per cent. per annum. Taking the shell transformers separately, annual breakdowns work out to 2½ per cent., so that the corresponding figure for the core type must be 14 per cent. Various sources of breakdown in core transformers are discussed. These may be divided as follows:—

(1) Flashing over lid bushings	20 per cent.
(2) Buckling and movement of coils under short circuit	26 per cent.
(3) Damage due to lamination of the iron circuit due to vibration	13 per cent.
(4) Water finding access to windings	11 per cent.
(5) Burning through overheating or displacement of connections between coil and lid bushings	10 per cent.

On the other hand, weak points in the shell type have proved to be:—

(1) Breakdown between high tension tappings, where brought through cover	25 per cent.
(2) Overheating of terminal boards	6 per cent.
(3) Breakdown of insulation between turns	56 per cent.

It will be seen that the two types have scarcely any weaknesses in common. Some have been eliminated during repair, others, such as (1) and (3) in the shell type, are the result of special arrangements not really necessary. Items (2) and (3) in the core type are inherent in the design. The latter trouble (damage to laminations) appears to arise through high voltage between turns due to transients. They have occurred only on one batch of transformers insulated at the conductor with double cotton. When thin manilla paper overlapped with linen tape was used on identical transformers there was no breakdown. The results of tests of the respective materials when new, after immersion for 3½ months in oil at 106 deg. C. and after 13 months' similar treatment, show that the heat improves the electrical properties of both samples. But the manilla and linen tape sample has five times the breakdown voltage of the double cotton. It is deduced that with the latter material the breakdown surge voltage is about 3 200 V, as compared with 16 000 V for the former. However, the trouble has not been serious, as in seven years only 20 transformers broke down, with an average of 198 shell type in operation. The shell type is also advantageous as regards routine maintenance, as it only requires overhaul at five years' intervals, whereas the core type should be lifted at least every two or three years. It is considered that the shell type has proved far superior for the conditions here existing.

At the main distribution station shell type transformers (water-cooled and oil-filled) of 4 000 kW kVA capacity are in use. The only failures that have occurred have been between turns, but the percentage per annum was high. At least half can be traced to general system disturbances or cable failures; the remainder occurred during severe lightning storms. Provided the cooling water is kept free from scale no overheating occurs, notwithstanding frequent overloading. In the power stations, where all the transformers are oil-filled and water-cooled, ranging up to 12 500 kVA, experience has again been in favour of the shell type.

Switchgear.

Switchgear has to fulfil the following duties:—(*a*) Transmission between power stations or distributing stations; (*b*) distribution to consumers' stations on a ring main or radial main principle; and (*c*) transformation of voltage to suit the needs of the consumer. Switchgear is readily obtained to deal with the normal load, and it is only fault conditions that bring to light weakness. Sections of type (*c*) have relatively high impedance so that fault conditions are light. Classes (*a*) and (*c*) have quite low impedance, and the kVA dealt with under fault conditions may be heavy. However, the failures recorded only amount to 2 per cent. for all switches over a period of eight years, and of these only 25 per cent. involved serious interruption of supply. Feeder switches, for which the percentage is 3 per cent., have been the chief source of failure. The conditions, involving transmission at 20 kVA, are obviously severe, and demand special switch design. As illustrating the nature of such failures, a case is mentioned when the roof of a building 100 ft. by 24 ft. was lifted, iron doors buckled and thick brick walls blown down, while the blast has blown over an iron fence 30 ft. distant from the standard brick sub-station. Switch contacts have sometimes survived fairly violent explosions. The effect in the switch seems to be associated with rapid expansion rather than great volume of vapour. The chief problems are to provide quick and long break to ensure breaking of the arc, and to avoid the first concussions so that the tank is not overstressed by hydraulic pressure; to delay the mixture of residual vapours with air until they are sufficiently cooled to be harmless, and to limit the kVA interrupted by the insertion of current-limiting devices during the switch operation. A curve is presented showing the percentage of switch failures during 1916–1921. The diminution from nearly 7 per cent. to a little over 1 per cent. indicates the improvements that have been made.

Earthing of the System Neutral.

The neutral point of each of the sectional systems is earthed at the power station or distribution station through a star-mesh connected transformer with a resistance in series with the star. Water resistance has proved better than metal resistance, and the values range from 4 Ω with 10 kV to 30 Ω on 80 kV. Where a system is earthed at two points, twice these values is used at each earthing point. This method has proved most beneficial in the event of the earthing transformer being inadvertently disconnected.

During storm disturbances flashing sometimes occurs on the insulators of current transformers, but is less liable to occur when there are metal shunts across the primary terminals. Carborundum shunts tend to shatter and are dangerous.

Lightning Arresters.

Originally elaborate gaps with shunting resistances were used as lightning arresters, but experience showed that they

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increased rather than reduced the hazard. Horn gaps with water resistance sufficient to limit discharge current in series were installed in all stations working at 10 kV or over. In the early days much trouble was experienced on feeders equipped with these arresters. It was the proper method of earthing the neutral point that made the use of such arresters possible. As regards trouble from lightning discharges, arresters seem of little benefit, and occasional flashing over line insulators appears inevitable. This happens occasionally on 10 and 20 kV systems, but the consequences are usually not serious. On the 40 kV system it rarely occurs; yet transformer windings on the 80 kV system have given way when those on the 40 kV system did not. The arresters cannot give protection. In America increase in coil insulation has been tried as a remedy. The underground 20 kV cables have given rise to more trouble than overhead lines. Here again experience confirms the value of earthing the neutral point rather than the benefits of arresters.

General Design of Stations.

In conclusion, the author summarises some of the leading features in general design. The bulk of failures have arisen in the switches, and experience shows that, in the event of a serious breakdown, it is desirable that each switch should be isolated in a separate chamber with separate means of access. Duplicate busbars are considered unnecessary, except where desirable for running groups of feeders separately. Arresters are located in the open air at the terminus of the incoming feeder, the connection to mains being made underground. This reduces the height of the building considerably, and the experience has been quite satisfactory, no cable having broken down.

Although the Paper is largely devoted to a discussion of sources of failure, it is pointed out that nowadays breakdowns are not at all frequent. In spite of the severe conditions, the reliability compares quite favourably with that of other systems.

Steel-cored Aluminium Cables for Overhead Lines.*

By H. KRAUTT.

Aluminium lines with steel cores have been used in America for over 15 years, and are now finding extensive use in Europe. In the present article, various contributions to this subject are discussed.

In the "E.T.Z.," vol. 42, p. 1447, Hiller discusses the reasons which have led to the introduction of steel-cored aluminium cables. There is no objection to the use of aluminium as conductor provided its purity is not below 99 per cent. A pure aluminium cable, the strands of which have a tensile strength of 19-20 kg./mm.², must not be loaded beyond 7-8 kg./mm.², otherwise the factor of safety falls below 2. This is due to the fact that the tensile strength of the cable is 10 per cent. below that of the strands, and also because a cable should not be loaded beyond the elastic limit, which for aluminium is 10 per cent. below the tensile limit. With long spans, this leads to large sag, entailing longer poles and longer distance between phases. These disadvantages are obviated by increasing the permissible loading by the use of a steel core.

Objections to Steel Core.

Two objections were originally raised to the use of the steel core—the danger of corrosion due to electrolytic action between steel and aluminium, and the different expansion of the two metals under heat. Experience has proved, however, that with well galvanised steel wires, corrosion and rust need not be feared. Also the fears based on unequal extension proved groundless, even when the aluminium was regarded purely as a load on the steel wire. The latter assumption is not sound, even when the aluminium is not fixed to the poles, because owing to the friction between the two metals, the aluminium always shares the load.

The section of the aluminium sheath depends mainly on the current, or on the voltage drop in an equivalent copper conductor. The section of the steel core depends on the factor of safety chosen and on the tensile strength of the steel. The latter varies from 70-150 kg./mm.², but it is not desirable to exceed 125 kg./mm.² because of mechanical difficulties in manufacture and erection. When a large section is needed to avoid corona loss with 100 kV, it is better to increase the aluminium section rather than use a thicker steel wire of less specific strength. Tests show the best ratio of steel to aluminium section is 1 : 4—for the same tension, this gives the same sag as the equivalent copper cable. The wind pressure on the steel-cored aluminium cable will be greater, because of the larger diameter, though this entails an increase in weight of the poles of 2-3 per cent. only. More important is the number of layers of aluminium wires on the steel core. The best arrangement is the double-layer aluminium sheath because of the better protection of the steel core against moisture, and the fact that the inner layer remains to carry the current in case the outer layer is damaged by a flash over.

A Table for Manufacturers.

The following table, based on the above considerations, has been drawn up for use by manufacturers. It is assumed that the aluminium alone conducts the current, and, in the comparison with the copper equivalent, that the steel carries the whole weight.

The amount by which the aluminium sheath assists in sharing the mechanical load has been investigated in several recent papers. The papers here discussed are by H. Schenkel, "E.T.Z.," vol. 43, p. 1153; K. Bittler, "B.B.C.," Mitteilungen, February, 1922; and a report by Dr. Berling, of the Felten and Guilleaume works at Cologne. The methods are compared at length, and an example is worked out under each group of assumptions.

* Abstracted from "E. u. M.," vol. 41, p. 113.

Equivalent Copper Section.	Steel Cable.				Aluminium Cable.				Overall Diam.	Section Ratio.	
	No. of Wires.	Diam. of Wires.	Diam. of Cable.	Section of Steel.	No. of Wires.	Diam. of Wires.	No. of Layers.	Section of Aluminium.		Aluminium. Copper.	Aluminium. Steel.
16	7	1·2	3·6	7·9	8	2·1	1	27·7	7·8	1·73	3·5
25	7	1·5	4·5	12·4	8	2·7	1	44·1	9·8	1·76	3·55
35	7	1·6	4·8	14·1	8 30	3·1 1·6	2	60·3	11·2	1·72	4·29
50	7	2·0	6·0	22·0	30	2·0	2	94·2	14·0	1·88	4·28
70	7	2·3	6·9	29·1	30	2·3	2	124	16·1	1·78	4·28
95	7	2·7	8·1	40·1	30	2·7	2	171	18·9	1·80	4·3
120	7	3·0	9·0	49·5	30	3·0	2	212	21·0	1·76	4·3
150	7	3·3	9·9	59·9	30	3·3	2	256	23·1	1·71	4·3
185	1 18	2·3 2·2	11·1	72·6	30	3·7	2	322	25·9	1·74	4·4
210	1 18	2·5 2·4	12·1	86·3	30	4·0	2	377	28·1	1·79	4·37
240	1 18	2·7 2·5	12·7	94·1	30	4·2	2	415	29·5	1·75	4·42

Diameters in mm. Sections in mm.².
Tensile strength: Steel Wire, 120 kg./mm.².
Tensile strength: Aluminium Wire, 19 kg./mm.².

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Reviews.

Alfred Yarrow: His Life and Work. By ELEANOR C. BARNES (Lady Yarrow). (London: Edward Arnold and Co.) Pp. 320. 10s. 6d. net.

Biography to me is the most interesting part of literature, but I rather rebel that I am offered a hundred political biographies to every one which concerns itself with men whom I can really understand, whose life was spent in ways that are more or less comparable to my own, whose aims and aspirations and ideals bear some relation to those which make life to me interesting and worth while. I therefore approach the life of Alfred Yarrow, by Lady Yarrow, with a prejudice in its favour. I find it a simple narrative of the doings of a busy and successful man, embellished by no poetic flights, free from any straining after literary finish, a mere catalogue of achievement. It is the sort of book that if I had the power I would make every economist and every student of political economy read, mark and learn. If economists had to pass an examination in industrial biography, economics might have to be re-written. Mr. Tawney, for instance, ought to be made to read every line of this book. He has given us a literary gem, which he calls "The Acquisitive Society." He wastes his genius and his life under the delusion that business is built upon a basis of *grab*, but here we have Miss Barnes writing 300 pages about every detail of the life and thoughts and actions of a great business man; a man who had no use for Socialism; a man who typifies in many ways all that the Socialist thinks so evil; a man who met with exceptional success, who acquired tremendous wealth, and from beginning to end of the 300 pages there is not a line to suggest that he was at any time actuated primarily by the desire to gain. Indeed, when he has made it, he gives away most of his money and indulges in homilies on the dangers of wealth.

The history of Sir Alfred Yarrow is the history of English engineering achievement from the middle of the last century down to the present day. Miss Barnes tells how he, with a few kindred youthful spirits, founded the Civil and Mechanical Engineers' Society in May, 1859, and takes us right through to his election as a Fellow of the Royal Society in May, 1922. She starts us in 1868 with the building of a steam launch for Colonel Halpin, which was made for £200 and sold for £145, and takes us step by step right up to those wonderful achievements in naval science which counted for so much in the War. I do not remember a book which touches on so many interests, or appeals to a wider class of reader. Although concerned with engineering in its most highly developed form, the book will be a delight even to the schoolboy with a mechanical turn of mind.

The life of Yarrow covers so many periods and so many interests that it is impossible in the space of a short review to touch upon more than one or two points that appealed to me while going through its pages. Sir Alfred, for instance, has a very poor opinion of governments and business institutions. He seems to have suffered on several occasions from the habit of governments of copying drawings and designs. On one occasion when he thought he had secured a contract with the French he went to Paris to sign the document. To his amazement, the drawings that he had submitted in good faith were returned to him with an intimation that there was no business to be done. But the pinholes in the corners of all the plans were sufficient evidence that the French Government had taken all that Yarrow had to sell without giving themselves the trouble of paying for it. In this connection Yarrow singles out the Austrian Government as adopting a higher standard than all the others; it was the practice of the Minister of Marine in Vienna to insist that Yarrow boats and their machinery should not be copied by the Austrian shipbuilders without fair remuneration being paid for the use of the design.

The book incidentally contains the history of the rise and development of organisation among employers in this country. The story of the engineers' strike of 1897, to which a whole chapter is given, is worth reading if only to bring home to us the length of the road that we have travelled in these matters in the short space of twenty-five years.

Sir Alfred Yarrow's views on many things are a little out of tune with what is popular among those whose opinions are based rather on theory than on practice. But his views as to the right use and disposal of wealth do not so easily lend themselves to criticism. He regarded the disposal of surplus wealth as a difficult problem which had to be solved. He solved it for himself by a lavish support of charity. He has done more for the London Hospital than perhaps any other single benefactor, while his convalescent home for children and other big endowments are only indicative of the innumerable smaller benefactions that have become almost a matter of routine with him.

The book does not pretend to be a critical biography, but after all that does not matter. If it is merely regarded as a catalogue of things done by one man without the aid of committees, and without even the assistance of a board of directors, it is a very useful contribution to the thought of the day.

E. J. P. BENN.

Telephony. By T. E. HERBERT. (London: Sir Isaac Pitman and Sons, Ltd.) Pp. 868. 18s. net.

This book is defined by the author as a self-contained elementary account of the basic principles of telephony linked up to the practice of the British Post Office. It is designed to meet the need of students desirous of passing the City and Guilds examination in Grade I; but the author has in many directions carried the reader considerably beyond this stage. While the author does not profess to have produced a book on the whole science and art of telephony, yet it need not, and should not, be considered merely as a "cramming" aid to the student seeking certificates.

The book consists of no less than twenty-six chapters packed full of informative matter illuminated by 618 illustrations. The latter are not only well-conceived, but extremely well executed; and one is glad to note that the author has not taken the path of least resistance and borrowed manufacturers' illustrations, but has developed a number of excellent perspective drawings of equipment of all types.

The first eight chapters deal with the physics of the subject: cells, their arrangement, joint resistance, magnetization of iron, measurement of current, of e.m.f. and of resistance, capacity, induced e.m.f., and the elements of alternate current theory find place here.

Chapter 9 is a very readable one dealing with the theory of sound, the fundamentals of speech transmission, and the telephone receiver.

Chapter 10 is a similar chapter on transmitters. Chapter 11 is concerned with battery and magneto subscribers' stations; the succeeding chapter with house telephones, and chapter 13 with auxiliary apparatus such as indicators of various types, jacks, plugs, cords, relays, meters, repeating coils, lamp signals, lamp jacks, etc. This chapter is very completely illustrated and a feature that is added and may be considered commendable is the particulars given as to res. of coils, minimum operating current, maximum release current, contact pressures and clearance for the different types. Similar particulars are given of the various types of switchboards in use. The author has quoted in all cases the official nomenclature of the British Post Office, so that the Department's apparatus may be identified or recognized. Far too many books on this subject have been written of which it may be said that their information is qualitative and not quantitative, and the book under consideration is a welcome relief in this respect. Chapter 15 details the various types of board, and the line and cord circuits of the C.B.S. system. The treatment here is very full and clear.

Common battery working in all its aspects forms the subject matter of the sixteenth chapter and is one of the most interesting sections of the book. Sections of C.B. boards, the lay out of the face, and the keyshelf, the theory of the substation, extension sets, etc., are all treated fully. Private branch exchanges of various types have a chapter to themselves. Junctions and trunk working absorb the next two chapters. Both these sections of the subject are completely described and the diagrams are beyond praise.

The latter sections of the book deal with the power plant, protection, internal wiring, routine testing of main lines, and the localisation of faults. Routine and fault testing in C.B. exchanges complete the testing section. A chapter is devoted to transmission, superposing, cable balancing, and inductive disturbances. The construction of aerial and underground routes is very thoroughly handled, and here again, the illustrations are praiseworthy. The final chapter deals with the thermionic valve and the telephone repeater.

As has been indicated, this book is not intended for the telephone engineer, but for the student. To the latter it may be confidently recommended as being a sound and adequate treatment of the subject. Wherever a knotty point arises, the author, where possible, provides an explanatory sketch. The printing and general get-up of the book are excellent.

H. H. HARRISON.

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Electrical Exhibits at the Gothenburg Exhibition.

What Sweden is Doing in the Domestic Field.

The Jubilee Exhibition which is now being held at Gothenburg, Sweden, gives the visitor a good opportunity of obtaining information as to the designs and manufacturing methods now being employed by Swedish electrical firms. It is, of course, well known that the water power of Sweden is being largely developed for electricity supply and electric traction purposes, but the home-grown equipment that is being produced to enable the energy so developed to be usefully employed is less familiar.

Small Demand for Domestic Apparatus.

We understand from a special correspondent who has recently visited Sweden that the main part of the left wing of the Machinery Hall at the Gothenburg Exhibition is devoted

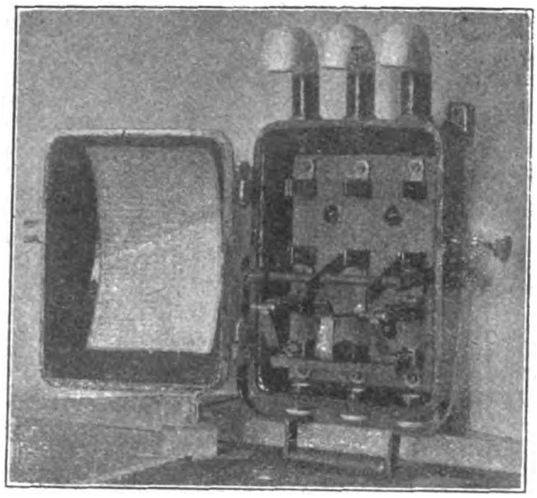

FIG. 1.

to electrical enterprises. After an inspection of these exhibits, he was particularly impressed by the small apparent demand for heating and cooking apparatus. A number of electric irons, kettles and coffee pots were in evidence, but the exhibitors stated quite frankly that very few of these apparatus had been sold because as yet they were too expensive to be popular.

One interesting form of electric iron exhibited was fitted with a white porcelain upper part. We believe examples of

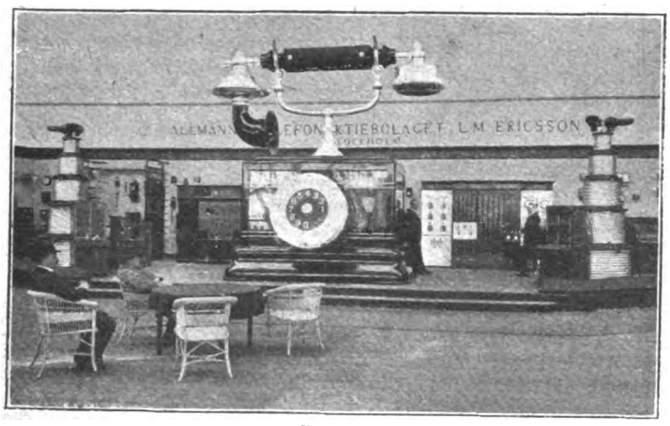

FIG. 2.

this equipment have appeared in this country. It is priced at 15 kr. (about 17s. 6d.), and is loaded at 330 W.

Electrical water heating is also receiving a certain amount of consideration, as was evidenced by a bath geyser which is priced at 600 kr. (about £36), and is loaded at 1 000 W. This geyser had a thermometer let into the upper face of the tap channel so that the heat of the water flowing into the bath was automatically registered.

On the lighting side, our correspondent noticed some ingenious fittings for workrooms, dentists' and doctors' consulting rooms, and hospitals. The lamp in these fittings is contained in a metal shade, the flex of which was wound on a drum, so that contact is established with a source of supply whatever the position of the lamp. This arrangement, it is claimed, makes a very flexible fitting, but it would be interesting to learn how it works under ordinary factory conditions.

A Protective Device for Squirrel Cage Motors.

On the engineering side an interesting protective device for squirrel cage motors was exhibited by the Elektriska Aktiebolaget. This was invented by Mr. Edwin Johnson of Partille, and is illustrated in the accompanying photograph (Fig. 1). As is well known, the starting current of a three-phase motor is several times larger than the normal operating current, and the fuses or circuit breakers have therefore to be set so that they will not operate at this excess current, and therefore may not open circuit on an overload of as large as 100 per cent. If for any reason one of the phases is cut out of circuit, the motor will operate on the two remaining connections as a single phase motor and take a current about 50 per cent. in excess of normal, and so sooner or later bring about a burn-out. The conditions are even more dangerous if the motor is started up with one of the leads broken, as the current then

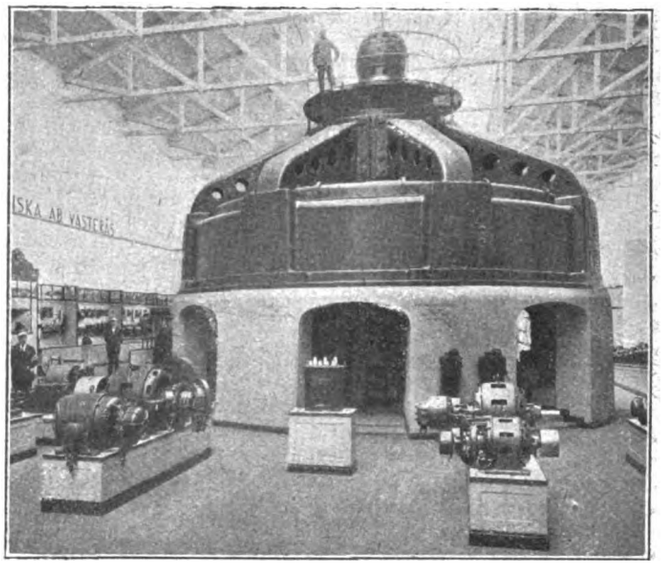

FIG. 3.

rises to several times the normal value. A real effective protecting device must, therefore, not only allow the motor to be started and stand momentary overloads, but also protect the motor, if it runs on a prolonged overload.

Mr. Johnson's apparatus consists of a triple-pole quick-break knife switch, connected in series with an automatic triple-pole contact device enclosed in a cast-iron box. This device consists of fuses in the phase circuits connected to the two outside terminals, and a mechanical contact in the phase circuit connected to the middle lead, the latter being arranged with a trip so that it always opens when one of the fuses blows. If a fuse blows, therefore, two leads are opened and the motor stops. The usual fool-proof arrangements which prevent the switch being closed when the box is opened are fitted.

The Birkar Regulator.

Another novelty shown was the Birkar regulator, which has been designed as a simple, reliable and durable apparatus for use with electrical equipment taking current up to 10 A. It consists of two contact arms enclosed in an evacuated glass tube, these arms being brought together or separated by means of a "bi-metal" plate which is specially sensitive to changes of temperature.

This device is claimed to be particularly useful for such applications as signs or on circuits where it is desirable to limit the current to a particular amount, while as a temperature regulator it can be employed in conjunction with flat irons, cooking apparatus and radiators.

Our illustrations, Figs. 2 and 3, show respectively a view of the Ericsson stand in the Machinery Hall, and another view of the same Hall.

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Equivalent Temperature Tests of the Various Types of Electrical Machinery.*

By Dr. M. L. KAHN.

The normal rating of electrical machinery is usually defined as the output which the machine can give continuously without exceeding certain temperature limits. To ascertain the temperature-rise of a given machine is therefore of great importance. On small machines this test presents no difficulties. Two large machines can be tested together by the Hopkinson method—one running as a motor and the other as a generator. But the machines are actually working at or near full load.

A single machine of large output cannot usually be loaded to its full capacity, and the temperature-rise can be ascertained only by equivalent heat tests. The machine is so connected that the losses in the core and windings are equal to the full-load losses, whilst the power required to drive the machine at full speed corresponds to these losses only.

There are two possible methods of testing, (*a*) the watt current is reduced to a neligible amount, while full voltage or over voltage is maintained—a " no-load run "—and (*b*) the voltage is reduced and full-load current flows through the windings—a " short-circuit run." These tests can be employed either singly or in combination, but obviously only give an indication of the temperature-rise expected at full load, and the figures obtained need the interpretation of care.

Direct-Current Motors and Generators.

The application of such tests to direct-current machines is simple. For the no-load run the machine is either driven as a generator at full voltage on open circuit or tested as a motor running idle at full speed. The open-circuit voltage of a generator should correspond to the normal terminal voltage *plus* the p.d. in the machine at full load. In the case of a motor, the voltage-drop is to be deducted. For the short-circuit tests the line terminals are short-circuited. The machine is driven at full speed, so excited that full-load current flows in the armature, interpole coils and series coils. To counteract the excitation of the series coils the shunt winding is so connected that the magnetomotive forces of the two windings oppose one another.

Apart from the windage and friction losses, the total loss at full load is the sum of the losses during these two runs; the temperature-rise at normal full load can therefore be approximated to by adding the temperature-rise measured after each of the two tests.

The author, in the original paper, analyses the losses. Losses in short-circuited coils under brushes may be accentuated under short circuit conditions if commutation is bad, and hence vitiate results. The sum of iron losses at no load and no short circuit is usually equal to the total loss on full load. The method of ascertaining temperature rise answers well for low speed machines where commutation losses are small. In the case of high speed machines the summation of the temperatures obtained on test may exceed that at full load, and the error may be magnified by windage losses. To allow for these discrepancies, the energy needed to drive the machine (i) unexcited, (ii) during short circuit run and (iii) during no load run, should be measured. If allowance is made for field losses, the armature losses are obtained by deducting (i) from (ii). Normal copper losses are easily calculated and deducted; the other losses are commutation loss and iron losses on short circuit. On high speed machines, total copper losses on short circuit are about double those on full load, and a similar allowance should be made for windage losses.

The temperature-rise of the commutator after the short-circuit run will be higher than at full load, due to excessive commutation loss. Generally from 20 to 30 per cent. has to be deducted from the temperature-rise at short-circuit to obtain the full-load temperature-rise on the commutator.

The summation of the no-load and short-circuit temperatures gives a fair approximation of the temperature-rise of series field windings and commutating pole windings at full load. But shunt windings do not carry the full field current during either the open-circuit of short-circuit run. A summation of losses and temperature rises is not feasible, and the temperature-rise must therefore be derived from the temperature-rise during the no-load run by increasing this temperature-rise appropriately, in a manner described in the original paper.

It is not advisable to derive the temperature-rise of shunt windings from measurements taken during short-circuit runs as the possible errors are too large.

Induction Motors.

There are various methods of carrying out equivalent temperature tests on induction motors. The two simplest are the no-load over-voltage test and the inverse rotation short-circuit test.

For the over-voltage test the motor runs at no load on over voltage. The objections to this test are (1) that the iron losses in the stator are higher than under normal full load, as they increase rapidly at high magnetic densities; and (2) that there are hardly any losses in the rotor. Hence this test will give a temperature rise of the stator iron which is much higher than the rise at normal load. A compromise can be made by applying a somewhat lower voltage and allowing less than full-load loss in the stator, but the method does not give even a reliable idea of the temperature rise of the windings, as both stator and rotor windings are carrying less than full-load current underloaded.

The second method is more definite and reliable, as both stator and rotor winding carry approximately full-load current. If the rotor of an induction motor is short-circuited at standstill, and a low voltage corresponding to the reactance voltage of the machine is applied to the stator terminals, the motor will take approximately full-load current in both stator and rotor. If the rotor is driven in a direction opposite to that in which it would run as a motor, the current remains practically unaltered. By driving the rotor in this direction at full speed, we can circulate full current in both stator and rotor with the normal conditions of ventilation.

If the voltage is adjusted to obtain full-load current in the stator winding, the losses in this winding are equal to the losses at full load, but the iron losses in the stator core are much lower than under actual full-load conditions. However, this is counterbalanced by the fact that the rotor losses are much higher than at normal full-load, and it will rise to a higher temperature.

The heating of the rotor is usually not of much consequence, as in the case of squirrel-cage rotors, the temperature-rise of the rotor does not matter, and in the case of slip-ring motors, the temperature-rise of the rotor winding is usually low. The only exceptions to this are rotors of high-speed motors with few poles, where the overhand of the rotor winding is large and has to be covered up with wide piano-wire bands. In this case the method may not be applicable unless the current during the test is adjusted to allow for this additional loss, but the author suggests methods by which this may be done.

In an ordinary induction motor, the total losses during the inverse running test are equal to or larger than those on normal full-load. Experience has shown that the test gives, if anything, higher temperatures than are obtained at normal full-load.

Alternators.

For alternators various methods of equivalent load runs are used. The simplest method is the combination of no-load and short-circuit runs. For instance the machine is run at no load and excited so as to give an open-circuit voltage of from 5 to 10 per cent. above the normal voltage. This is to allow for the fact that, due to the reactance of the stator winding, the flux in the machine at normal full load is somewhat higher than that corresponding to normal voltage of open circuit.

Thermometers are inserted in the ventilation spaces in the stator core, and readings are taken every 15 minutes to ascertain when the temperature of the stator is steady, for which a run of about four hours is usually sufficient.

The temperature-rise of the various parts is measured after shutting down. The stator winding is then short-circuited and the machine is excited so that full current flows in the stator winding. By adding the temperature-rise of the various parts obtained during the open-circuit and short-circuit runs, a temperature-rise is obtained which is higher than the

* Abstract of a paper read before the Institution of Electrical Engineers.

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temperature-rise at normal full load, because the total short-circuit losses added to the open-circuit losses are rather higher than the full-load losses. Further, windage and friction losses in the machine take place during either run, a fact of special importance in the case of all high-speed machines where these losses form a large percentage of the total losses. In the case of turbo-alternators this method is therefore not applicable.

A modification of this method consists of a combination of alternate no-load and short-circuit runs. By altering the relative period of the two runs the total losses in the field can be altered and a ratio can be found which gives an average loss in the field winding corresponding to the field loss at normal full-load. But the results of this somewhat complicated method are hardly sufficiently reliable to compensate for the extra trouble involved.

For three-phase alternators a simple method which requires little preparation and gives satisfactory results is the reversed-coil method. This allows full-load current to circulate in the armature and full field to be maintained during the test with full voltage across each phase, while the field current corresponds approximately to the excitation required at full non-inductive load. In the original paper the method is described in detail and the underlying principles further elucidated in an appendix.

Rotary Converters.

In a heat run on rotary converters the machine is run at full voltage from the alternating-current side as an over-excited synchronous motor, giving a certain leading wattless current which can be adjusted by the field excitation. On a six-phase rotary converter, a wattless current of about one-half of the watt current per ring at full load will cause I^2R losses in the armature winding equal to the full-load I^2R losses. The commutation losses will be greater than at full load, and the temperature rise of the armature will therefore be a little higher than at full load.

The shunt winding will carry approximately the full field current, and the temperature-rise of this winding can, if necessary, be adjusted for full-load loss. The temperature-rise of series and commutating pole windings cannot be obtained by this method.

Advertising in the Engineering Press.

The Illustration.

By HUGH M. GOODY.

That " pictures talk " is a truism which needs little emphasis to the engineer. Indeed, as suggested in a previous article, he seems at times to realise the value of this mode of expression to the exclusion of other and not less essential features of an advertisement. The reason of this is not far to seek. Every honest manufacturer, looking at his product, feels a glow of satisfaction at the final embodiment of so much thought and energy. He feels that if only he could actually place the product before a possible purchaser, those perfections and conveniences which are so obvious to himself would, without any further effort on his part, complete the sale. In this belief he publishes pictures of his manufactures, and feels confident that the apparatus " will sell itself." Unfortunately, that is largely a fallacy, since there are few, if any, commodities of which the full advantages are evident at sight. Such feelings are, however, entirely natural, and are responsible for the fact that, although it is almost, if not quite, as difficult to illustrate effectively as to write good " copy," yet with 99 per cent. of engineering advertisers, the first necessity in an advertisement is the block.

The foregoing is not, however, intended to belittle the value of illustration since the " appeal " (if not the " sales force ") of a picture is often quicker and more lasting than that of type. It is hoped that the following notes will indicate some of the essentials of a successful illustration.

The Difficulties of Illustration.

The difficulties which the advertiser (particularly if he be an engineer) will encounter fall mainly under two heads—(1) the creation of the picture and (2) its reproduction. The picture may exist either in the brain of the advertiser or in more concrete form (e.g., the product itself). In the latter case it is merely a question of successful photography or sketching. In this connection it cannot be too strongly emphasised that photographers who have had lifelong experience on portraits are not necessarily successful with engineering subjects. A treatise on engineering photography is impossible here, but it may be pointed out that most photographs of engineering apparatus are taken under extremely poor conditions (e.g., in the shop), and that it is worth while to give some consideration to the preparation and lighting of the subject, if a successful picture is desired. Speaking generally, the photograph or sketch of an engineering product should be mechanically accurate in every detail.

Where it is desired to effect some striking presentation of the apparatus or to have an " atmosphere " picture suggesting its applications or advantages, the task is a little more difficult. Such a picture will exist only in the mind of the advertiser, and he is faced with the difficulty (which he will find a very real one) of conveying his conception to an artist. If the advertiser has some slight sketching ability his task will be to that extent lighter. If he has not, he can only explain very clearly (if possible with the aid of similar illustrations) what he has in mind, and then allow the artist to proceed on the " trial and error " principle. In either case it is more important to give the artist the idea behind the required picture rather than an outline of the picture itself. The artist should also know by what method and on what type of paper the picture is to be reproduced, in order that his drawing may give the best possible results.

Block-making Hints.

If and when a suitable picture has been obtained, the question of block-making will arise. The " half-tone " block is, of course, the best possible reproduction of a photograph or wash drawing for press advertising. While screens as high as 150 and 175 may be successfully employed for catalogue illustration on coated paper, it is not advisable to employ a higher screen than 100 or 120 for press work. The former is the better, but the latter forms a compromise which may be used for both catalogues and press advertising with fairly good results. The retouching of photographs for half-tone blocks is highly skilled work and the best results will be obtained if the engraving firm who carry out this work have specialised in engineering subjects. The retoucher will then be able to surmise intelligently the nature of any parts which may be in the shadow and require bringing out.

Advantages of the Line Block.

For a great deal of work in the technical press (except in the case of those rare periodicals which employ a coated paper) the line block has many advantages over the half-tone. It gives a clearer impression over a longer period and at a less initial cost (about half). It does *not*, however (even with the use of stipples, either by the artist or the block-maker) give quite the same realistic effect as the half-tone. It should nevertheless be made much greater use of than is at present the case in the engineering press. Pleasing results can be obtained by the use of ink or charcoal with various types of paper, scraper boards, etc., to say nothing of the " mechanical stipples," of which every block maker possesses a selection, if only the engineering advertiser will take full advantages of the various processes known to the artist and to the engraver.

Storing and Recording Blocks.

If considerable numbers of blocks are in use it will be necessary to evolve some system of storing and recording. For the latter purpose a card index will serve, while the blocks should be stored on shallow shelves or trays. Absorbent paper should be used where necessary to prevent the printing surfaces coming into contact with anything hard; a few scratches due to careless handling or storage will ruin an expensive block. Where a block is to be used a number of times, it is policy to treat the original line or half-tone engraving as a " master block," and only to employ the duplicates for printing. Duplicates of half-tone blocks should be electros, and of line blocks either electros or nickel-faced stereos, the former where a long life is required. Ordinary stereos have a comparatively short life, and will not stand many runs in journals which have large circulations.

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There is one point which the engineering advertiser requires to watch most carefully, and that is that his block-making charges are not disproportionate to his space charges. The engineering advertiser employs in most cases a very small number of papers. Of these possibly no two have the same size of page. On the assumption that he does not wish to repeat an advertisement more than, say, four times a year, he may require to provide as many as thirteen blocks for each periodical per year, owing to the differing sizes of space. This difficulty may to some extent be got over when planning the campaign by taking varying proportions of a page in each journal so as to obtain approximately the same area in each. (For example, 10 in. across four columns in "The Engineer" is the same area as a full page in THE ELECTRICIAN) However, this is only possible to a limited extent, and if full advantage is to be obtained from each block another avenue must be explored. This is in the direction of making the block to fill only a portion of the actual space, say the top or bottom or one side. The remainder of the advertisement can then be enclosed by printers' rules, and if the lay-out has been well thought out beforehand, it will be possible to employ rules which match the block sufficiently well to knit the whole thing together and not present a "scrappy" appearance. It may be possible to return to this subject in a later article, as it is one to which the advertiser should devote some thought, instead of giving *carte blanche* to the artist, as is the usual procedure.

Subject Matter Problems.

It remains to deal with the subject matter of illustrations where something more than a picture of the product is required. We will suppose that in advertising certain mining equipment it is desired to reproduce a view of a colliery. In all such cases it is important to pick out some feature of the application which will "jump to the eye," such as the winding gear. Do not show detailed views of multitudinous buildings; the one feature, possibly even a part of it, will say "colliery" sufficiently loudly, and to do much more would possibly have the result of interesting the reader in the view of the colliery rather than in the plant you were advertising.

A valuable method of pictorial advertising is the "action photograph" showing equipment in operation amid its normal surroundings. In this case a really good installation should be photographed under the best conditions, and thereafter little or no retouching should be done. If in addition it is permissible to give particulars of the actual installation, together with operation data, the effect upon the reader will be enhanced. It is, of course, one of the limitations of the line block that for such purposes it is of little use, and it is almost essential to employ the more expensive half-tone. Drawings, diagrams, data curves and test certificates are always of interest to the engineer, and may be made use of in advertisements. Their reproduction can usually be effected by means of line blocks, and presents little difficulty. Apart from ordinary "action photographs," full use should be made of photographs of special installations, as for example, where apparatus has been in use for a long period without trouble, or where the plant has given satisfaction under particularly onerous conditions.

A Difficult Subject.

In conclusion it must be confessed that the subject of advertisement illustrations is one with which it is extremely difficult to deal adequately, without attempting to give a treatise on commercial art, which would be out of place in these columns. The writer will, however, be content if he has been successful in indicating the place of the illustration in engineering publicity, and how the subject, the artist or photographer, and the method of reproduction should be dealt with to suit both each other and the advertisement as a whole.

Industrial Councils.

At the Conference arranged by the INDUSTRIAL LEAGUE AND COUNCIL at Beaconsfield last week-end, a resolution was passed unanimously that "this informal Conference of employers and employed heartily approves of the steps proposed to be taken by the Association of Joint Industrial Councils and Interim Reconstruction Committees to obtain legislative facilities to give statutory effect to the voluntary decision of any duly recognised Industrial Council on the application of such Council."

Blackburn Electricity Committee has decided to invite open competition for the VACANCY ON THE STAFF caused by the accidental death of Mr. Wallwork, mains superintendent.

Engineer Stores in the Great War.

Most people have some impression of the vastness of the supplies of engineering materials required in the Great War, but probably few outside official circles understand how complex and difficult the problem was. Some interesting light on this point was shed in a couple of lectures recently delivered to the engineer students at the Merchant Venturers' Technical College, Bristol, by Col. S. L. CRASTER (late Chief Mechanical Engineer, War Office).

No Reserves of Engineering Plant.

At the outbreak of war there were no reserves of special engineering plant or machinery existing; yet by the end of 1914 the multifarious demands for railways, roads, canals and docks, etc. in France were being met. A reserve of engineering and railway plant was formed the first few weeks of the war. A special staff had next to be created to supervise the forwarding of material at the various ports. The miles of water-logged trenches in France made special demands, and in December, 1915, 15 000 pumps and 250 miles of hose were under manufacture. The endless and novel problems submitted from all theatres of war led to the forming of a special experimental ground at Claygate, where trials of tunnelling machines, pipe-pushers, trench diggers, etc., were made. One by one the Royal Flying Corps, the Directorate of Military Roads and Railways, and other departments took up their individual problems; but in the meantime new demands were continually arising.

Hot Water Apparatus and Ice Plant.

Among other instances Col. Craster mentioned that East Africa took £51 000 worth of cement, butting stores and machinery in 1918, and Mesopotamia in the same year demanded many 60 ft. bridges, hot water apparatus and ice plant, and a 1 000 kW power station for Basrah port, to drive 7 000 hospital fans and manufacture 20 tons of ice daily. The power station was at work in April, 1917, though the original boilers were sunk on the way and had to be replaced. The Mediterranean took a million pounds worth of engineering stores in 1916, while in the following year on the Western Front the use of tractor-drawn guns and the advent of tanks demanded complete reconsideration of bridge girder designs. In addition, the policy of cultivating devastated areas was initiated in order to provide green food and fodder.

In April, 1917, the United States entered the War, and their army was supplied mainly from England. Demands came in increasing flood—among the items being units of baking plant to supply 1½ million bread rations per day! Meanwhile, minor theatres of war continued to furnish problems. One of the most interesting was the provision of transport facilities to the "Dunster Force," operating in the direction of Enzeli and the Caspian, and served by a precarious line of communication over mountainous country between Mesopotamia and Hamadan. Eventually a rope-way, capable of handling 360 tons per day, was devised. In 1918, 50 miles was ordered, but this, like other units for the Balkans, was not needed, owing to the dramatic termination of hostilities. They were, however, taken over by the Indian Government in the following year for use in the Khyber. The cost of the system in 1918 was about £2 000 a mile.

One other item may be mentioned—the Allenby Bridge, over the Jordan, ordered by cable on April 7th, 1918, and delivered, complete with all erecting gear, on July 1st by an R.E. Territorial subaltern, who afterwards supervised its erection.

In operations on such a scale it was inevitable that there should be some mistakes. But there were undoubtedly also some fine performances.

The New Director of Fuel Research.

The Lord President of the Council has accepted with much regret the resignation of Sir George Beilby, after nearly seven years' voluntary service as Director of Fuel Research and Chairman of the Fuel Research Board under the DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH. The Board was established in 1917 to investigate the nature, preparation and utilisation of fuel of all kinds. The Lord President has appointed Mr. C. H. Lander, to be Director of Fuel Research, and Sir Richard Threlfall, a present member of the Board, to be Chairman. Sir Charles Parsons will continue his membership of the Board for a further period. Sir George Beilby retains his membership of the Advisory Council of the Department, and has consented to act as Honorary Adviser to the Board. The following gentlemen have accepted appointment as additional members of the Board:—Mr. R. A. Burrows, Sir John Cadman, Dr. Charles Carpenter, Mr. Samuel Tagg, Prof. Sir James Walker, Prof. R. V. Wheeler.

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Electrical Exhibits at the Leipsic Spring Fair, 1923.*

Most of the electrical exhibits in the recent Leipsic Spring Fair were shown in the new "Haus der Elektrotecknik"—a building not yet quite completed. Some stands, reserved for firms in the Ruhr Basin, were unoccupied. Also, no exhibits from Brown, Boveri and from Bergmann appeared to be there. For ignition in internal combustion engines, Mea-Vertriebs showed a bell-shaped magnet giving the same spark from early to retarded ignition, and adjusted by turning the magnet, thereby obtaining easy starting and smooth running even at low speeds.

To avoid brushes and starter for three-phase induction motors, the Weissberg Simplex motor has, in addition to the copper winding, also a brass winding on the rotor, which is short-circuited step by step by means of a centrifugal switch. The switching-in current is 1·75 times the normal current. Albert Obermoser had a squirrel-cage rotor with the iron cut away between the poles, which pulled into synchronism without d.c. excitation. For pulling-in under load d.c. is needed, for which purpose a rotor winding with commutator (shown by Max Levy) can be used instead of a separate exciter for small sizes. Ball bearings for motors up to 20 h.p., and roller bearings for traction motors, were seen (A.E.G.). For textile motors A.E.G. showed variable-speed, three-phase commutator motors, while the Sachsenwerk preferred to convert into d.c.

Progress in Rectifier Construction.

The construction of rectifiers revealed much progress. The mercury rectifier has proved to be very reliable. S.S.W. have developed their rectifier to work with very reduced load, thereby rendering it unnecessary to use a special loading resistance for paralleling with machines—the voltmeter current being sufficient. A disadvantage of the rectifier is the difficulty in obtaining the mid wire of a three-wire system. By applying oil cooling to the glass mercury rectifier the A.E.G. has increased the output of the 150 A bulb to 500 A. In large, metal mercury rectifiers the mercury seal is replaced by a rubber seal in the S.S.W. pattern, the rubber surface exposed to the vacuum chamber being kept small and protected by a metal ring. In addition to a rotary pump, a mercury pump is also used to maintain the vacuum.

Switchgear Developments.

Various high power and high voltage switches are described. Voigt & Haeffner exhibited a device for automatically re-closing a switch in a sub- or transformer station without supervision. When the switch releases itself, a weight commences to descend, and re-closes the switch after a three-minute delay. If the short circuit has not cleared itself, the switch at once reopens and locks the falling weight until the automatic action is again released by an operator.

An attempt to replace the present constructions of automatic voltage regulators was seen in the more robust device actuated by oil pressure by Neufeldt & Kuhne. Improvements in fuse construction included devices for the better protection of d.c. and three-phase motors.

Among the energy meters, an A.E.G. type was arranged for including the no-load transformer losses when the meter was in the low voltage circuit. For this purpose, the standard three-phase meter was provided with a Ferraris motor, which was adjusted to develop an additional torque proportionate to the constant no-load loss.

Research in America.

In his recent presidential address to the INSTITUTE OF PHYSICS, Sir J. J. Thomson gave some account of the work he had seen during his recent visit to America in the research departments of some of the great manufacturing firms. These laboratories were established in the face of considerable opposition, but now the universal opinion appeared to be that the research department was one of the most profitable in manufacturing concerns, and, however great the necessity for economy, its cost would be the last to be reduced.

The scale of these laboratories was far greater than anything we had in this country, and much of the work carried out was not merely what might be called development work but was fundamental scientific work, worthy of a University laboratory. On the other hand, the American Universities did not seem designed to produce a large number of men qualified to take up advanced research work.

* From an article by W. Kraska in the "Elektrotechnische Zeitschrift."

Electrical Imports and Exports.

Increase in Exports for past Month.

IMPORTS.—The following are official values of electrical machinery, apparatus and material imported into this country (*a*) during May, 1923, and (*b*) the aggregate figures from January 1st to May 31st, with increase or decrease compared with corresponding periods of 1922 :—

Electrical machinery, (*a*) £79 633 (decrease £19 358), (*b*) £464 524 (decrease £84 979); telegraph and telephone cables, submarine, nil; other than submarine, (*a*) £14 441 (increase £11 766), (*b*) £44 584 (increase £29 754); telegraph and telephone apparatus, (*a*) £75 157 (increase £56 205), (*b*) £229 780 (increase £159 218); other electrical wires and cables, rubber insulated, (*a*) £5 204 (decrease £5 361), (*b*) £52 541 (increase £4 592); with other insulations, (*a*) £11 581 (increase £6 848), (*b*) £48 147 (increase £24 460); carbons, (*a*) £10 173 (increase £6 163), (*b*) £27 072 (increase £11 163); glow lamps, (*a*) £10 781 (increase £33), (*b*) £83 612 (increase £9 719); arc lamps and electric searchlights, (*a*) £54 (increase £47), (*b*) £882 (increase £810); parts of arc lamps and searchlights (other than carbons), (*a*) £1,776 (increase £1 113), (*b*) £6 517 (increase £2 302); batteries, (*a*) £13 256 (increase £7 284), (*b*) £57 332 (increase £29 442); electrical instruments (commercial and scientific) and electricity meters, (*a*) £6 939 (decrease £1 923), (*b*) £43 314 (increase £15 452); switchboards, (*a*) nil, (*b*) £1 927 (increase £468); other electrical goods and apparatus, (*a*) £74 931 (increase £33 954), (*b*) £330 358 (increase £113 391). Total of electrical machinery, apparatus and material (other than uninsulated wire), (*a*) £303 926 (increase £96 771), (*b*) £1 390 590 (increase £315 731).

EXPORTS.—The exports of electrical machinery, apparatus and material, produced or manufactured in the United Kingdom, (*a*) during May, 1923, and (*b*) from January 1st to May 31st, with increase or decrease compared with corresponding periods of 1922, were as follows :—

Electrical machinery, (*a*) £342 151 (increase £45 864), (*b*) £1 669 566 (decrease £513 604); including railway and tramway motors, (*a*) £34 133 (increase £25 102), (*b*) £119 793 (increase £52 054); other generators and motors, (*a*) £182,845 (increase £28 973), (*b*) £880 794 (decrease £274 531); and other electrical machinery, (*a*) £125 173 (decrease £8 211), (*b*) £668 979 (decrease £291 127); telegraph and telephone cables, submarine, (*a*) £40 804 (increase £15 039), (*b*) £227 608 (increase £96 572); other than submarine, (*a*) £84 893 (increase £41 721), (*b*) £405 884 (increase £155 163); telegraph and telephone apparatus, (*a*) £182 277 (increase £20 713), (*b*) £819 668 (decrease £49 874); other electrical wires and cables, rubber insulated, (*a*) £79 981 (increase £29 704), (*b*) £455 442 (increase £209 661); with other insulations, (*a*) £85 610 (increase £21 826), (*b*) £436 565 (decrease £48 245); carbons, (*a*) £7 002 (increase £2 113), (*b*) £25,495 (increase £5 148); glow lamps, (*a*) £26 352 (decrease £6 378), (*b*) £132 120 (decrease £36 730); arc lamps and searchlights, (*a*) £532 (decrease £57), (*b*) £2 797 (decrease £1 046); parts of arc lamps and searchlights (other than carbons), (*a*) £161 (decrease £1 787), (*b*) £456 (decrease £3 430); batteries, (*a*) £43 841 (decrease £3 196), (*b*) £224 960 (increase £30 028); electrical instruments (commercial and scientific) and electricity meters, (*a*) £31 950 (increase £11 367), (*b*) £139 852 (decrease £15 219); switchboards, (*a*) £7 449 (decrease £802), (*b*) £52 933 (decrease £94 368); other electrical goods and apparatus, (*a*) £126 472 (increase £34 331), (*b*) £570 929 (increase £59 793). Total of electrical machinery, material and apparatus, other than uninsulated wire, (*a*) £1 059 475 (increase £210 458), (*b*) £5 164 283 (decrease £206 151).

Air Cooling.

Heating and Ventilating Engineers in Conference.

The summer meeting of the INSTITUTION OF HEATING AND VENTILATING ENGINEERS was held at Folkestone, on Tuesday, under the presidency of Mr. John Watson. At the business meeting, Mr. J. Roger Preston, in an interesting paper, remarked that the cooling of air had been mostly carried out as a necessity in specialised industrial processes, either for the purpose of reducing the humidity by condensing part of the aqueous vapour, or for the production of low temperatures. The use of the same in this country, for the purpose of obtaining comfortable and healthy conditions in our buildings, had been very limited, except to the extent of cooling the air within a few degrees of the initial wet bulb temperature, with the usual air washer recirculating the spray water. Modern physiological research tended to prove the necessity of keeping the wet bulb temperature within narrow limits, say, from 54 deg. to 58 deg., if it was desired to ensure comfortable and healthy conditions.

The author went on to deal with the means of obtaining conditions approaching this ideal in a building when it was hot and humid outside. It was in the memory of many that an ordinary air washer, for the purpose of cleansing the air, was considered to be a luxury and an expensive one. This, however, was now quite common, and they might see the day when an up-to-date heating and ventilating plant would not be considered in any way complete without a properly designed equipment for cooling and dehumidifying.

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Merchandise to Sell and Profit By.

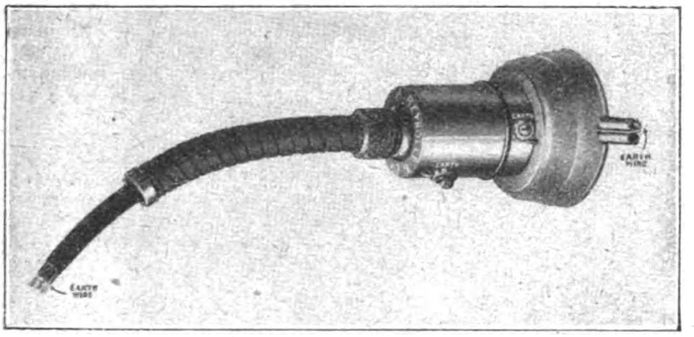
In these columns we shall each week illustrate and review various lines of electrical apparatus. We shall not confine ourselves to new equipment, our policy being to deal with equipment which, if not novel, has some outstanding feature of design or quality. The rapid growth of public interest in the "electrical idea" and the ever-increasing number of new devices placed upon the market means that it will be absolutely necessary for buyers to study these pages of THE ELECTRICIAN.

It will be noticed that a simple but effective buyers' index can be made from these pages. For every item with its illustration will fit a standard filing or index card, so that with a suitable index the buyer will have a ready and up-to-date reference to anything that may interest him.

To make this feature a success, we invite descriptive information of apparatus from manufacturers and others. If possible, advance information of new lines should be sent us, and we shall endeavour to publish this on a date which will coincide with the issue of the manufacturers' own publicity matter.

Reyrolle's Contribution to a Higher Standard.

The need for a higher standard of electrical practice is accepted. Particularly is this so with regard to wall plugs and sockets. The announcements of several manufacturers on the question of the B.E.S.A. standards has quickened the interest of contractors in this small, but important, item of accessories. The B.E.S.A. specification, however, cannot achieve everything; certainly it cannot provide for the hazard of the right type of plug being fitted in any particular point. It must be left to others to do this, and several

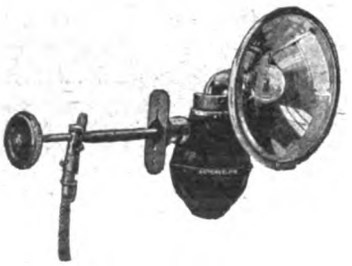


AN ENGINEERING WALL PLUG FOR THE HOUSE.

manufacturers have taken up the task. Among these must be included A. REYROLLE AND CO., and they are rendering a service to the trade by their active propaganda. We illustrate their "Domestic" metal clad wall plug and socket with an earthing pin. Earthing pins on sockets used with apparatus in the kitchen and bathroom are not installed very often, and contractors will enhance their reputation for sound work and raise the standard of practice, if they will pay more attention to this question.

A Motor Accessory for the Enterprising.

We fear that a reference to motor car accessories as "merchandise to sell and profit by" will only secure the interest of but few electrical retailers. For there are not, unfortunately, many who attempt to cater for this market, but we are of the sure opinion that there will be a change of thought very soon. It must be so, and the reason for the change in attitude will be largely due to the "Benjamin Bulletin." In this little publication there is an editorial, which, although primarily intended for the half-hearted motor agents, will cause the electrical retailer to have misgivings as to whether he, too, is not losing good turnover. We recognise, of course, that the electrical retailer cannot expect to do the business a motor agent or garage has the opportunities of doing, none the



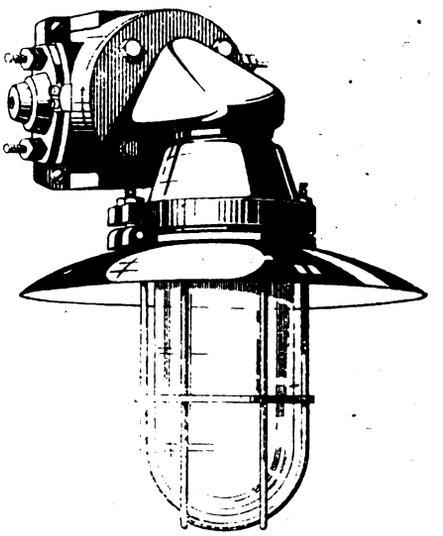
THE SALOON MODEL BENJAMIN AUTOREELITE.

less an active survey of what there is to sell will not be wasted. In our judgment the first step is to seek out just exactly what there is to sell, and in this process it will be revealed what a large market is waiting to be served. Of the several manufacturers who market real automobile accessories, as distinct from "gadgets," is the BENJAMIN ELECTRIC CO. It is the main object of this note to emphasise the need for study of this business, not to refer to any particular device, but we feel it will be of interest for us to illustrate the Benjamin "Autoreelite." This pattern has been specially designed for cars with closed bodies, and, as the illustration will show, it is capable of being operated from inside the car, the universal movement to all angles being obtained with the greatest ease while driving.

The fact that such a well known electrical house as the Benjamin Co. should manufacture motor accessories is an assurance of "good goods," and that fact alone makes it imperative for electrical retailers carefully to consider this question of retailing motor car accessories.

Colliery Lighting.

It is our opinion that manufacturers of lighting equipment cannot give too much study to the lighting of collieries and colliery engineers and managers cannot give too much attention to the same question. Until comparatively recently development has been slow, but now colliery engineers have several excellent systems to study, and it will be proved that several manufacturers can offer equipment to satisfy the most severe conditions. Among these manufacturers must be included the SIMPLEX CONDUITS CO., and



A SIMPLEX CONDUITS FITTING FOR COLLIERY WORK.

we illustrate a unit consisting of a bracket lantern and box. This fitting is intended to take the place of a bulkhead fitting. It is claimed by the Simplex Co. that the unit offers many advantages over the old-fashioned "bulkhead" fitting. We regret that space will not permit our showing an illustration of all, or certainly several, units which the "Simplex Colliery Lighting System" includes, but catalogue No. 974 will be sent to all interested readers of THE ELECTRICIAN. This publication does not stop at being a mere catalogue; it can be described as a short treatise in colliery lighting.

An Announcement of a Good Seller.

The enterprising retailer will never become weary of any announcements of really good devices to sell. Will it turnover rapidly? is the question to be answered, and beyond doubt the "Cressall" battery charging panel will do so. It is manufactured by

A USEFUL BATTERY CHARGING RESISTANCE.

the ELECTRIC DEPOT, LTD., and is listed at 40s. complete with full working instructions.

The panel consists essentially of a carefully graded bank of resistance units, composed of woven asbestos and non-corroding special alloy wire; the whole being suitably enclosed and protected. The capacity of the woven nets is carefully predetermined to ensure that the working temperature is confined well within safe

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limits, at the same time making use of the exceptional radiating properties of this form of construction. A standard fixed charging current of three A is allowed for. The complete apparatus is provided with a main (rotary type) quick make and break switch, legibly inscribed to show the "on" and "off" positions at a glance, while, in addition, two insulated terminals are provided for connection of d.c. mains, and a further pair of terminals for coupling up the accumulators; each set being clearly labelled and polarity indicated.

A New Iron for Chary Housewives.

It is known and accepted that a large number of housewives are still, even in these days of E.D.A. publicity, a little chary with regard to the use of an electric iron. Many still have what can best be described as a superstitious dread that it is not safe, and the foolish scare headings in the lay press have confirmed their unnecessary fears. It is possible that a number of these excellent housewives can be converted by a simple but convincing talk, but it is difficult to deal with those who refuse to be convinced. Nothing will be

THE HOUSEWIVES' TREASURE.

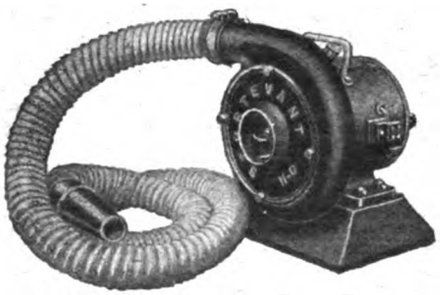
gained and it would be but poor salesmanship to attempt such a course by trying to laugh away these fears. The best plan is to offer an iron with some automatic switch device. We have previously commented on several irons embodying this feature, and we now illustrate an iron which will shortly be placed upon this market and distributed by S. GUITERMANN & Co. As will be seen from the illustration the iron takes the usual shape of the many patterns on the market, but the handle is designed with a switch which functions when the handle is gripped as it would be for normal operation. It is the intention of the agents to market the iron under the name of "Safe-Economy," at a list price of 28s. 6d.

Siemens' Fans for 1923.

Any notes on the markets for fans are not complete without mention of SIEMENS AND ENGLISH ELECTRIC LAMP CO. This company hold an extensive stock of a reliable make in all types, and can quote competitive prices to the trade.

The Eclipse of the Dust Bellows.

Contractors who make a speciality of the maintenance of power installations will find that a "Sturtevant" portable electric dust-blowing set will prove a most useful tool to have in the equipment, and will render an excellent return on the capital outlay. There



"STURTEVANT" ELECTRIC DUST BLOWER.

are still many who argue that a simple hand-pumped bellows will do the job just as well; but this is not so, and time will see the scrapping of this old-fashioned equipment. The set which we illustrate is manufactured by the STURTEVANT ENGINEERING CO., and is sufficiently portable to be taken from job to job.

A Recipe for Success.

The recipe for a successful boost with a popular line of merchandise is quite a simple one, the three principal ingredients being dominating publicity, an attractive price, and good quality. These three essentials form the basis of the selling campaign just launched by METROPOLITAN-VICKERS ELECTRICAL CO. The publicity is in the form of a most artistic folder providing for overprinting, entitled, "The Cosmos Iron for the Home," and it will undoubtedly make an irresistible appeal to the buyer. The iron is of sound construction, both electrically and mechanically, and the trio of essentials for success is made complete by the attractive list price of 21s.

Catalogues, Price Lists, &c.

In this column we review briefly each week catalogues and price lists received. We invite from manufacturers and others copies of any new publicity matter.

ELECTRICAL COMPONENTS have kindly sent us a copy of their abridged net price list of electrical accessories.

TODMAN, RYALL AND CO. have recently issued a stock sheet of d.c. motors and dynamos of their "L.W." type.

The SUN ELECTRICAL CO. announce the publication of the June issue of their monthly price list on electrical supplies.

"M.E.M. Aims and Claims" is the title of a booklet recently published by the MIDLAND ELECTRIC MANUFACTURING CO.

A comprehensive list of electric fans and small fans has just recently been issued by the ENTERPRISE MANUFACTURING CO.

The "Cambridge" accumulator tester is described in a mailing card just issued by the CAMBRIDGE AND PAUL INSTRUMENT CO.

The NATIONAL BOILER AND GENERAL INSURANCE CO have issued a catalogue with technical data on "National" patent fusible plugs.

Wireless retailers will note with interest that L. MCMICHAEL, LTD., have recently published a catalogue on wireless apparatus and parts.

"Fuller" static transformers are fully described in a very informative booklet just issued by the SWEDISH GENERAL ELECTRIC CO.

"Vincent Switch and Fusegear" is the title of a new catalogue, a copy of which the VINCENT SWITCHGEAR MANUFACTURING CO. has just sent us.

SIMPLEX CONDUITS have ready for distribution to interested readers of THE ELECTRICIAN, a list No. 974 entitled "Simplex Colliery Lighting Units and Accessories."

FERRANTI, LTD., continue to develop "Nomag" cast iron. The latest development takes the form of non-magnetic cast iron resistance grids, and these are described in List FA 76.

The publication entitled "Cambridge Instruments for Power Plant" will attract the attention of engineers. It is a recent publication of the CAMBRIDGE AND PAUL INSTRUMENT CO.

Buyers who anxiously await the issue of the regular monthly stock list of motors and dynamos manufactured by ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, will note with interest that the June list is now available.

WATSON AND SONS are the agents in this country for the Buck X-Ograph Co., of St. Louis, U.S.A. A folder, a copy of which Watsons have kindly sent us, contains an interesting description of the X-Ograph dental film packets.

SIEMENS AND ENGLISH ELECTRIC LAMP CO. have just published a monthly trade price list for June. It deals with all kinds of apparatus, and will be of particular interest to buyers who have to watch for the very keenest prices on lines such as lampholders and switches.

The ELECTRICAL APPARATUS CO. are the latest manufacturers (up to the time of going to press) to issue a catalogue on wireless apparatus. The new publication is leaflet W1, which describes several types of apparatus, and leaflet W2 gives some hints on choosing a receiving set.

Following the note which appeared in our "Merchandise to Sell and Profit By" column on the "Sunic" high frequency apparatus, it is of interest to record that the manufacturers, WATSON AND SONS, have issued bulletin 53S, which is a more comprehensive explanation of the working of the apparatus.

The MANCHESTER ELECTRICITY SUPPLY DEPARTMENT have rendered a signal service to the "electrical idea" by the booklet they have just issued entitled "Domestic Electric Service." The lesson of this compelling example of propaganda will be felt far beyond the boundaries of the City of Manchester.

The list, which has just reached us from SIMPLEX CONDUITS, describing Simplex signs is but another example proving how this company keeps pace with modern needs. It also reveals what a wealth of business there is yet to be done in electric signs, and it behoves all contractors to have a copy of the latest Simplex list.

The UNDERFEED STOKER CO. announce the publication of a descriptive circular entitled "Lopulco System of Pulverised Fuel for the Societe Anomyne Union d'Electricite, Paris." It describes an installation, to be erected at Vitry, of the "Lopulco" system for the combustion of pulverised fuel, and will be of interest to engineers.

There is a publication in the electrical trade which can be described with every truth a *vade mecum*. We refer to the Incandescent electric lamp handbook, published from time to time by the BRITISH THOMSON-HOUSTON CO. The handbook has been revised and issued under No. 1d, and to those who would be *au fait* with the lamp situation we tender the advice to secure a copy.

"Keep Cool" is the injunction displayed boldly upon a new folder, No. L23 4A, just published by the BRITISH THOMSON-HOUSTON CO. It is hardly necessary to say that the folder describes the B.T.-H. fan, and it is of importance for retailers to note that prices have been reduced for this season. We understand that these business pulling folders are available for the asking by enterprising retailers, overprinted with their name and addresses.

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Parliamentary Intelligence.

Government Trainees in the Electrical Industry.

On June 13th, Mr. R. MORRISON asked the Minister of Labour, in view of the fact that 50 per cent. of the ex-trainees in the electrical industry were at present unemployed, owing to the inability of employers to find improver vacancies, whether the Ministry was prepared to allow the trainees at present unplaced to complete their three years' training in Government instructional factories?

Sir M. BARLOW: At least 72 per cent. of the men trained in the electrical industry are known to be employed at the trade. A period of experience in an employer's workshop is necessary to complete the course of training, and I fear the suggestion contained in the question would not be a satisfactory alternative. Every effort is being made to obtain improvership vacancies by a canvassing staff specially appointed for the purpose and by other means.

Mr. MORRISON: Is the right hon. gentleman aware that a very large percentage of these men who are out of work have been waiting for improverships for twelve months, and that under these conditions they are rapidly forgetting what they learned?

Sir M. BARLOW: I am quite alive to the difficulty, but we really must, as I have said on more than one occasion in this House, look to improved trade conditions for the real solution. At the same time, as a temporary measure, I have instituted at the Ministry, in connection with the Government instructional factories, refresher courses for men who have been for some considerable time unable to obtain improvership vacancies, and these refresher courses, on the whole, are working satisfactorily.

Mr. MORRISON: May I take it that men who have been endeavouring to obtain improverships for over twelve months will now have employment obtained for them?

Sir M. BARLOW: I cannot give any definite undertaking of that kind. I am doing my best, by means of the machinery of refresher courses and in other ways, to deal with this difficulty, but I cannot give a definite pledge quite on the lines suggested.

Overhead Electric Lines.

On June 13th, Mr. CAUTLEY asked the Parliamentary Secretary to the Ministry of Transport whether he was aware that the Haywards Heath and District Electricity Company were threatening and commencing to erect overhead electric lines in the residential districts of Haywards Heath and Cuckfield, and the picturesque village of Lindfield, in the County of Sussex; that the large majority of the residents were strongly opposed to such action; and whether he would see that his consent was not given to the erection of overhead lines until the residents had had an opportunity of having their case heard by the Ministry?

Col. ASHLEY: The local authorities concerned were given an opportunity of expressing their views as far back as last August, and in consequence of objections raised by them the company have since been endeavouring to find an alternative scheme. I understand that a satisfactory alternative has now been found and that the local authorities concerned have passed a resolution withdrawing their previous objection. I may add that in such cases I am anxious to give every consideration to objections raised on the score of injury to the beauty of the landscape, but have, of course, to consider what burden may be laid on the undertaking by any steps I may take.

Torquay Corporation Bill.

When the Local Legislation Committee of the House of Commons considered the provisions of the TORQUAY CORPORATION BILL relative to the electricity undertaking of the Corporation, last week, there was some discussion as to the maximum charges which should be allowed. It was pointed out by Mr. W. J. Jeeves, for the Corporation, that the undertaking of the Newton Abbot Electric Supply Co. had been purchased by the Newton Abbot Urban District Council, and handed over to the Corporation. The Corporation were establishing a very much enlarged undertaking in the Urban District of Newton Abbot, to provide a supply of electricity for an enlarged area which included Newton Abbot and various parishes. It was an alternative, in that part of the country, to a joint electricity committee, which it was not thought practicable to form, and this scheme was considered to be the cheapest and best way to provide electricity for the whole district.

The maximum charges asked for in the Bill were, for the March and December quarters, 12s. 6d. for any amount up to 15 kWh and 1od. for each additional kWh, and, for the June and September quarters, 8s. 4d. up to 10 kWh and 1od. for each additional kWh.

In reply to the Chairman (Sir Thomas Robinson), who asked what would be the cost per kW when they had wound up the capital account, Mr. H. F. Woods, electrical engineer to Torquay Corporation, said it would be about £40, which included distribution, transmission and everything else, as well as the purchase of the undertaking. They would have a capacity of 6 000 kW, made up of two 1 500 kW machines and one 3 000 kW machine. These were all turbo-alternators.

The Chairman said he did not understand why the Corporation asked for a maximum charge of 1od. per kWh.

Mr. Woods replied that the reason was that capital charges were comparatively high.

Mr. Jeeves reminded the Committee that the whole thing had been done with the consent of the Electricity Commissioners, who thought it was the cheapest, although it must be a heavy burden on Torquay for the first few years.

The Chairman said it was the first time he had met with 1od. per kWh as a maximum.

Mr. Jeeves said he could quote a number of cases of temporary Orders, and pointed out that under the Electricity Supply Act there was provision for revision every three years.

After further discussion the Committee allowed the clause.

There was another clause contained in the Bill, which provided that any method of charging approved by the Minister of Transport may authorise a periodical charge in respect of the maximum power required by the consumer in addition to the charge for the electricity supplied to him. It was suggested by the Minister of Transport, however, that the clause was unnecessary, in view of the terms of Section 31 of the Electric Lighting (Clauses) Act. After a short discussion, in the course of which Mr. Jeeves urged that the point was not covered by the existing law, the Committee decided that the clause should be struck out.

The Future of the Tramcar.

Mr. E. S. Rayner's Optimistic View.

On Friday last, at the Congress of the INSTITUTE OF TRANSPORT, Mr. E. S. Rayner, general manager of the Hull City tramways, discussed modern tramways from the traffic point of view under existing conditions. Speed in itself, he said, presented no problem so far as the tramcar was concerned. It was a simple matter to design and build a tramcar to travel at any speed, and if we could rebuild our cities with streets up to 120 ft. wide, with tracks to accommodate different classes of traffic, tramways would fear no competitors or criticism on that score. It was not possible to redesign and rebuild our cities, and the only alternative was to make the best use of existing thoroughfares, to remodel entirely our ideas, to cease thinking of thoroughfares as having an unlimited capacity for traffic of varying capacities and speeds, and to regulate the vehicles upon them, both as to type and speed. It was a fallacy to think that danger and congestion only arose from the fast-moving vehicle; the slow, halting van or lorry was quite as blameworthy, for it was the prime cause of the overtaking and passing of vehicles and the consequent congestion in our streets.

Maintaining a Definite Speed.

In his opinion, the time was coming, if it had not already arrived in some of our cities, when a definite speed would have to be maintained in certain streets. Only vehicles capable of attaining that speed would be allowed to use them—at any rate at certain times of the day—and the overtaking and passing of vehicles would be prohibited. If overtaking and passing were eliminated, the long-distance traffic in either direction, or the traffic that had to cross the road and turn to the right, would keep to the centre, and traffic which intended turning to the left would take the outside berth. The net result would be a considerable gain in speed for all users, and a very much safer condition of things.

The speed of vehicles was not the only consideration; the real criterion was the speed at which the maximum number of passengers could be moved in the minimum length of time, the cost of doing it, and the economical use of the streets. The restriction of trams to a fixed track was in reality, he maintained, a blessing in disguise, for it ensured that each tramcar would take its proper station. If all other vehicles did the same and the overtaking and passing of vehicles were eliminated, the capacity of the streets and the average speed and safety of transport would be materially increased.

The Question of Size.

Though the size of the tramcar was rapidly approaching its economic limit, there still remained a considerable margin before the capacity of the track was exhausted. The factor governing the efficient use of the track was "headway," which was governed by two things—speed of loading and unloading, and acceleration. With the high-powered motors now in use the acceleration was satisfactory, but the question of loading and unloading was a different story. Larger cars demanded better exits, or the necessary "headway" between cars was increased instead of decreased, thus discounting the advantages gained by increasing the size of the car. As a result of experiments now in progress he hoped soon to see a substantial improvement in this direction.

Tramways, concluded Mr. Rayner, were and would remain a necessity in large towns and cities. No form of road transport could deal with mass passenger transport so cheaply and effectively.

Institution Notes.

Members of the INSTITUTION OF RAILWAY SIGNAL ENGINEERS paid a visit last week to the Signal Department of the Great Western Railway at Reading.

Dr. W. C. Geer, of the B. F. Goodrich Co., will give an address on Monday at 8 p.m. at the Engineers' Club, Coventry Street, London, W., before members of the INSTITUTION OF RUBBER INDUSTRY on "Some American Rubber Manufacturing Problems."

The employees of Mr. John Walsh, Blackburn, had their ANNUAL EXCURSION on June 15th, when a visit was paid to the Blackpool Carnival. The various places of interest were visited and tea was provided. Mr. James Hayes, foreman, moved a resolution of thanks to Councillor Walsh for his generosity.

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Electricity Supply.

Extensions and Developments.

WHITEHAVEN Town Council has received from the Commissioners sanction to loans amounting to £2 720 for mains extensions.

BRISTOL Electricity Committee proposes to spend £15 594 on the conversion of a factory building into offices for the department.

PLYMOUTH Electricity Committee has authorised cable extensions in various parts of the city and outlying districts at a cost of over £11 500.

PORTSMOUTH Corporation is altering the consumers' voltage from 100 to 200 with the object of reducing the area of the cable employed.

TUNBRIDGE WELLS Town Council is to apply for sanction to a loan of £53 428 for the change of system of supply and extensions at the electricity works.

PORTSMOUTH Town Council has decided to erect an electricity sub-station and office at Havant at a cost of £1 400. The work is to be done by direct labour.

HASTINGS Electricity and Public Lighting Committee has recommended the erection of a new generating station, in order to cope with the rapidly increasing business of the undertaking.

The foundation stone of the first section of the NOTTINGHAM Corporation's new power station at Wilford was laid by Alderman Huntsman, Chairman of the Electricity Committee, on June 14th.

BATTERSEA Electricity Committee recommends the provision of a new feeder cable at a cost of £1 835, and that application be made for sanction to a loan of £4 119 for rotary pump, transformer house, etc.

CARLISLE City Council has decided to proceed with the erection of a new generating station at Willow Holme. The estimated cost is £200 000, of which £60 000 has already been spent on machinery installed at the existing works, which will be transferred to the new works.

In connection with the bulk supply of electricity to PAISLEY from Greenock and Kilmarnock, the former Corporation has also agreed to give a supply to the Clyde Valley Power Co. at an agreed rate. The arrangements involve a complete linking-up scheme over the whole area.

Alterations in Charges, Proposed and Actual.

At MANSFIELD the lighting rate has been reduced from 8d. to 7d. per kWh and the rate for heating to 1½d. per kWh.

HOVE Electricity Committee recommends that as from the date of the next meter readings, lighting and power charges be reduced by ½d. per kWh and ¼d. per kWh respectively.

BUXTON is applying to the Commissioners for sanction to continue the present charge of 9½d. per kWh until March 31st next, and to fix the maximum charge from that date at 9d. per kWh.

SHEFFIELD Electric Light Committee recommends a reduction from 60 per cent. to 50 per cent. on the basic rate in all cases where the charge is 2d. per kWh or under (including traction).

BOLTON Electricity Committee has decided upon the following reductions:—Lighting from 5d. to 4¾d. per kWh; cooking and heating, from 1·9d. to 1⅞d. per kWh; power, from 2·9d. and 2·1d. per kWh to 2¾d. and 1½d., according to the amount consumed.

The Ministry of Transport has allowed the application of the North of Scotland Electric Light and Power Co. to charge 1s. per kWh for electricity at BRECHIN without qualification. There was previously a provision that the dividend paid by the company must not exceed three-quarters of the dividend paid in any pre-war year. The decision of the Ministry has caused much local indignation.

TAUNTON Town Council has adopted revised charges for electricity, under which consumers pay 8d. per kWh for the first 25 kWh per quarter, and then on a graduated scale down to 4½d. per kWh for 1 000 kWh and over per quarter. For cooking and heating the charge is to be 3d. per kWh for the first 50 kWh per quarter, and 1½d. per kWh beyond. The power charge is 3d. and 2d. per kWh according to the amount consumed.

SHOREDITCH Lighting Committee recommends a revised scale of charges as from the end of the current quarter. The lighting rate (maximum demand) is to be 7d. per kWh for the first 1½ hours of daily use and 3d. per kWh thereafter, with a flat rate of 5½d. per kWh. The heating and cooking charge is to be 1d. per kWh, and the power charge £1 per quarter per H.P. of maximum demand, plus 1d. per kWh for all electricity consumed.

The North Metropolitan Electric Power Supply Co. has applied to the Ministry of Transport for an order authorising a charge at HERTFORD of 9d. per kWh, flat rate, or 1s. per kWh. for the equivalent of the first 100 hours use per quarter of the maximum demand and 4d. beyond, and an annual service rate consisting of a fixed charge of £24 per kW per annum, and 1½d. per kWh for all electricity consumed, with minimum payments of 11s. 3d. for each winter quarter, and 7s. 6d. for each summer quarter.

Tapping New Areas.

An electric lighting scheme, to cost £17 000, is on foot at ENNISKILLEN (Fermanagh).

A meeting for residents is to be held at BETHESDA to consider the question of a public supply of electricity.

LICHFIELD Town Council has decided to obtain expert advice with reference to a supply of electricity for the city.

BATLEY Town Council has decided to give a supply of electricity to the Hanging Heaton district at an estimated cost of £4 460.

TRURO is to ask the Cornwall Electric Power Co. on what terms they will be prepared to supply electric light and power in the city area.

A canvass at CLOWNE has shown a majority in favour of electric light. Current is to be supplied in bulk by the Staveley Coal and Iron Co.

NEWTON ABBOT Rural Council has consented to the application of Mr. Raymond Hartree, of Calcombe, for a Special Order authorising him to supply electricity to parishes in the Council's area.

THETFORD Town Council has decided to print and circulate a report from Mr. Lee as to the provision of electricity for Thetford and Brandon by means of a hydro-electric station on the Little Ouse river.

It is stated that Edmundson's Electricity Corporation will not fall in with the scheme to supply a large area in North Norfolk with electricity from NORWICH. It is thought that if the company refuses co-operation the scheme will fail.

MALVERN Urban Council has decided to lodge objections to the application of the Worcester Corporation to the Commissioners for an Order empowering them to extend their supply of electricity outside the city boundaries, and to erect overhead mains near and through the Malvern urban district, to connect with the Hereford system.

HENLEY-ON-THAMES Town Council, whilst approving the draft order of the Thames Valley Electric Light Co., have asked that no overhead wires be fixed in the town. The company have demurred to laying wires underground in any but the main thoroughfares, and the Council have appointed a deputation to meet the company to get the roads specified.

Inquiries, Orders and Miscellaneous.

The Commissioners have extended the time limit for lodging objections to the proposed WEST OF SCOTLAND Electricity District to December 31st next.

The LANCASHIRE ELECTRIC POWER Co. has applied to the Electricity Commissioners for a Special Order to generate and distribute electricity in Adlington urban district. Objections to be sent to the Secretary, Electricity Commission, Whitehall, London, by July 8th.

The RUSHDEN AND DISTRICT ELECTRIC SUPPLY Co. has applied to the Electricity Commissioners for a Special Order extending the company's area of supply to Raunds urban district, and parts of Thrapston, Wellingborough and Bedford rural districts.

The WELLINGBOROUGH ELECTRIC SUPPLY Co. has applied to the Electricity Commissioners for a Special Order extending the company's area of supply to parts of Irthlingborough and Finedon urban districts and parts of Kettering and Wellingborough rural districts. Objections to be sent to the Secretary, Electricity Commission, Whitehall, London, by July 12th.

Mr. Raymond Hartree, of Sandhills, Salcombe, Devon, has applied to the Electricity Commissioners for a Special Order—the CENTRAL SOUTH DEVON ELECTRICITY ORDER—authorising the generation and distribution of electricity in Salcombe, Kingsbridge, Ashburton and Buckfastleigh urban districts and Kingsbridge, Totnes and Newton Abbot rural districts. Objections to be sent to the Secretary, Electricity Commission, Whitehall, London, by July 4th.

Personal Items.

MR. HENRY A. TROTTER has re-joined the Board of the Cordoba Light, Power and Traction Co.

Mr. D. SINCLAIR, general manager of British Insulated and Helsley Cables, Ltd., has been appointed to a seat on the board. He will continue to act as general manager.

Mr. JAMES WOOD, assistant manager of the Manchester Corporation tramways, has just completed 50 years' municipal service. He has held his present position since 1910, and was previously accountant to the tramways department.

Following prolonged discussion, the General Purposes Committee of Middlesbrough Corporation has recommended that the salary of the electrical engineer, Mr. R. H. SCOTSON, be reduced by 5 per cent. A similar recommendation has been made in the case of the tramways manager, Mr. H. G. JEKEN. The present salary of both these officers is £693.

We are glad to see that in the organisation of the Southern Railway Co. the electrical engineer is a chief officer directly responsible for all electrical work to the general manager. MR. HERBERT JONES, electrical engineer to the London and South Western Railway, will be the first holder of this appointment, and Mr. H. RICHARDS has been appointed assistant electrical engineer.

Mr. E. GARCKE has, owing to pressure of work, resigned the chairmanship of the North Metropolitan Electric Power Supply Co., a position he had held since its incorporation, but will remain a director, and Sir JAMES DEVONSHIRE, the managing director, has been appointed chairman and managing director. Mr W. L. MADGEN has resigned his position as director of the company owing to ill-health, and Mr. E. R. SOAMES has been appointed to fill the vacancy.

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Imperial Notes.

AUSTRALASIA.

English Electric Co. of Australia.

The net trading profit earned by the ENGLISH ELECTRIC CO. OF AUSTRALIA in the year ended March 31 was £37 175, compared with £46 543 in the previous year. A dividend of 10 per cent. per annum is recommended. Debentures for £76 600 have been exchanged for shares during the year, increasing the capital to £361 720.

Melbourne Suburban Railways—Electrification Completed.

Work on the construction of the Heidelberg-Eltham section of the Melbourne suburban railways is now sufficiently forward to enable passenger trains to be run. This extension practically completes the scheme under which the electrification of the MELBOURNE SUBURBAN RAILWAYS has been proceeding during the last ten years, with the exception of engineering work which has still to be done in the sub-stations and the Newport power station. Electric trains will now run between Melbourne and Eltham, and the period of the journey will be reduced to 41 minutes, compared with 60 minutes under the combined electric and steam service.

Electricity Commission's Hustle.

The work of constructing the transmission line between Geelong station of the Melbourne Electric Supply Co. and COLAC (45 miles) has been carried out by the staff of the Electricity Commissioners at the average rate of half a mile per day. The construction of a sub-station at Belmont, on the outskirts of Geelong, and a receiving sub-station in Colac and the erection of 800 poles, 150 miles of aluminium conductors and other electrical equipment have all been completed since the beginning of the current year. The work was treated as an urgent matter owing to Colac having been left without a supply of electricity through the destruction, by fire, of the local power house.

INDIA.

Madras Supply Corporation's Satisfactory Year.

A satisfactory year's working is reported by the Madras Electric Supply Corporation in the report for 1922. The number of kilowatt-hours sold and the profit in rupees have both shown substantial increases, but the net profit in sterling has declined from £26 487 to £21 959, owing to a basis of 1s. 4d. having been reverted to for rupee conversion. The balance of £9 728 brought forward gives a total of £31 687. It is proposed to pay a dividend of 8 per cent., free of tax, on the ordinary shares (the same as for 1921). The additional remuneration due to the directors under the articles of association amounts to £169, and after reducing the cost of the issue of seven per cent. debenture stock by £2 000, a sum of £8 038 is carried forward.

The working of the Tramways Co., whose ordinary shares are owned by the Corporation, showed an available balance of £17 546, A dividend of 7 per cent., free of tax, was paid on the ordinary shares, the sum of £7 538 being carried forward.

Aerial Ropeways in Bengal.

The Select Commitee on the Bengal Aerial Ropeway Bill has suggested certain modifications in the original Bill. The ropeways will frequently pass over mining properties, and to provide against damage by them to underground workings in mining areas, the Committee think it just that a promoter, if he wishes to place his line in such a manner that it will interfere with the getting of minerals in such areas, shall either compensate the person working such minerals for the loss so occasioned, or shall divert his line when it begins to interfere with the working of the minerals. Secondly, they think it would be necessary at first to combine with other provinces in obtaining the services of qualified inspectors. The working of the ropeway is a highly technical subject; no one is competent to act as inspector of these ropeways unless he has very special knowledge, and the number of such men is extremely limited in India. The Committee further recommend the formation of an Advisory Committee consisting of the Chief Engineer and two expert officers.

SOUTH AFRICA.

Cape Electric Tramways Dividend.

An interim dividend of 3 per cent., free of tax, payable to all shareholders registered on June 10th, has been declared by the Cape Electric Tramways, Ltd.

Victoria Falls and Transvaal Power Co.'s Increased Dividend.

Following distributions at the rate of 5 per cent. since 1916, a dividend on the ordinary shares of the Victoria Falls and Transvaal Power Co. has been declared at the rate of 8 per cent., less tax, for 1922. On the preference shares is declared a final dividend of 4 per cent., less tax, in respect of 1922, making 10 per cent. for that year, and a dividend of 3 per cent., less tax, on account of the current year.

Reporting to NEWCASTLE CORPORATION on the elimination of friction between the Corporation and its employees, the Transport and Electricity Committee recommends adherence to the present method of dealing with matters locally. Other committees recommend rejoining the appropriate Joint Industrial Council.

Foreign Notes.

EUROPE.

Lisbon Electric Tramways.

The operations of the Lisbon Electric Tramways for 1922, after deducting debenture interest and amortisation of the Spanish company and £24 515 for the debenture service of this company, resulted in a net profit of £9 748 (against a loss of £29 184 for 1921). Deducting this sum from the debit of £48 455 brought forward, there remains a balance of £38 708 to be carried to the debit of the next account. The report states that the adverse rate of exchange had rendered it impossible to cover expenditure and meet the demands for higher wages. After prolonged negotiations increased tariffs were authorised in April and again in December. A further revision of tariffs is hoped for in the near future. The 6 per cent. cumulative preference dividend is in arrears as from June 30th, 1917.

Water Power in France.

The Paris correspondent of the "Times" states that the French Government, which has already passed through the Chamber of Deputies a vote of six million francs (nominally £240 000) for the purpose of supplying agricultural districts with electrical energy, is now being urged to grant a national credit to enable France to develop and make greater use of her water power and thus reduce her bills for imported coal. France it is pointed out, has at her disposal five million kW of hydraulic energy which is more than sufficient to supply adequate electrical power for her railways, factories and workshops. "Why, then," M. Chéron, the Minister for Agriculture, asked at a recent conference at Montpellier, "should France depend upon foreign coal for the maintenance of her commercial activity?"

THE FAR EAST.

Japanese Super-station Plans.

Mr. N. Saitoh, director of the Daido Electric Power Co., one of the largest companies of its kind in Japan, recently declared that, with the return of better business conditions in Japan, plans for the merging of a number of power systems into one of the largest super-power systems in the world are gradually taking shape. He said that at the present time the Daido Co. is producing 300 000 kW and has possibilities for generating 1 650 000 kW. The Daido Co., he said, controls practically all rights along the Kiso and Tenryu rivers. It supplies power in Nagoya and Osaka for light and power as well as for interurban railway service. Its power plants of the hydro-electric type are situated on the Kiso and Yahagi rivers and it also has a small reserve steam station in Nagoya. The population in the territory now being served by the Daido Co. includes 1 750 000 in Osaka, 550 000 in Kyoto, 500 000 in Kobe, 300 000 in Nagoya and 500 000 in other smaller cities.

LATIN AMERICA.

United Tramways of Montevideo.

The report of the United Electric Tramways of Montevideo for for the year ended March 31st states that gross receipts for the year ended October 31st last (the Uruguayan company's fiscal year) were £567 125, at par rate of exchange, an increase of £11 400, but there had actually been a loss on exchange of £18 397. Operating expenses decreased by £4 391. The action against the Municipality of Montevideo, arising out of their intervention and seizure of the company's property in 1922, is still pending. The directors again report that authority to increase tariffs has not been granted. The profit and loss account, after providing £46 083 for debenture interest, and deducting administration charges, shows a balance of £27 653, while £5 090 was brought in. After setting aside sums for the redemption of debenture stock and share capital, and paying the 6 per cent. preference dividend for the year, there remains a balance of £1 327, which is carried forward. The board see little prospect of being able to pay a dividend on the ordinary shares while authority for the increase in tariffs continues to be withheld. The net profit was £26 194 for the preceding year, when, also, no dividend was paid on the ordinary shares.

U.S.A.

New Engineering Department Organised by Westinghouse Co.

The creation of a new engineering department in the organisation of the Westinghouse Electric and Manufacturing Co. has been announced by Mr. R. S. Feicht, director of engineering. The new department will be known as the Porcelain Insulator and Transmission Engineering Department, and Mr. C. L. Fortescue, well known in electrical engineering, has been appointed manager. This new department, according to the announcement, will handle the design of line insulators and other work which may be assigned to it from time to time in connection with transmission problems. It will make studies and analyses of these problems, but will not be concerned with the design of large transmission systems. Mr. Fortescue, the new manager, has been engaged in work on insulation and transmission for more than 20 years. His name has appeared on several hundred patents, covering individual pieces of apparatus, apparatus combinations and methods of operation.

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Electric Traction.

Miscellaneous Tramway Items.

PORTSMOUTH Town Council has received sanction to a loan of £19 000, for renewals of the tramway track, etc.

Following the breaking of a live tramway wire at DUNDEE recently, Professor Fulton, of University College, Dundee, tested the wire, his report showing that it was above the Tramway Association standard in every instance.

DONCASTER Town Council is having the tramway feeder cables between Baxter Gate and Spring Garden renewed at an estimated cost of £375, and two tramway return cables, between the generating station and Spring Garden, are to be provided at an estimated cost of £624.

A stoppage of BOLTON tramway service has been averted. The Committee of the Corporation and representatives of the Transport Workers' Union have arranged to meet to discuss the points at issue, and the employees have received instructions from their leaders to continue at work in the meantime.

LIVERPOOL Corporation tramways manager states that on some tram tracks in the city the electric cars travel at 20 miles an hour, a speed at which the motor bus is not allowed to travel. "It is to be hoped," he said on Saturday, "that eventually the streets will be so adapted by means of special tracks that the cars will travel similarly to what might be termed a railway through the city. We are moving toward something of that kind."

Extensive Proposals in Edinburgh.

A report has been prepared by Mr. R. Stuart Pilcher, manager of EDINBURGH Corporation Tramways, dealing with extensions of the electric tramway system, which have been advocated from time to time by members of the Town Council. He states it would be advisable to provide an alternative tramway to Princes Street in George Street that could be used for certain routes. He proposed that George Street should be included in the next Provisional Order. The estimated cost was £29 400. There were other short extensions to existing routes which, he thought, the committee should consider with a view to including them in the Provisional Order. These were:—Slateford terminus to Slateford Village, £7 923; Gorgie terminus to Slaughton Road (cross roads), £10 611; Willowbrae Road to Duddingston Road (cross roads), £22 070; Braid Hills terminus extension to junction at Braid Road, £12 450. Mr. Pilcher states there was every indication that the time had now come for Parliamentary sanction to be obtained for the construction of a tramway to Colinton Village. The estimated cost was £42 750. With reference to the proposal to extend the tramway from Slateford to Juniper Green, he does not think there is enough traffic to warrant this. It is expected that the last of the cable cars will be withdrawn from service to-morrow (Saturday).

Fares, Receipts and Passengers.

PLYMOUTH tramway receipts for the four weeks ended June 2nd amounted to £15 697 19s. 7d., compared with £15 246 11s. for the corresponding period in 1922.

ABERDARE District Council has decided to adopt the principle of the penny stage on the tramways for a period of three months. There is a loss on working at present.

During the week ending June 9th, the receipts on LONDON tramways under "Underground" control amounted to £41 358, compared with £57 842 for the corresponding period last year.

WALSALL Corporation tramways carried 10 079 666 passengers during the year ending March 31st as against 9 158 260 in the previous year. The car mileage run was 866 443 as against 799 898.

The experiment of issuing weekly family passes is being tried on one route of the Bradford Corporation Tramways. The fare on the route is 1½d. for any distance, and the passes, available for any car on all seven days, are being issued at 2s. each. They are transferable within the family of the holder, and a good demand for them has been reported. The chairman of the Tramways Committee has promised to consider the reversion to 1d. fares.

City and South London Tube Strike.

Conciliation Board and Resumption of Work.

The dispute which has arisen in connection with the reconstruction of the City and South London Tube Railway, and which resulted in an unofficial strike of tunnellers, was considered on Monday at a meeting of the Civil Engineering and Constructional Conciliation Board, held at Westminster.

At the close of the meeting, which was private, an official statement was issued to the effect that it had been unanimously agreed that the Board could not consider the alleged grievances of the men on these works until there was a resumption of work. Should a resumption of work take place, the Board would be convened immediately to consider the grievances which might exist, and the right would be extended to any representative of the men to attend and submit their claims before a full Board, with a view to an agreement being reached. It was further decided that any decision subsequently made by the Board in respect of these claims should be retrospective to June 0th.

It was officially stated that no lock-out notices had been posted by the contractors, and that the report that the remaining workers had been threatened with a lock-out was incorrect. It is understood that the proposal of the Board is to be considered by the men now on strike.

Wireless News.

Senator Marconi's Experiments.

In a statement issued to the Press on his arrival at Southampton on board his yacht "Elettra" last week, Senator Marconi said that during the two months he had been away on his research cruise he had been working all the time on the system of directive wireless telegraphy, by which a message could be sent in one direction only, and he was delighted to say that experiments had proved highly satisfactory. The apparatus with which he had been working was the only installation of its type, but it was likely to come into universal use in the future. The results he had obtained proved that communication could be maintained over great distances. The new system, said the Senator, effectively eliminated atmospheric disturbances, and he might say that he had experienced no trouble of that sort during the whole of his two months' research. The course of the trip was roughly 2 200 miles, or the distance from England to Canada. There was one other interesting piece of news, and that was that they were able to hear distinctly at Casablanca, which is 1 000 miles from home, the musical concerts and news matter transmitted by the British Broadcasting Co. from Marconi House. Mr. Marconi intends shortly to set out on another voyage of research, probably up the Mediterranean, and the primary object will be further tests with the new directive system.

Medical Aid at Sea by Wireless.

The Board of Trade has been informed that arrangements have been made by the Norwegian and Swedish Governments for the transmission gratis of medical advice from the Bergen and Gothenburg radio stations in cases of sickness or accident on board ship. The master of the ship in question can send a wireless telegram in Norwegian, Danish, Swedish, German, English or French, containing a short report of the case to either of these stations, whence it will be transmitted to the Bergen Municipal Hospital or the Almanna och Sahlgrenska Hospital at Gothenburg respectively. The doctors at these institutions will dispatch by wireless the advice which they consider should be given in the circumstances. No charge will be made either for the telegrams or the advice.

Sir Edward Manville on Empire Wireless.

Presiding at the annual meeting of the British Imperial Council on June 13th, Sir EDWARD MANVILLE remarked that the whole commercial community of the Empire was deeply interested in Imperial wireless communication. The British Government had from time to time postponed any definite decision, but it was stated that the construction of a high-power wireless station at home was to be undertaken without further delay. He thought that was not a mere pious expression of opinion, and that they would soon have wireless communication with the most distant parts of the world.

Miscellaneous Wireless Items.

To-night (Friday) the programme from the London station of the B.B.C. includes a talk by Sir ERNEST BENN on "European Trade."

The Oxford Wireless Telephony Co. has been approached from several sources to represent to the British Broadcasting Co. the necessity of having a RELAY STATION IN OXFORD.

The performance of the "Meistersingers" at Covent Garden on June 14th was successfully TRANSMITTED BY RELAY over a land line from London to Glasgow. The "Glasgow Herald" remarks that from the technical point of view the experiment represents a considerable advance.

The METROPOLITAN POLICE are now using a motor vehicle which, even while travelling at high speeds, can receive and transmit wireless telephone messages. The aerial consists of five strands of wire, each 14 ft. in length. For transmitting the aerial is raised 3 ft. above the top of the car.

The Boilermakers' Dispute.

A conference is to be held between the Shipbuilding Employers' Federation and the Boilermakers' Society in London to-day (Friday) with the object of making a further attempt to reach a settlement of the present SHIPYARD DISPUTE. The lock-out of the members of the Boilermakers' Society is now in its eighth week, and nearly 10 000 members of the Society are involved. In addition upwards of 13 500 men of other trades in the shipyards are idle in consequence of the dispute.

The SIEMENS SPORTS CLUB will hold its first annual sports and gala to-morrow (Saturday) at the Sports Ground, Park Lane, Charlton. An attractive programme has been arranged.

A letter sent to all members of the NATIONAL FEDERATED ELECTRICAL ASSOCIATION states that at the national conference between the executives of the N.F.E.A. and the E.T.U. at Leicester on May 29th, the following resolution was passed in connection with the National Standardised Wages Agreement:—"That there be no alteration pending a review of the whole situation in January, 1924. In the meantime that wages be stabilised on the current rates of all grades until February 1st, 1924."

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Tenders Invited.

GREAT BRITAIN.

ST. AUGUSTINE'S CHURCH, WOODSTON.—Electric light wiring and fitting of church and rectory. Particulars from the Rector.

WESLEYAN CHURCH, KNOTTINGLEY (LEEDS).—Electric light wiring and fitting. Particulars from Mr. G. E. Armytage, Weeland Road, Knottingley.

HINDLEY LIBRARY COMMITTEE.—Electric light installation and ventilating fan; also boiler for heating system. Particulars from the Librarian and Secretary.

HORSHAM GUARDIANS, June 28th.—Centrifugal pump, to deliver 20 gallons of water per minute at a head of 26 ft., direct coupled to electric motor, with starting panel, wiring, etc. Particulars from the Clerk, 9, Carfax, Horsham.

EDINBURGH EDUCATION AUTHORITY, June 25th.—Heating and electrical apparatus for James Clark School Extension. Specifications from the Education Offices.

MANCHESTER EDUCATION COMMITTEE, June 27th.—Electric light wiring and fitting of municipal schools at Ross Place, Varna Street, Wheeler Street, Elysian Street, Collyhurst, Cheetham, and Alfred Street. Specifications, etc., can be obtained at the Education Offices, Deansgate, Manchester.

GOVERNORS OF GLOUCESTER UNITED SCHOOLS, June 30th.—Electric light wiring of Crypt Grammar School and Sir Thomas Rich's School. Specification from the Clerk to the Governors, 24, Barton Street, Gloucester.

STAFFORDSHIRE EDUCATION COMMITTEE, July 5th.—Electric light installation for the Farm Institute, near Penkridge, Staffs. Specification from the Director, County Education Offices, Stafford.

CARDIFF CORPORATION, July 7th.—25 special low-type top-covered tramcar bodies and 25 electrical equipments for same. Specifications can be obtained by firms on the King's National Roll from the Tramways General Manager, The Hayes, Cardiff.

MANCHESTER TRAMWAYS COMMITTEE, July 10th.—Permanent way special track work. Specifications from the General Manager, 55, Piccadilly, Manchester.

KENSINGTON (LONDON) GUARDIANS, July 12th.—Electric light installation at the Institution, Marloes Road, Kensington. Specification, etc., from the Clerk to the Guardians, Marloes Road, Kensington, W.8.

ST. PANCRAS (LONDON) BOROUGH COUNCIL, July 19th.—Supplying and laying about 190 yards of 36 in. c.i. socket and spigot pipes, with reinforced concrete outlet into the Regent's Canal, in connection with the electricity undertaking. Specification from the Electricity Department, 57, Pratt Street, Camden Town, N.W.1.

GLASGOW CORPORATION, July 30th.—(1) Two 15 000 kW turbo-alternators and condensing plant; (2) Eight boilers, economisers and accessories; (3) H.t. switchgear, for Dalmarnock Power Station. Specifications from the City Electrical Engineer, 75, Waterloo Street, Glasgow.

LEEDS CORPORATION, July 31st.—Steam turbine, three-phase alternator and exciter of about 10 000 kW capacity, speed not exceeding 3 000 revs. per min., and auxiliaries for surface condensing plant. Specifications from the General Manager, Electricity Department, 1, Whitehall Road, Leeds.

AUSTRALASIA.

VICTORIAN ELECTRICITY COMMISSION, August 25th.—Transformers. Specification (No. 23/93) from the Agent-General for Victoria, Melbourne Place, Strand, London, W.C.2.

SYDNEY CITY COUNCIL, November 19th.—Storage batteries, regulating switches, copper connections, charging boosters and switchgear. Specifications from the Electricity Dept., Town Hall, Sydney.

IRELAND.

MINISTRY OF FINANCE OF NORTHERN IRELAND, June 26th.—Electrical works and supplies for the various government establishments in Belfast and district during 12 months. Forms of tender, etc., from the Ministry (Room 32), 15, Donegall Square West, Belfast.

ATHLONE URBAN DISTRICT COUNCIL, July 4th.—One 47 B.H.P. semi-Diesel crude oil engine, electric light type, with independent 4 B.H.P. oil or petrol engine to drive an air compressor, compressed air receiver, piping, etc. Specification from the Borough Surveyor, Court House, Athlone.

NEW ZEALAND.

DUNEDIN CORPORATION, July 30th.*—Switch cubicles.

N.Z. PUBLIC WORKS SUPPLIES AND TENDERS COMMITTEE, July 31st.*—Electrical equipment for a dredge to be used in the vicinity of Auckland in connection with a river improvement scheme.

PUBLIC WORKS TENDERS BOARD, WELLINGTON, February 28th.*—Headworks for hydro-electric power station at Arapuni, on the Waikato river.

SOUTH AFRICA.

JOHANNESBURG CORPORATION, July 17th*—(1) Four portable continuous chart recording ammeters; (2) Totally enclosed water-jacketed air compressor (Contract 96).

URUGUAY.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO, July 7th.*—Twenty 300 kVA static transformers; July 12th.*—General stores; August 7th.*—Outdoor cable, with special insulation.

* Particulars from the Department of Overseas Trade

Tenders Accepted.

BLEAN GUARDIANS have accepted the tender of S. Terry for electric light wiring at the workhouse.

The tender of Chamberlain and Hookham has been accepted by WINCHESTER CORPORATION for one year's supply of house service meters.

DEWSBURY CORPORATION has accepted the tender of Whitehead and Poole for electrically driven pumps for sewage disposal works, at £3 009 6s.

The tender of Johnson and Phillips for power cable for South Quay, £937 18s. 9d., and for Prince's Dock, £5 891 12s. 1d., has been accepted by the CLYDE NAVIGATION TRUSTEES.

BURNLEY CORPORATION has accepted the tenders of the Lancashire Dynamo and Motor Co., for booster and switchgear, £747, and Enfield Ediswan Cable Works for cable, £350 10s.

The tender of the Metropolitan-Vickers Electrical Co., for 1 670 kW rotary converter and switchgear for Marsh Lane power station, Bootle, is recommended for acceptance by LIVERPOOL CORPORATION.

The tender of Stothert and Pitt for an 8-ton electric crane, at £3 000; and that of the General Electric Vehicle, Ltd., for four electric vehicles for refuse collection, at £4 000, have been accepted by PORTSMOUTH CORPORATION.

Tenders accepted by REIGATE CORPORATION include those of the Hackbridge Electric Construction Co. for static transformers, £379 5s., and Switchgear and Cowans, Ltd., for high and low pressure switchgear for sub-station, £1 173 17s.

The following tenders have been recommended for acceptance by GLASGOW CORPORATION for plant for Dalmarnock power station; British Electric Transformer Co., three 1 875 kVA transformers, £3 883; G. and J. Weir, evaporators, £1 975.

CARDIFF CORPORATION has accepted the tender of the Cargo Fleet Iron Co. (lowest tender) for about 275 tons of steel tramway rails (British standard section No. 7), £11 12s. 9d. per ton. Four tenders were received, the highest being £15 per ton.

The tenders of Callender's Cable and Construction Co., for six miles 0.0225 sq. in. cable, £840, and W. T. Henley's Telegraph Works Co., for two miles 0.1 sq. in. four core cable, £1 463, have been accepted by BIRKENHEAD CORPORATION.

ABERYSTWYTH CORPORATION has accepted the following tenders in connection with the sewerage scheme: Boving Engineering Works, electrically driven pumping plant, £905; S. S. Stott and Co., electrically driven sewage screen and raking apparatus, £838.

BRIGHTON CORPORATION is recommended to accept the following tenders in connection with the new Kemp Town sub-station:—Bruce Peebles and Co., rotary converter, £2 505, and h.t. and l.t. switchgear, £3 022; Siemens Bros. and Co., cables, £8 511 12s.; Herbert Morris, Ltd., crane, £210.

The EGYPTIAN STATE RAILWAYS DEPARTMENT has accepted the following tenders: Sayer and Colley, Babcock boiler, £E.1 677; Soc. Generale d'Electricite et de Mecanique, Alexandria, switchboard panel, £E.68, spares £E.115; Ferranti, Ltd., two three-phase transformers, £E.390; J. G. Jacot Descombes, two h.t. feeder cables, £E.1 626.

GLASGOW CORPORATION is recommended by the Tramways Committee to accept the tenders of the Metropolitan-Vickers Electrical Co. for two rotary converters and switchgear for Barracksire substation, British Insulated and Helsby Cables, Ltd., for trolley wire, and Western Electric Co. and Siemens Bros. and Co. for low-pressure cables.

STEPNEY (LONDON) BOROUGH COUNCIL have accepted the following tenders: Clayton, Son, and Co., w.i. pipe work at Limehouse station, £2 810 (two lower tenders received which did not comply with specification); W. Lucy and Co. (lowest tender) for 12 single feeder boxes, £99 (four tenders received, highest £188 12s.); Sutton and Co. (lowest tender) for conduit work, £912 6s. 9d. (three tenders received, highest £979 5s. 4d.).

LEEDS CORPORATION has accepted the following tenders for apparatus and material for the Electricity Department: A. Reyrolle and Co., extension of main switchboard, £3 624; British Thomson-Houston Co., switchgear, £1 620; Ferguson, Pailin Ltd., switchgear, £1 800; Tramway Supplies, Ltd., switchgear, £706 10s.; Middleton Estate and Colliery Co., cable troughing, £2 307 5s. 10d.; B. Whitaker and Sons (1923), cable troughing and covers, £2 125; Enfield Ediswan Cable Works, cable, £2 813 8s.

Orders recently secured by MANN, EGERTON AND CO., of London, Norwich, etc., for electric light and power installation work include contracts for the Admiralty, War Office, Home Office, Postmaster-General's Dept., Treasury, Colonial Office, Scottish Office, and Customs Dept., and also for work at the Zoological Gardens (London), the Lowestoft Hospital, the Regent Theatre at Norwich), blocks of shops and offices in Regent Street and Haymarket (London), and country houses in various parts of England.

The following tenders are recommended for acceptance by the METROPOLITAN ASYLUMS BOARD:—Electrical Contracting and Motor Co., Pontefract (lowest tender received) for electric wiring of North Western Hospital at £1 660 (23 tenders received, highest, £3 666). T. Clarke and Co., (lowest tender) for electric light and power wiring at the Grove Hospital, £156, (9 tenders received, highest, £228 10s.) Electric Construction Co., (lowest tender) for two motors for Grove Hospital laundry, £178 5s. (7 tenders received, highest, £281 9s.).

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Companies' Reports, Dividends, etc.

ALLEN-LIVERSIDGE, LTD.—Interim dividend declared at the rate of 10 per cent. per annum for the six months ended April 30th.

FERRANTI, LTD.—Dividends announced of 6 per cent. on the 6 per cent. cumulative preference shares and of 7 per cent. on the 7 per cent. non-cumulative preference shares, both payable on July 2nd.

RICHARD JOHNSON, CLAPHAM AND MORRIS, LTD.—The net profit for the year to March 31st last was £18 092, plus £23 520 brought in, making £41 612. Dividend recommended on the ordinary shares of 2½ per cent., less tax, making 5 per cent. for the year, placing £5 000 to reserve and carrying forward £22 060.

J. G. WHITE AND CO.—The net profit for the year ended February 28th, 1923, was £1 244, which it is proposed to carry forward. The directors state that investments show a considerable reduction as compared with the previous year, due to sales of securities on a satisfactory basis. The 7 per cent. preference dividend again becomes cumulative, beginning September 1st next, and six months' dividend to February 28th, 1924, will become payable on July 1st of that year.

HEAD, WRIGHTSON AND CO.—The profit for the year to April 30th, after taxation adjustment, was £41 365 (against £51 163) and £16 544 was brought forward. Preferential charges require £17 052, the reserve account receives £10 000 (against £20 000), while £846 is reserved for preference dividend from March 31st to April 30th, 1923. From the balance it is proposed to pay a final dividend on the ordinary shares of 5 per cent., making 7½ per cent. for the year (unchanged), and to carry forward £14 261.

RANSOMES, SIMS AND JEFFERIES, LTD.—The net profit for the year to March 31st last, after making provision for depreciation, bad and doubtful debts, and interest on debenture stock, was £5 895, plus £42 059 brought in, making £47 954. The report states that during the year trade conditions both at home and abroad have been unfavourable, and it has been necessary to transfer £70 000 from the general reserve to meet a further fall in the value of the stock-in-trade. The directors regret that they are unable to recommend any dividend on the ordinary or preference shares for the 18 months to December 31st, 1922.

WAYGOOD-OTIS, LTD.—The net profit available for the year to March 31st last, after providing for all expenses and £5 918 for depreciation, £49 864, compared with £77 360 for the previous year and £83 069 for the year to March 31st, 1921. The total available for distribution, with £22 339 brought in, is £72 203, from which the reserve accounts receive £20 000, against £40 000, and the pensions' fund £3 000, compared with £5 000. A final dividend of 5½ per cent. on the ordinary shares is proposed, making 8 per cent., against 8 per cent. and a bonus of 2 per cent. for the previous year, leaving to be carried forward £17 003.

REES ROTURBO MANUFACTURING CO.—The accounts are now available for the period of 13 months to September 30th, 1922. A balance is shown, including £1 567 brought forward from the previous year, of £5 341, which is carried forward. The sum of £1 657 was added to capital expenditure for patterns and loose tools. In September last the Rees Roturbo Development Syndicate, whose issued capital was 30 000 £1 shares, returned 19-20ths of the capital to its shareholders. As the Rees Roturbo Manufacturing Co. owned 15 994 shares in the syndicate, they received the sum of 19s. per share, or £15 194, which was used for the repayment of an equivalent amount of loan. During the year loans were reduced from £34 050 to £9 900. In respect of the eleven months to August 31st, 1922, two years' preference dividend (to September 30th, 1918) were paid. The general reserve fund stands at £15 000, depreciation reserve £17 000, and taxation reserve £10 800.

Supply and Lighting.

NOTTING HILL ELECTRIC LIGHTING CO.—Interim dividend declared of 4s. per share, tax free, on the deferred shares.

Cable and Telegraph Companies.

INDIA RUBBER, GUTTA PERCHA AND TELEGRAPH WORKS CO.—The directors announce that they are unable to recommend the payment of an interim dividend on the ordinary shares. The half-yearly dividend on the preference shares will be paid on July 24th.

WEST AFRICAN TELEGRAPH CO.—The gross revenue for 1922 was £66 708, the profit being £8 065, plus £50 adjustment of Corporation tax for 1921 and £3 599 brought forward, making £11 715. Dividend recommended of 4 per cent., free of tax, leaving £2 417 to be carried forward.

GLOBE TELEGRAPH AND TRUST CO.—Following the dividend announcement (3s. per share on the preference, making 6 per cent. for the year and 5s. per share on the ordinary, making 10 per cent.) the report states that the net revenue for the year to May 31st was £342 325, plus £20 854 brought in, making £363 179. Interim dividend distributions have taken £238 586, leaving £124 593. The final dividends proposed absorb £79 679, leaving £44 914 to be carried forward.

New Issues.

ENFIELD EDISWAN CABLE WORKS, LTD.—An issue was made on Saturday of £200 000 7½ per cent. cumulative preference shares of £1 each at par. The issue is designed to provide additional plant and further working capital.

ENGLISH ELECTRIC CO.—Six per cent. debentures to the value of about £1 250 000 have been issued to replace the present 8 per cent. notes. The debentures are convertible into ordinary shares over a period of ten years.

New Companies.

F. W. LAMP CO., LTD.—Private. Cap., £1 000 in £1 shares. Import and export merchants and agents for the importation and exportation of electric lamps, etc: Reg. office: 11, St. Mary Axe, London, E.C.3.

ARMATURE AND ENGINEERING CO., LTD.—Private. Cap., £1 000 in £1 shares. Motor, electrical, mechanical, lighting, heating and general engineers, carriers and transport agents, armature winders, etc. Reg. office: Sydenham Works, Lower Bristol Road, Bath.

SHEFFIELD WIRELESS DEPOT, LTD.—Private. Cap., £1 000 in £1 shares. To acquire the business of a wireless apparatus dealer now carried on by Margaret Jackson at 178, Norfolk Street, Sheffield, as the "Wireless Service Depot." Reg. office: 178, Norfolk Street, Sheffield.

THORNTON AND VOWLES, LTD.—Private. Cap., £2 000 in £1 shares, (1 000 7 per cent. preference and 1 000 ordinary. Manufacturers of and dealers in wireless apparatus of all kinds. G. E. Vowles, St. Leonards, Hooley Street, Sherwood, Nottingham, electrician, is a subscriber.

VENTIMOTORS, LTD.—Private. Cap., £5 000 in £1 shares. To adopt an agreement between J. Gardner and F. J. Nettlefold, and to carry on the business of electricians, electrical and mechanical engineers, suppliers of electricity for light, heat, sound, motive power or otherwise. Reg. office: Friars House, New Broad Street, London, E.C.

RADIO TRANSFORMER CO., LTD.—Private. Cap., £1 000 in £1 shares. To acquire the business now carried on by E. H. Norton at 3, Stanwell Street, Colchester, as the "Radio Transformer Co.," and to carry on the business of manufacturers of wireless sets, electrical equipment and component parts thereof, etc. Reg. office: 3, Stanwell Street, Colchester, Essex.

F. H. THORNE AND CO., (1923), LTD.—Private. Cap., £500 in 400 7 per cent. cumulative preference and 100 deferred shares of £1 each. Scientific instrument makers, mechanical engineers, makers of name plates, dials, scales, index and instruction plates, specialists in toolmaking, machinery, stamping, turning and experimental works, etc. Reg. office: 100, Union Street, Borough, London, S.E.1.

ROLAND C. BELLAMY, LTD.—Private. Cap., £10 000 in £1 shares. Manufacturers and repairers of and dealers in automobiles, motor cars, motor tractors, motors, cycles, carriages and vehicles of all kinds; indiarubber manufacturers, electricians, electrical, aeronautical and mechanical engineers, wireless installers and manufacturers, etc. R. C. Bellamy, Sorrento, The Park, Grimsby, is managing director.

AMALGAMATED WIRELESS (AUSTRALASIA), LTD.—Particulars of Amalgamated Wireless (Australasia), Ltd., have been filed, pursuant to Section 274 of the Companies (Consolidation) Act. The company was incorporated in New South Wales. The British address is Room 421, Australia House, London, W.C.2. F. A. Hunter, radio engineers, of 66, Comeragh Road, West Kensington, London, S.W., is authorised to accept service.

WESTMINSTER TOOL AND ELECTRIC CO., LTD.—Private. Cap., £8 000 in £1 shares (100 founders' and 7 900 ordinary). To acquire the business carried on by A. P. Haslam, A. L. Tester and J. Williams at 116, Putney Bridge Road, London, S.W., as the "Westminster Tool and Electric Co.," and to carry on the business of manufacturers of and dealers in all kinds of electrical and mechanical drills, grinders, blowers, tools and appliances, etc.

RADIO RECEPTION, LTD.—Private. Cap., £1 200 in 1 150 7½ per cent. cumulative preference shares of £1 each and 1 000 founders' shares of 1s. each. Radio, electrical, automobile, mechanical and mining engineers, electricians, manufacturers of and dealers in apparatus for transmission, emission or reception of sound, pictures, light, heat and power, also telegraphy, telephony, radio telegraphy and telephony, etc. Reg. office: 19, Bond Street, Ealing, London, W.5.

NEON LIGHTS (1923), LTD.—Private. Cap., £30 000 in £1 shares. To enter into an agreement between Neon Lights, Ltd., and G. M. Williams, of the first part, W. H. Walton and F. S. Phillips, of the second part, and the company of the third part, and to carry on the business of manufacturers, factors, dealers and merchants of and agents and advertisement contractors for Neon lamps and lights, and any electrical, scientific, mechanical or other device, whether with or without Neon lamps, tubes, and gas, etc. Reg. office: 6, Old Jewry, London, E.C.

Books Received.

"Grundzüge der Starkstromtechnik." By Dr.-Ing. K. Hoerner (Berlin: Julius Springer.) Pp. 257.

"Electro-Chemistry Related to Engineering." By W. R. Cooper. (London: Constable and Co.) Pp. 136. 12s. 6d. net.

"Elektrotechnik in Einzeldarstellungen."—I. By Prof. Dr. Gustav Benischke. (Braunschweig: Friedr. Vieweg and Sohn.) Pp. 149. 3s. 7d. net.

M. André Blondel has made application for the RESTORATION OF PATENT, dated April 4, 1918, and numbered 125084 (8580/19), granted to him for "Improvements in or relating to the application of oscillographs and other galvanometers to radio telegraphy," which has expired owing to non-payment of renewal fee.

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Company Meeting.

British Electric Traction Co.

Mr. J. S. Austen presided at the twenty-seventh ordinary general meeting of the BRITISH ELECTRIC TRACTION CO., LTD., on June 15th. In moving the adoption of the report, he said that during the past year the company had done a little better than in the previous year, and the directors were able to recommend the payment of a dividend of five per cent., the first distribution at that rate for some years. During the year they redeemed £60 000 of their debenture stock, and the discount on that, amounting to £11 000, had been applied to reducing the value of their securities. In addition to that, they had realized a considerable profit—about £70 000—from sales of securities, and that had also been applied to the reduction of stocks.

The company had a very large proportion of its holdings in electrical undertakings. He did not propose to make a speech on those undertakings in general, but there were one or two to which he would refer. The Auckland undertaking was one which had been mentioned on several previous occasions, and he thought that this was the last time on which it need be mentioned. Some years ago that undertaking was sold to the City of Auckland for bonds of the City. Those bonds had now been disposed of at a satisfactory profit. With regard to the Shropshire, Worcestershire, and Staffordshire Electric Power Co., that concern had entered into an undertaking with the Electricity Commissioners to build a super-generating station, and if that succeeded—of which there was every prospect—the British Electric Traction Co., would no doubt bear a part in financing future extensions.

Traction and Supply Companies.

With regard to the companies the management of which was in their hands, in the tramway and omnibus undertakings the receipts in 1922 were adversely affected by the general trade depression, unfavourable weather, reduced railway fares, the engineers' lock-out, competition and some reduction in fares, and against all that they had to set only a reduction in expenses. In the result, their profits were about 20 per cent. below those of the previous year.

With regard to their electricity supply undertakings, the trade depression in the early months of the year caused a diminished demand for electricity, but the demand increased during the latter part of the year. More units were sold for the whole year than in 1921, but at a lower average price. An interesting feature was the improvement which had taken place in the small electric lighting undertakings, of which they owned a fair number. In pre-war times those companies had been strangled by the low rates which they were obliged to charge. They were now allowed to charge fair prices and the result was that they were earning a moderate return on the capital invested in them, and a curious result of that increase of prices was that more units had been sold. It really was not unfair to say that the increased charges had conferred a benefit both on the companies and on the public.

Current Year's Prospects.

Taking the federated companies—those which they managed—as a whole, there was at the moment no visible reason why the present year should not show an improvement on the past. All sorts of things might happen, but it was better to treat the matter as it stood at present. With regard to the tramway and omnibus companies, during the first three months of the year the results, compared with those of the corresponding period of 1922, showed a substantial increase in all sections. That indicated that the results for the whole year should be better than those of the previous year.

With regard to their list of investments, in past years, criticism had been raised at the way in which the directors were accustomed to present the list. They had gone into the matter very carefully and now gave their exact holdings classified according to the method in the Stock Exchange Official List. They had purchased during the year a considerable amount of new securities, and at the moment these showed a handsome profit.

Mr. E. Garcke seconded the resolution and it was carried unanimously.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER.—"Designs for Bathroom Furnishings"; "The Bathroom in the House"; "Furnishing Trades Benevolent Association Garden Party."

THE CHEMICAL AGE.—"Dr. Armstrong's Presidential Address on 'Chemistry and Industry'"; "The Importance of a Fine Chemical Industry to the Nation."

THE EUROPEAN COMMERCIAL.—"Special Review of the Coal, Iron and Steel Markets of Europe and the United States"; "The Gothenburg Jubilee Exhibition"; "Enlargement of Harbours in Finland."

THE FRUIT GROWER.—"Mosaic Diseases of Tomatoes and Cucumbers"; "Marking Imported Produce"; "Horticultural Organisation."

THE GAS WORLD.—"Next Week's Meeting of the Institution of Gas Engineers in Belfast"; "The Gas Industry in Ireland"; "The Fairweather Calorimeter."

THE HARDWARE TRADE JOURNAL.—"Hardware Exports—Bigger Shipments of Hollow-ware"; "Hints of Setting and Fixing Machinery"; "Hardware Assistants' Education—The Test for Juniors."

Legal Intelligence.

Case against London Supply Corporation Settled.

The case of X. G. L. Syndicate, Ltd., against London Electric Supply Corporation, Ltd., which alleged different charges to different consumers, was to have been heard by Mr. Justice ASTBURY in the Chancery Division on June 13th. Mr. LUXMOORE, for the plaintiffs, said he desired to relieve his lordship of trying the case. The parties had come to terms, and he would not trouble his lordship with them except to say that there was an agreement for the payment of the plaintiffs' costs which were to be taxed in case the parties differed, and £100 which was paid into Court as security for costs by the plaintiffs would be released and paid out to the plaintiffs' solicitors.

Mr. CRAIG HENDERSON, who appeared for the defendants, agreed.

His LORDSHIP granted an order embodying the terms of settlement.

Underground Railway's Income Tax.

Mr. Justice ROWLATT, sitting to hear Revenue appeals in the King's Bench Division on June 13th, allowed an appeal by the Crown from a decision of the Special Commissioners of Income Tax who had allowed a claim by the Underground Electric Railways Co., of London, Ltd., for the repayment of income tax on a loss suffered through a fall in the rates of exchange in providing currency to satisfy payments in Amsterdam and New York. The loss—£67 922—constituted the "expenses of management" on which the company claimed relief.

Mr. Justice Rowlatt held that the cost to the company of obtaining money abroad was not an expense of management within Section 33 of the Income Tax Act 1918 and as before stated allowed the appeal and reversed the decision of the Special Commissioners.

Forty Years Ago.

"The Electrician," June 23rd, 1883.

TELEPHONY IN DUBLIN.—We understand that the exchange system in Dublin is to be open day and night.

THE SUNDERLAND CATASTROPHE.—We hear of at least one child being rescued from the crush in a dying state and restored to animation by means of electricity. Dr. Abrath, of the Sunderland Hospital for Foreign Seamen, had the gratification of being the successful operator in this case.

TELEPHONE WORK FOR LADIES.—"Cassell's Magazine" for the current month contains a letter addressed to the publishers from Miss Merlin, lady superintendent of the United Telephone Company, in which she states that one hundred ladies are now employed by that company, nine of the exchange offices being under their care. She speaks in high terms both of the employment itself and of the manner in which the ladies have discharged their duties.

ELECTRIC LIGHTING PROVISIONAL ORDERS CONFIRMATION BILLS.—During last week four additional Bills (Nos. 4 to 7) for confirming Provisional Orders made by the Board of Trade under the Electric Lighting Act, 1882, were introduced, read the first time, and referred to the Examiners. Bill No. 4 related to Barton, Eccles, Winton and Monton, Carlisle, Croydon, Luton, Margate, Nelson, Rochester, Scarborough and Sudbury; No. 5 to Bermondsey, Clerkenwell, Hampstead, Holborn, Hornsey, St. George's-in-the-East, St. Giles's, St. James's, St. Martin's, London, St. Luke's and Wandsworth; No. 6 to Limehouse, Poplar, Richmond (Surrey), Rotherhithe, St. Giles's, St. Olave's, St. Saviour's (Southwark), Shoreditch and Wednesday and Darlaston; and No. 7 to Barnes and Mortlake, Hackney, Islington, St. Pancras and Whitechapel.

National Engineers' Association.

Visit to Works of the Brush Electrical Engineering Co.

At the invitation of the Brush Electrical Engineering Co., a party of members of the NATIONAL ENGINEERS' ASSOCIATION visited Falcon Works, Loughborough, on June 9th. The party included a number of textile mill engineers from Manchester and district and a number of works engineers from Leicester. The activities of the Brush Co. in the manufacture of electrical equipment for textile mills was of particular interest to the visitors, who inspected carefully the display of motors designed specially for use in textile mills and the machinery installed for their manufacture. The various processes in the manufacture of the Brush-Ljungstrom turbine were also of interest to the visitors.

After the shops had been inspected, the visitors were entertained to tea. Speaking on behalf of the Brush Co., Major Coulston pointed out that it was one of the oldest electrical manufacturing companies in the world, and mentioned that it is now 20 years since the company first equipped a textile mill for electric drive. The president of the National Engineers' Association, Mr. Catterall replying, enlarged on the possibility of the Brush-Ljungstrom turbine for reducing the cost of production in textile mills.

Brookhirst Switchgear Exhibitions.

An exhibition of "Brookhirst" motor control gear has been arranged by the manufacturers, BROOKHIRST SWITCHGEAR, LTD., at 5, Deansgate, Manchester. The latest types of d.c. and a.c. motor starting pillars are being shown, and visitors will be welcome at any time. The exhibition will remain open until the end of October.

A permanent exhibition on similar lines has been organised by the firm at their London office, Australia House, Strand, W.C.2.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

ADAMS, Ernest Walter, 664, Old Kent Road, wireless maker. £61 19s. March 22nd.

ELECTRICAL INSTALLATION CO., 16, Central Arcade, Wolverhampton, engineers. £10 12s. 3d. May 2nd.

McCREA AND CO., 103, Praed Street, Paddington, electrical engineers. £13 1s. 11d. April 24th.

ROBERTS AND CO., 26, Margaret Buildings, Whites Row, Aldgate, electrical engineers. £28 5s. 1d. May 5th.

WESTON, Edgar, 38, New Oxford Street, W.C., electrical engineer. £22 18s., April 26th; and £16 14s. 2d., April 26th.

Receiverships.

ISAACSON AND BROWN, LTD. H. C. Mundy, of 135, Auckland Road, Ilford, E., was appointed receiver and manager on June 8th, 1923, under powers contained in debentures dated January 23rd, 1913.

PARKINSON (J.) AND CO. (LEEDS), LTD. (formerly CULKIN AND PARKINSON, LTD.). D. D. Perkins, of 26, East Parade, Leeds, was appointed receiver on May 31st, 1923, under powers contained in instrument dated January 12th, 1922.

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

ARROWSMITH (H.) AND CO., LTD., magneto makers and repairers, 8, Stewart Street, Deansgate, Manchester. This company has gone into voluntary liquidation, the statement of affairs submitted to the statutory meeting of creditors showing liabilities of £1 071 (trade creditors £545), and net assets of £279, or a deficiency of £792. It was pointed out that so far as the debenture holders were concerned there was a deficiency of £241, and consequently there was no balance available to meet the claims of the unsecured creditors. Since its inception in November, 1921, the company had traded at a loss. The debentures were issued for cash a year ago. The present position was attributed to the loss on trading which was largely due to the necessity of cutting prices and depreciation of the assets. A receiver had been appointed on behalf of the debenture holders and he had advertised the business for sale as a going concern.

CRYSTOPHONE MANUFACTURING CO., LTD., 16, Wells Street, London, W.1, manufacturers and dealers in wireless, telephone and telegraphic supplies. A meeting of creditors was held on June 14th, at the offices of Poppleton, Appleby and Hawkins, 4, Charterhouse Square, E.C., when it was stated that the company had gone into voluntary liquidation and had appointed Mr. E. H. Hawkins and Mr. A. Yeatman as joint liquidators. The statement of affairs showed liabilities £2 066 (£1 560 due to the trade), and assets set down at £1 144. Mr. Yeatman explained that execution had been levied and the greater portion of the stock had been removed by the sheriff for the purposes of sale. It was believed that on a realisation the remaining assets would not produce more than £266. The company was formed on November 2nd of last year, and it took over a partnership business established the previous June. The trading receipts of the company had totalled £3 336 against payments of £3 841. The bank had granted an overdraft of £500 on the personal guarantees of certain of the directors. A resolution was passed confirming the voluntary liquidation of the company with Mr. Hawkins and Mr. Yeatman as joint liquidators, and an advisory committee of three of the principal creditors was also appointed. The following are creditors:—Chloride Electric Storage Co., £49; Dubilier Condenser Co., £44; Ever Ready Co., Ltd., £51; Graham, Alfred, and Co., £124; United Rubber and Gutta Percha Co., Ltd., £13; London Electric Wire Co., £26; Sullivan, H. W., £68; Paragon Rubber Co., £161; Power Equipment Co., Ltd., £26; Radio Installations Co., Ltd., £54; Radio Equipment Co., Ltd., £27; Sterling Telephone Co., Ltd., £44; Wates Bros., £141.

MUNRO, Donald Alexander, and MOIR, John James, trading as MUNRO, MOIR AND CO., 8, Endell Street, London, W.C., electrical dealers, etc. A statement of affairs was placed before a meeting of creditors last week showing liabilities £9 641 (£1 757 due to the trade and £7 884 to cash creditors), and net assets £956, a deficiency of £8 685. It was stated that the principal cash creditor was prepared to assist the debtors, and he had handed over £650 in cash which would ensure the trade creditors receiving a minimum dividend of 5s. in the £. It was proposed that a deed of assignment should be executed to Mr. Dormer and that the estate should be realised. A resolution was passed approving the proposal.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-Up Voluntarily.

BLACKBURN (W.) (KEW), LTD. Charles Latham, Dundee House, 15, Eastcheap, London, appointed liquidator.

Bankruptcy Information.

FRANCIS, Leonard, 2, Morrison Street, Castleford, in the county of York, electrical engineer. Receiving order, June 12th. Debtor's petition.

Notices of Intended Dividends.

COX, Charles John (trading as C. J. COX AND CO.), Pontefract Road, Castleford, electrical engineer. Last day for receiving proofs, June 30th. Trustee, W. Tate, 9, Central Bank Chambers, Leeds.

PILBROW, Frederick Arthur (trading as H. AND J. WEST), 7B, Stoke Road, Gosport, Hants, electrical engineer. Last day for receiving proofs, June 28th. Trustee, C. Hoult, Official Receiver, 87, High Street, Portsmouth.

Partnership Dissolved.

DEVON ELECTRICAL ENGINEERING CO. (Ernest Asher WHITE and Charles Walter SHILLUM), electrical engineers, 28, High Street, Barnstaple, Devon, March 27th, 1923, by reason of the death of E. A. White.

Edinburgh Gazette.

MACMILLAN, John Gibb, electrical dealer, trading as THE GLASGOW ELECTRICAL SUPPLY CO., 138, Bath Street, Glasgow. Meeting of creditors in this summary sequestration at the office of the trustee, 53, Waterloo Street, Glasgow, on Thursday, July 5th, at 3 p.m.

Bankruptcy Proceedings.

WILKINSON, Sam George, 25, Havelock Road, Harrow, Middlesex, late 76, High Road, Wembley, Middlesex, electrician. The statement of affairs shows liabilities £4 193 and assets estimated to realise £291, a deficiency of £3 902. Debtor, after having sold a business, paid his liabilities, and with a balance of £400 commenced trading in partnership with another at 76, High Road, Wembley, as the WILTON ELECTRICAL CO., and his partner, who was a practical electrician, was to receive one half of the profits and £3 a week as wages. No profits were, however, paid to his partner, who retired from the concern in December, 1922. There are some debts still outstanding which were incurred during the partnership. On March 23rd last debtor executed a deed of assignment to a trustee, who has been requested to render an account of his receipts and payments.

Prices of Metals, Chemicals, etc.

TUESDAY, June 19.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£70 15 0	15s.	—
Electro Wirebars	,,	£74 10 0	10s.	—
H.C. Wire, basis	per lb.	10¼d.	1/16d.	—
Sheet	,,	10¾d.	—	—
Phosphor Bronze Wire (Telephone)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2½d.	1/16d.	—
Brass 60/40—				
Rod, basis	,,	7⅛d.	—	—
Sheet, basis	,,	10¼d.	—	—
Wire, basis	,,	10⅛d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£6 0 0	—	2s. 6d.
Galvanised Steel Wire, basis 8 S.W.G.	,,	£19 10 0	—	—
Lead Pig—				
English	,,	£26 15 0	—	10s.
Foreign or Colonial	,,	£25 10 0	—	10s.
Tin—				
Ingot	,,	£190 5 0	—	£7
Wire, basis	per lb.	2s. 6¼d.	—	1d.
Aluminium Ingots	per ton	£120 0 0	—	—
Spelter	,,	£29 10 0	—	£1 7 6
Mercury	per bottle	£10 12 6	7s. 0d.	—

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2½d.
,, (Roll-Brimstone)—,, £8 5s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. ,, £26 per ton, £7 10s.
Boric Acid (Crystals). ,, £50 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 2½d.; plantation 1st latex, 1s. 2⅛d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd.

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

194 545 J. STONE AND CO. and A. E. HONEY. Electro-magnetically operated switch mechanism. (17/3/22.)
194 572 L. W. WILD and E. P. BARFIELD. Electric furnaces. (12/4/22.)
194 574 CHLORIDE ELECTRICAL STORAGE CO. (B. FORD). Storage batteries. (13/4/22.)
194 580 AUTOMATIC TELEPHONE MFG. CO. Telephone systems. (29/3/22.) (Addition to 193 694.)
194 585 A. P., G. C. and P. A. LUNDBERG and G. PEGG. Electric switches. (26/4/22.)
189 084 B. STAHELI and L. LEVAILLANT. Electric pocket lamps. (14/11/21.)
180 665 METROPOLITAN-VICKERS ELECTRICAL CO. Electrical protective systems. (24/5/21.)
194 595 S. G. FROST. Thermionic valves, etc. (19/5/22.)
194 597 CAMBRIDGE AND PAUL INSTRUMENT CO. and W. H. APTHORPE. Adjustable sensitive electrical regulating device. (23/5/22.)
194 605 R. F. TURNER and A. R. MATTHEWS. Electrical connectors, terminals, or binding posts. (2/6/22.)
183 114 SCINTILLA. Windings of d.c. electro-magnets. (9/7/21.)
194 613 WARD LEONARD ELECTRIC CO. and F. H. BULLINGER. Automatic controller for electric circuits. (7/7/22.)
194 628 C. TER COCK. Electrically-operated change-speed gear. (26/8/22.)
194 633 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electric control systems. (20/9/22.)
194 634 MACFARLANE ENGINEERING CO. and J. C. and W. A. MACFARLANE. Electric generators for electric welding and for the production of low frequency alternating currents. (30/9/22.)
186 926 SCINTILLA. Dynamo-magneto units for motor vehicles. (4/10/21.)
188 643 R. BOSCH AKT.-GES. Magneto-electric machines. (11/11/21.)
194 637 PHILIPS' GLOEILAMPENFABRIEKEN. Electrodes for electric discharge tubes. (13/6/22.)
194 638 F. A. EUSTIS. Electrolytic iron. (22/12/21.) (Divided application on 34 503/21.)
194 639 F. A. EUSTIS. Electrolytic iron. (22/12/21.) (Divided application on 34 503/21.)
194 646 J. E. POLLAK (SIEMENS AND HALSKE AKT.-GES.). Telephone systems. (5/12/21.) (Divided application on 193 980.)
194 736 P. R. JACKSON (SPERRY GYROSCOPE CO.). Arc lamps. (14/9/21.)
194 742 C. J. BEAVER and E. A. CLAREMONT. Electric joints. (21/9/21.)
194 746 MEASUREMENT, LTD., and F. HOLDEN. Electricity meters. (11/11/21.)
194 747 F. A. JOHNSON and K. RAHBEK. Apparatus especially useful as relay, oscillograph, telephone automatic current or tension regulator, &c. (14/11/21.) (Addition to 144 761.)
172 615 DR. F. SKAUPY. Incandescent lamps. (16/11/21.) (Convention date not granted.)
194 754 DR. F. SKAUPY. Incandescent lamps. (16/11/21.)
194 759 A. WALDBERG. Electro-metallurgy or the electro-deposition of metals. (18/11/21.)
173 483 SIEMENS AND HALSKE AKT.-GES. Telephones. (29/12/20.)
194 764 E. B. COLLINGHAM and C. J. A. OWEN. Dynamo-electric generators for lighting on motor vehicles. (13/12/21.)
194 765 E. POLLOCK. Thermionic valve relays. (13/12/21.)
194 766 A. J. WHEELER. Automatic metering of telephone calls. (14/12/21.) (Cognate application, 9 401/22.)
194 767 BRITISH UNITED SHOE MACHINERY CO. (UNITED SHOE MACHINERY CORPORATION). Electric heating of tools of edge-setting and other machines (14/12/21.)
194 778 A. POINCET. Electrically-heated apparatus for use in hair waving, &c. (15/12/21.)
194 780 V. PLANER. Apparatus for effecting electrical measurements and tests on the principle of the Wheatstone bridge. (15/12/21.) (Convention date not granted.)
194 789 S. ABEL. Electric immersion liquid-heaters. (16/12/21.)
194 796 W. S. SMITH and A. D. SHUTER. Coating of electrical conductors. (17/12/21.)
194 799 H. A. WATTS. Electric resistances. (19/12/21.)
194 800 P. C. RUSHEN (BING WERKE VORM. GEB. BING AKT.-GES.). Means for fine mechanical adjustment of electrodes such as are used in spark gaps and detectors. (19/12/21.)
173 240 F. W. LE TALL (WESTINGHOUSE ELECTRIC AND MFG. CO.). Electro-magnetic control devices for electric arcs. (21/12/21.) (Convention date not granted.)
194 831 P. A. BECKER. Electric driving mechanism for sound recording or reproducing machines. (29/12/21.)
173 527 DR. O. T. BLATHY. System of pole-changing for polyphase induction motors. (8/6/20.) (Addition to 161 973.)
178 411 DR. O. T. BLATHY. System of pole-changing for polyphase induction motors. (9/4/21.) (Addition to 161 973.)
194 836 E. POLLOCK. High-frequency telephony, telegraphy, etc. (3/1/22.)
194 847 L. G. DE KERMOR. Apparatus for heating water by electricity. (13/1/22.)
194 854 W. T. WILKINSON and R. TILLEY. Electric lighting of motor road vehicles. (19/1/22.)
194 859 H. WOLFE, W. SLACK and G GRIFFITHS. Insulators for aerial lines. (23/1/22.)
194 864 L. G. PRESTON and G. SHEARING. Thermionic valve-transmitting sets. (24/1/22.)
194 877 METROPOLITAN-VICKERS ELECTRICAL CO., LTD., and R. BROOKS (WESTINGHOUSE ELECTRIC AND MFG. CO., in part). Control handles for electric devices. (1/2/22.)
194 878 WESTERN ELECTRIC CO. and G. DEAKIN. Selecting switch mechanism (1/2/22.)
194 882 GENERAL ELECTRIC CO., LTD., C. F. TRIPPE and O. DURDLE. Electron discharge apparatus such as thermionic tubes. (4/2/22.)
194 883 C. S. GOODE. Thermionic tubes. (6/2/22.)
194 886 T. MCKENNA (DICTOGRAPH PRODUCTS CORPORATION). Battery carrier and container. (7/2/22.)
194 899 L. G. PRESTON, H. C. HUGHES and S. R. MULLARD. Thermionic valves. (15/2/22.)
194 922 J. C. WHITE. Switches. (3/3/22.)
194 924 FULLERS UNITED ELECTRIC WORKS, LTD., and L. FULLER. Galvanic batteries. (7/3/22.)
182 091 F. KRUPP AKT.-GES. Overload circuit breakers. (20/6/21.) (Addition to 175 964.)
177 811 PATENT-TREUHAND-GES. FÜR ELECTRISCHE GLUHLAMPEN. Electric gas lamps with glow discharge. (4/4/21.)
194 954 A. MELOTTE. Apparatus for starting low-powered electric motors. (8/4/22.)
194 956 J. F. SCHLEPER. Method of jointing electric conductors. (13/4/22.)
186 029 ORIENTEX HANDELSGES. Electric flat-irons. (12/9/21.)
179 528 SCINTILLA. Switch apparatus for controlling electric starting motors of engines. (4/5/21.)
194 968 A. C. WYNNE. Tumbler switches. (27/4/22.)
194 974 AKT.-GES. BROWN, BOVERI ET CIE. Multiple-control apparatus for electric railways. (1/4/22.)
194 975 M. A. PERSSON. Electric contact-plug. (8/3/22.)
180 997 M. A. PERSSON. Electric switch. (2/6/21.)

APPLICATIONS FOR PATENTS.

June 4.

14 589 H. G. HARLEY. Speed regulating mechanism for automobile dynamos.
14 590 H. G. HARLEY. Engine starting dynamos.
14 592 W. SUTTON and E. H. WILSON. Radio-telephone apparatus.
14 595 H. W. RICHARDS. Electro-magnetic wave signalling systems.
14 617 A. F. BEACH. Fusible cut-outs.
14 633 METROPOLITAN-VICKERS ELECTRICAL CO. Transformers.
14 636 L. GRAFENBERG. Alkaline batteries. (7/6/22, Germany.)
14 652 SOC. FRANCAISE RADIO-ELECTRIQUE and H. J. J. M. DE REGNAULD DE BELLESCIZE. Wireless receiving systems.
14 670 G. SEGUIN. Arc welding of track rails.
15 008 A. E. L. SCANES. Transformers.

June 5.

14 678 A. H. RAILING, A. E. ANGOLD and J. STANLEY. Electric condensers.
14 680 COVENTRY AUTOMATIC TELEPHONES, LTD. and J. E. COLLYER. Telephone systems.
14 682 W. J. RICKETS and A. W. SHARMAN. Selective reception in high frequency telegraphy.
14 716 J. WILKINSON AND SONS (GREENGATES) and H. J. BREAREY. Electric vulcanising apparatus.
14 720 H. G. GERTY. Electrolysis.
14 733 MIKRO, LTD., and C. F. HILTON. Tele-microphone relays.
14 740 R. J. W. HEATH. Holders for thermionic valves.
14 746 L. ERIKSON. Suspensions for electric lighting fixtures.
14 749 METROPOLITAN-VICKERS ELECTRICAL CO. Control systems for electrical distribution. (5/6/22, U.S.).
14 750 BRITISH THOMSON-HOUSTON CO. Electric discharge apparatus. (5/6/22, U.S.)
14 752 GENERAL ELECTRIC CO., LTD. Photometers.
14 753 H. ST. G. ANSON. Instruments for examination of oscillating electrical conditions.
14 776 J. S. MÖLLERHÖJ. Balancing self-inductions and effective resistances for cables.
14 777 C. A. M. BUCKLEY. Wireless telephone instruments.
14 794 F. M. RICHARDS. Mounting crystals for detectors.
14 795 E. C. R. MARKS (BURROWS MAGNETIC EQUIPMENT CORPORATION). Testing magnetisable objects.

June 6.

14 799 W. S. WORTHINGTON. Switching device for wireless telegraphy, etc.
14 820 COVENTRY AUTOMATIC TELEPHONES, LTD. (ADAMS). Switching devices for automatic telephone systems.
14 824 J. C. TRICKEY. Crystal detectors.
14 845 E. C. BRAMWELL. Variometers for wireless telegraphy, etc.
14 854 F. LUCK. Combined electric torch and inspection lamp.
14 855 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Maintaining gaseous conduction discharges.
14 878 and 14 879 STERLING TELEPHONE ELECTRIC CO. and W. M. HOLBEACH. Tuning, etc., devices for wireless apparatus.
14 880 STERLING TELEPHONE ELECTRIC CO., J. R. BEARD and F. R. GRIFFITHS. Loud-speaking telephone.
14 881 STERLING TELEPHONE ELECTRIC CO. and T. D. WARD-MILLER. Variometer.
14 884 HOLMES AND JAMES and H. E. SUTHERLAND. Fuse-boards, etc.

June 7.

14 885 J. M. FORD. Electro-magnetic induction micrometers.
14 887 A. M. TAYLOR. Electric power transmission systems.
14 888 J. H. NELSON. Junction boxes for electric wiring.
14 901 E. P. QUIN. Sanding apparatus for tramcars.
14 916 R. O. MCGOWAN. Electric terminals, etc.
14 925 and 14 926 W. E. HIGHFIELD and J. E. CALVERLEY. Electric converting apparatus.
14 934 SOC. FRANCAISE RADIO-ELECTRIQUE. Electric filters for high-frequency oscillations. (8/6/22, France.)
14 948 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Automatic reclosing circuit breaker systems.
14 949 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electric measuring instruments.
14 956 H. G. BARTHOLOMEW. Telegraphy and photo-telegraphy.
14 958 R. G. ELLIS. Switches.
14 963 F. MICHAUX. Incandescent lamps for motor vehicles, etc. (10/12/22, Belgium.)

June 8.

14 975 E. JOHNSON. Ceiling plate for electric lighting.
14 995 J. BENTLEY and W. E. PORTER. Speed regulation of series wound d.c. motors.
15 000 E. W. BONSON. Multiple telephone connectors.
15 001 C. NEWMAN. Wireless telegraph demonstration apparatus, etc.
15 035 A. H. STEAD. Crystal detector.
15 037 D. E. GARNETT. Crystal detector.
15 050 BRITISH THOMSON-HOUSTON CO. Magnetically controlled vacuum tube devices. (9/6/22, U.S.).
15 068 P. GEORGOUSSIS. Rotary converters.
15 069 P. GEORGOUSSIS. Excitation of a.c. machines.
15 074 G. ANTONOFF. Batteries.
15 030 WESTERN ELECTRIC CO. Strand-wrapping machines. (31/8/22, U.S.).

June 9.

15 086 T. B. NAYLOR. Series switch or rheostat.
15 088 and 15 092 COVENTRY AUTOMATIC TELEPHONES, LTD., and J. E. COLLYER. Telephone systems.
15 089 J. LAWRENCE. Electric variable drives.
15 090 E. A. CONSIDERE and G. ELSTON. Light shades for electric bulbs.
15 126 G. JONES. Driving arrangements for motors.
15 127 METROPOLITAN-VICKERS ELECTRICAL CO. and W. J. BROWN. Valve amplifiers for electric currents.
15 128 METROPOLITAN-VICKERS ELECTRICAL CO. and W. J. BROWN. Receiving apparatus for high-frequency signalling.
15 129 METROPOLITAN-VICKERS ELECTRICAL CO. and W. J. BROWN. Sound transmitting machines.

Arrangements for the Week.

FRIDAY, JUNE 22nd (To day).

INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.
10.30 *a.m.* Annual General Meeting at the Town Hall, Scarborough.
TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.
10.30 *a.m.* On Mumbles Pier, Swansea. Paper on "Tramway Rolling Stock," by Mr. W. E. Ireland.
PHYSICAL SOCIETY OF LONDON.
5 *p.m.* At the Imperial College of Science, South Kensington, London, S.W.: Lecture on "The Excitation and Ionisation Potentials of Gases and Vapours," by Prof. F. Horton.

WEDNESDAY, JUNE 27th to 30th.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS.
Annual Meeting at Glasgow.

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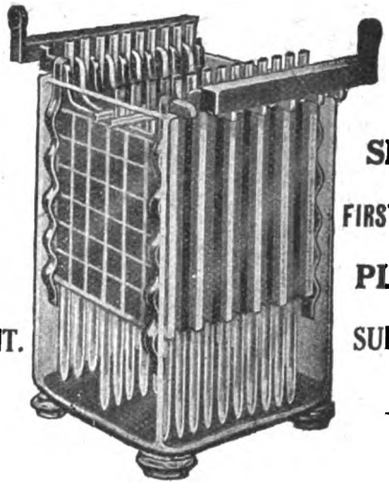

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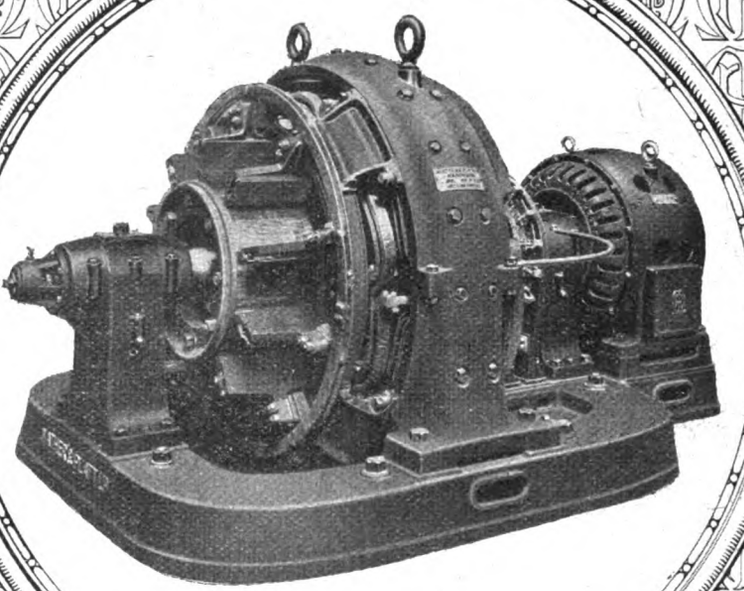

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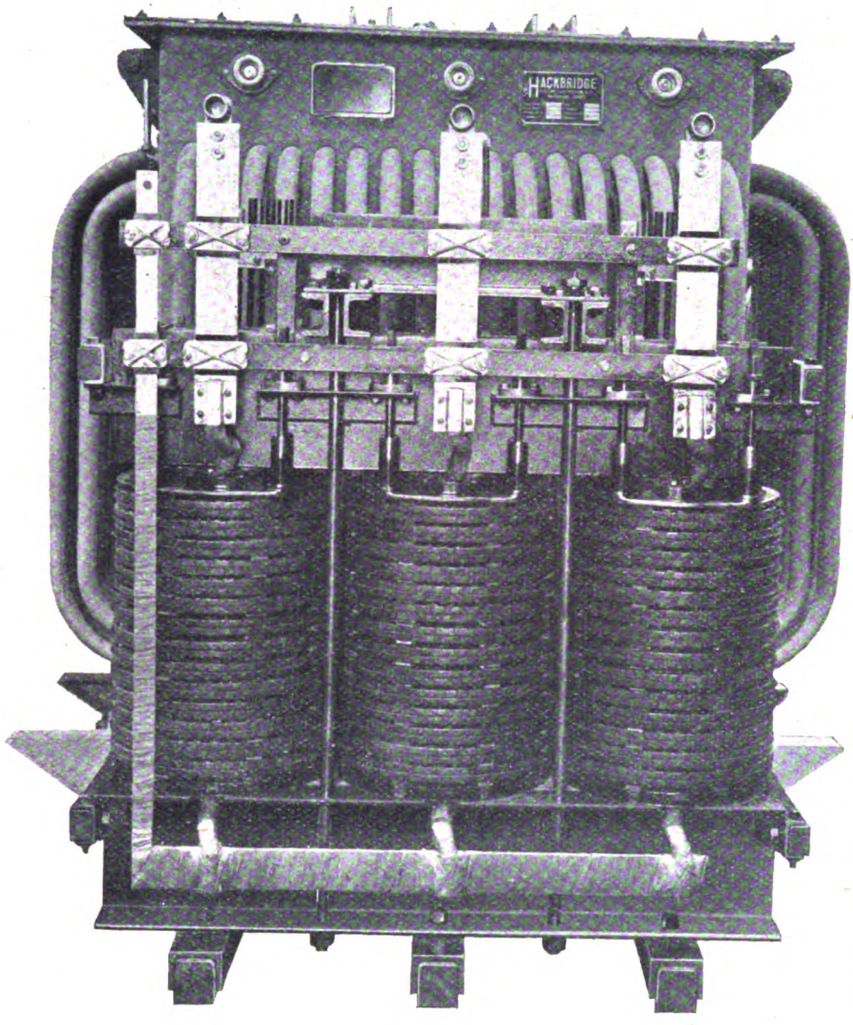

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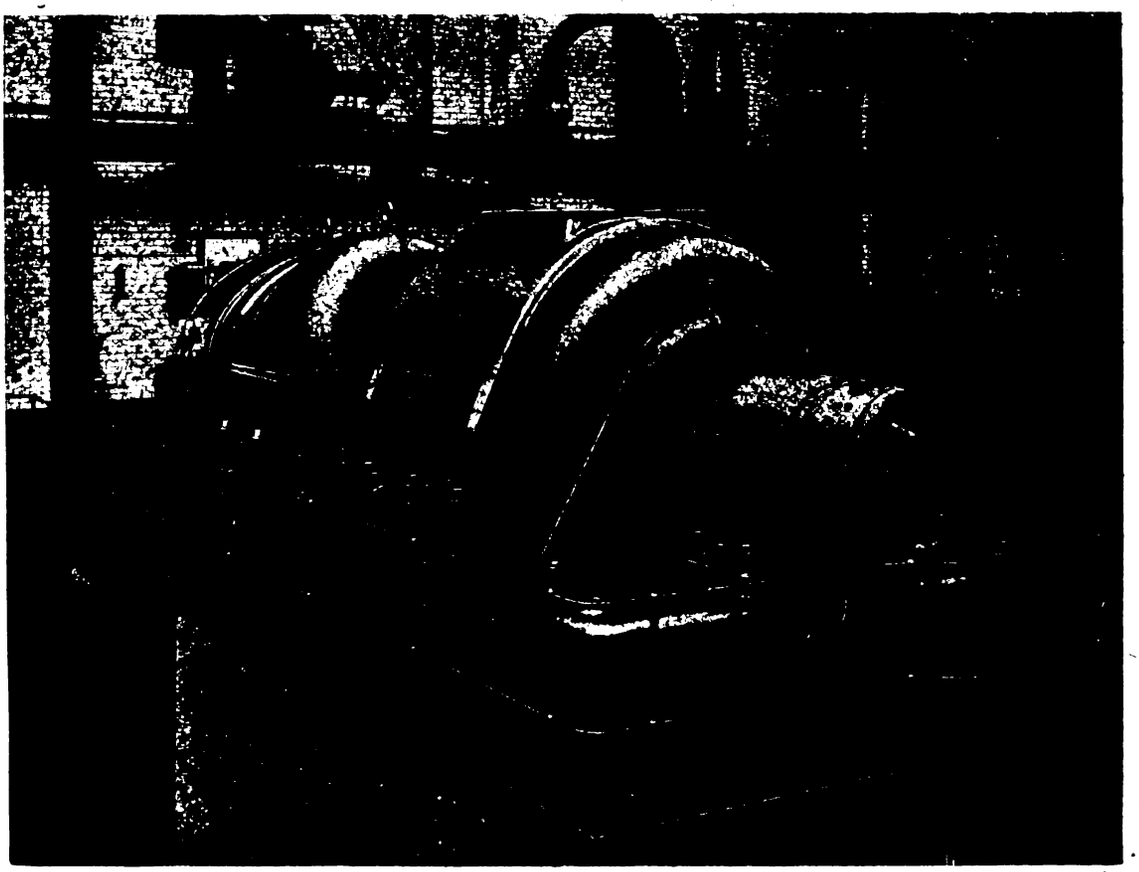

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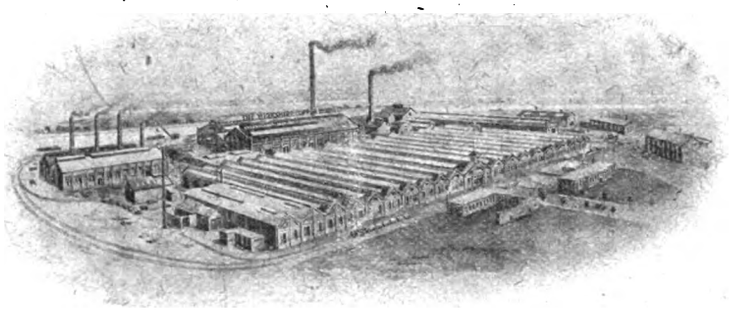

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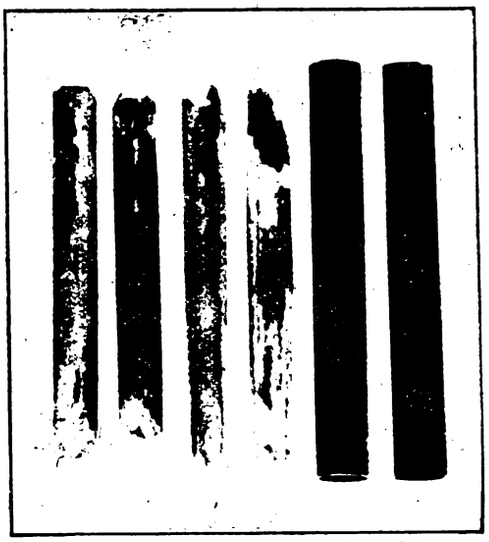

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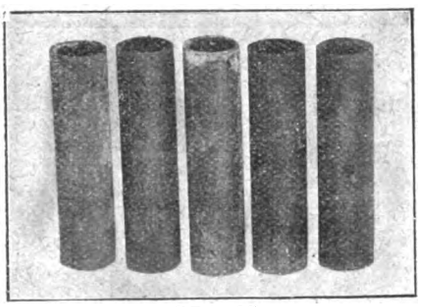

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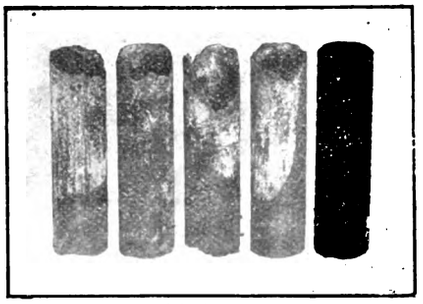

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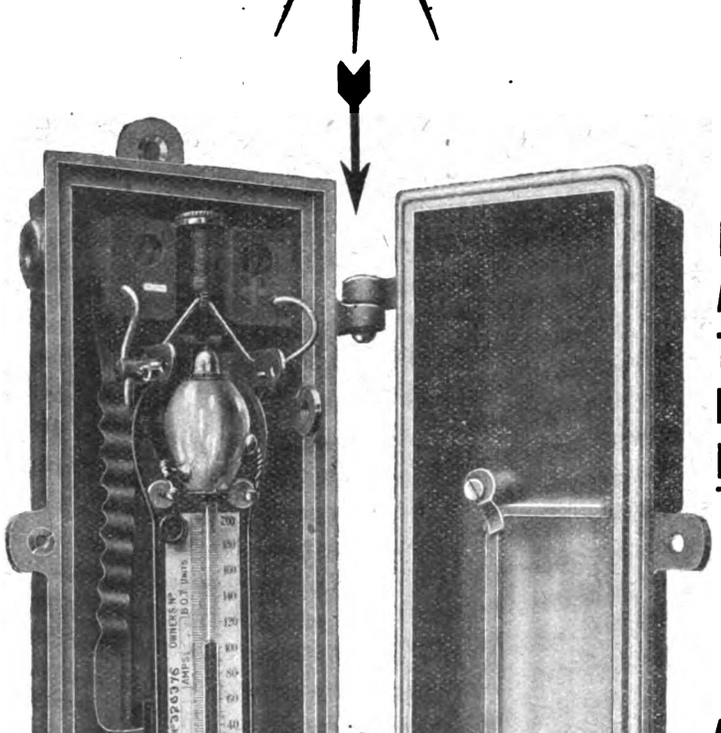

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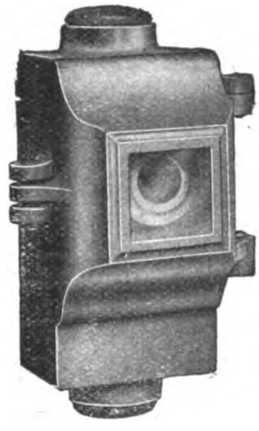

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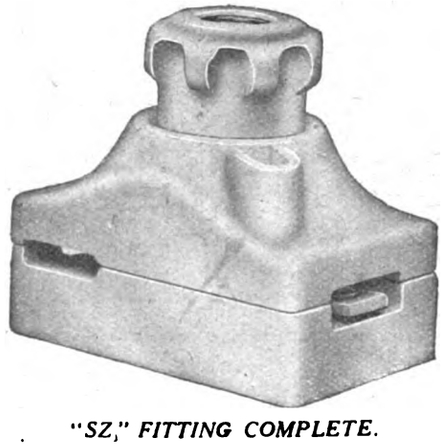

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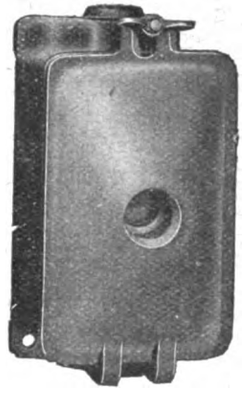

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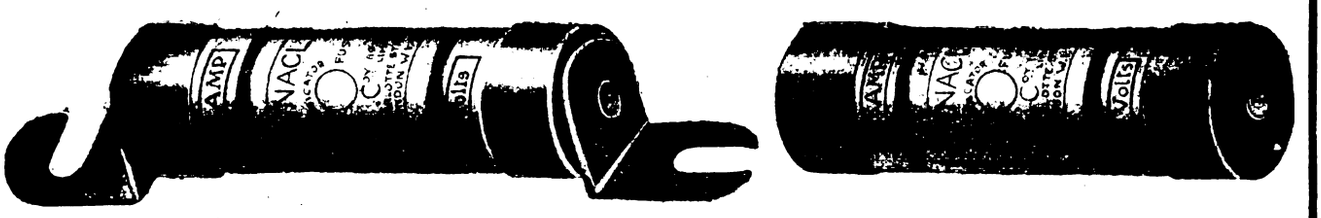

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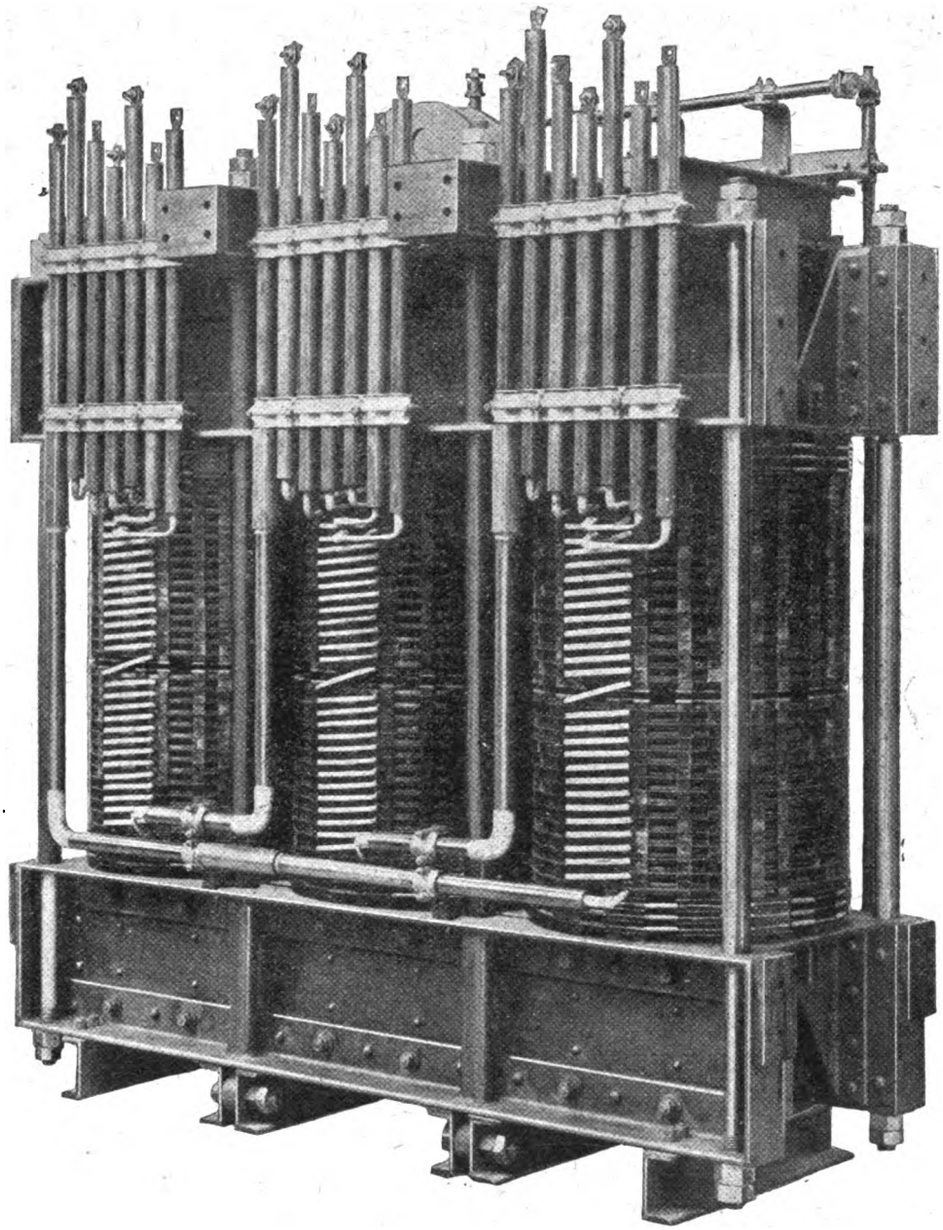

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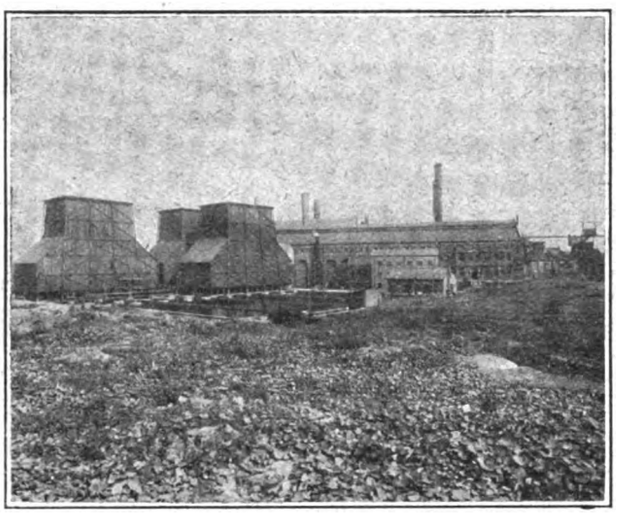

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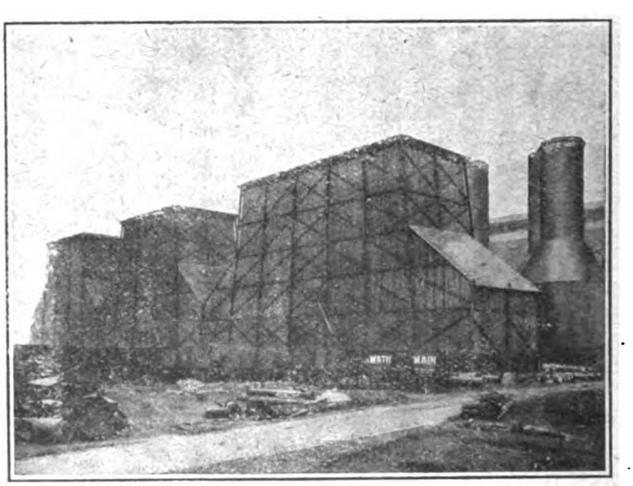

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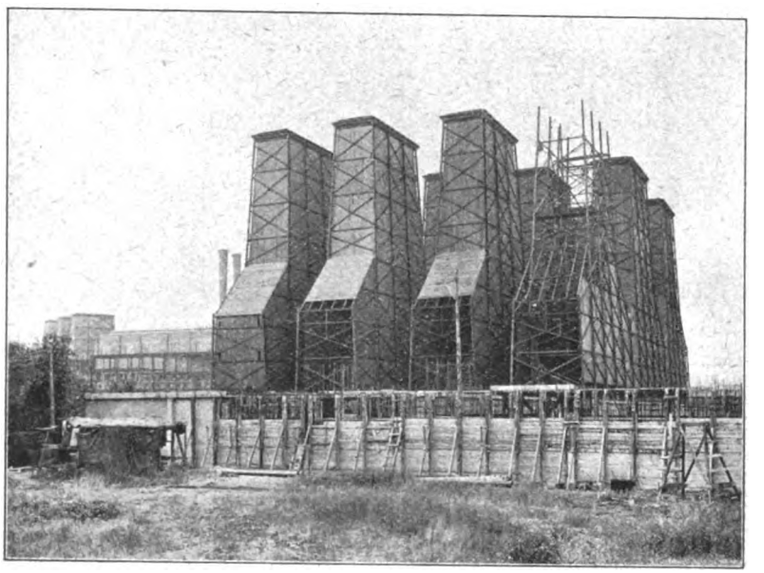

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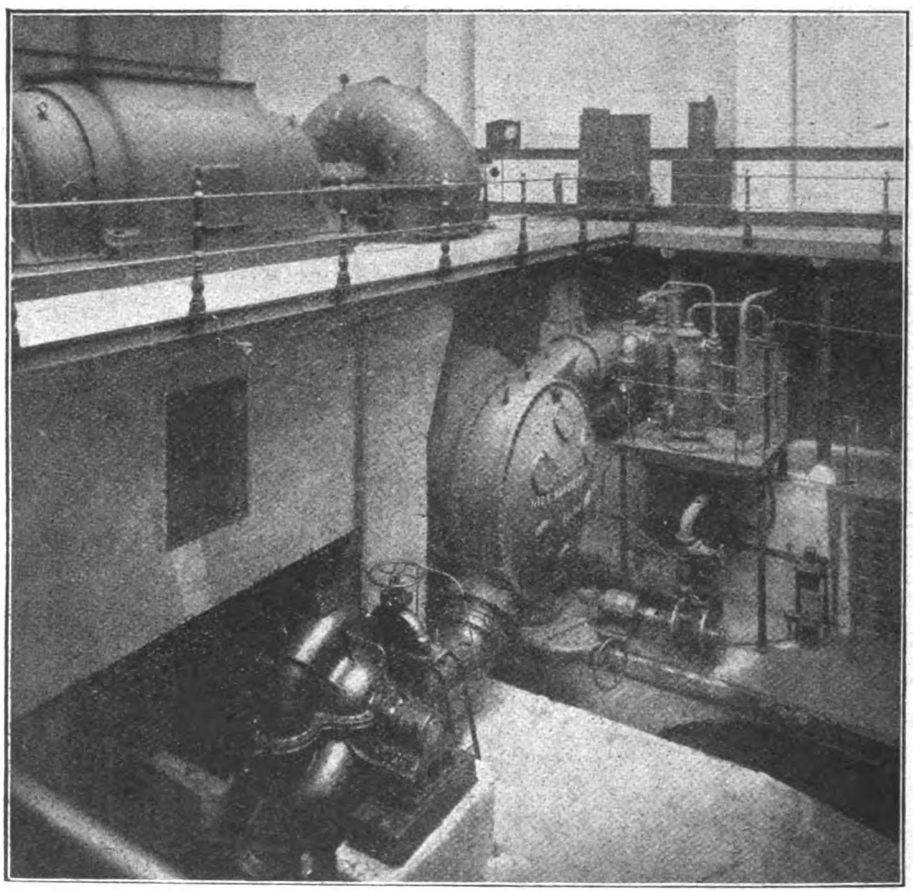

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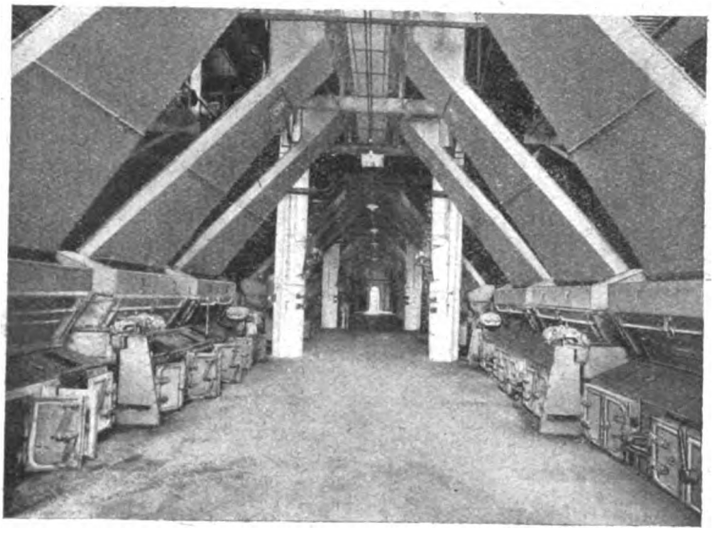

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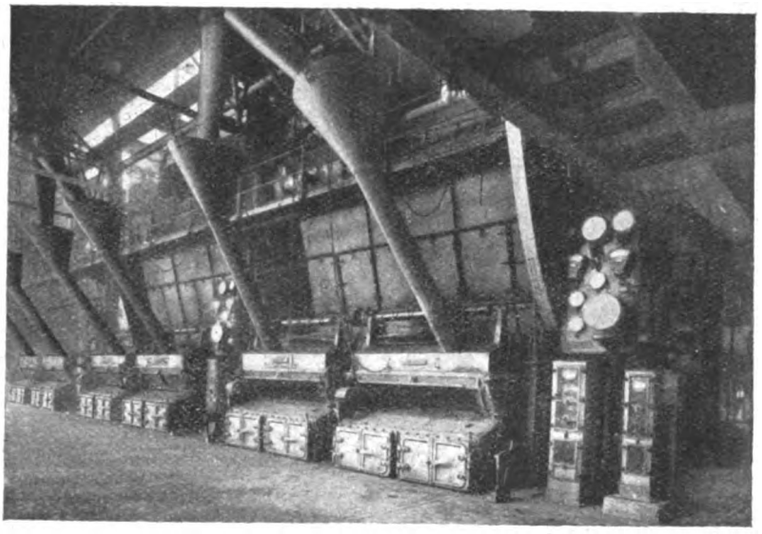

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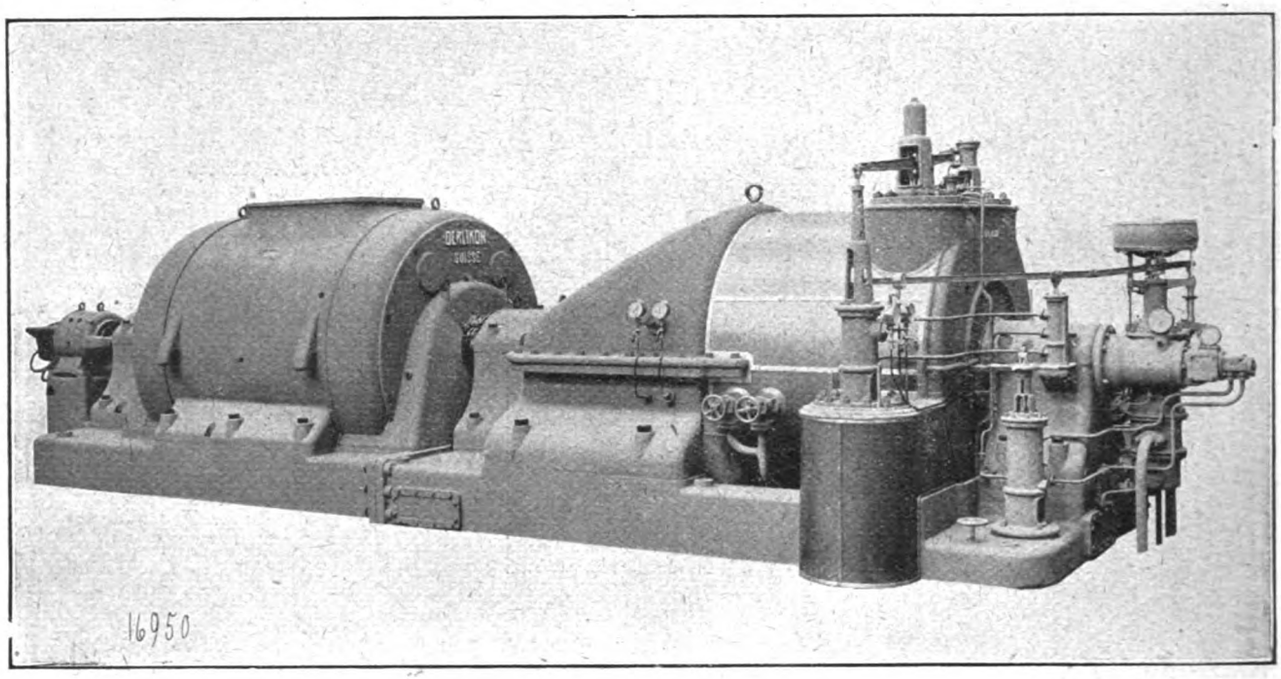

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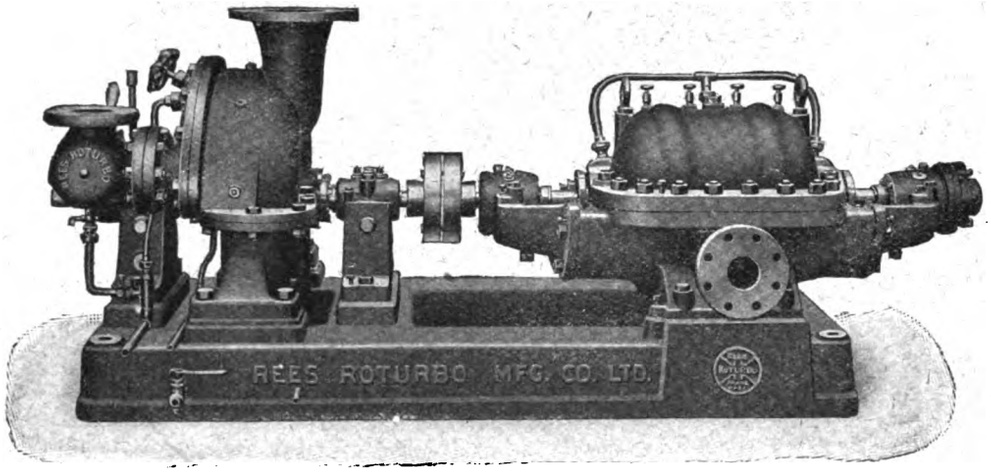

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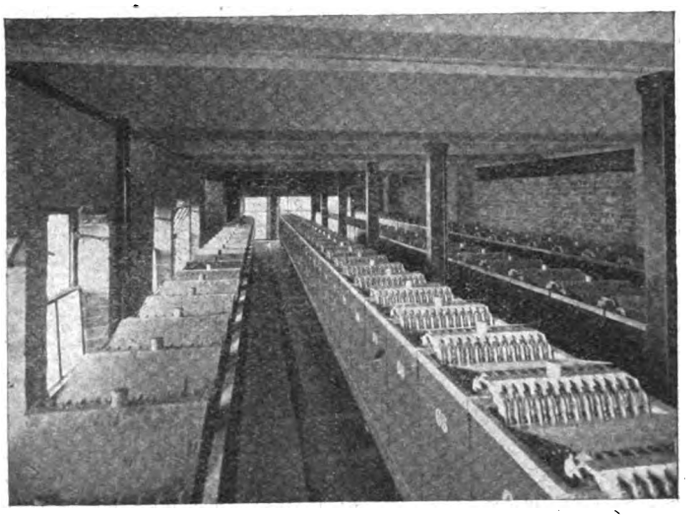

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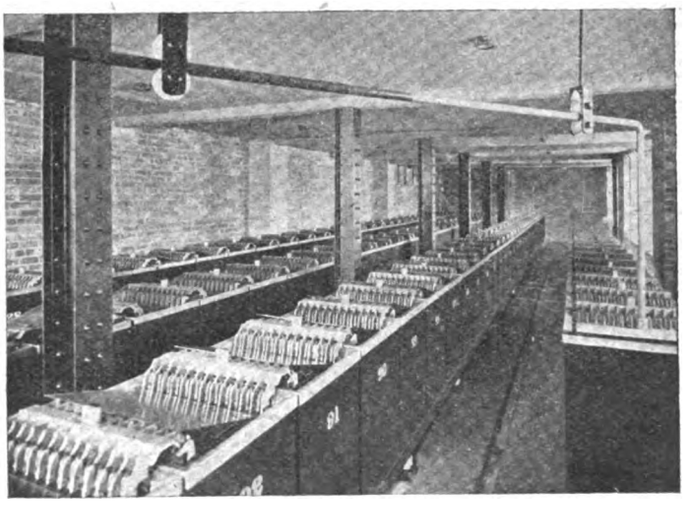

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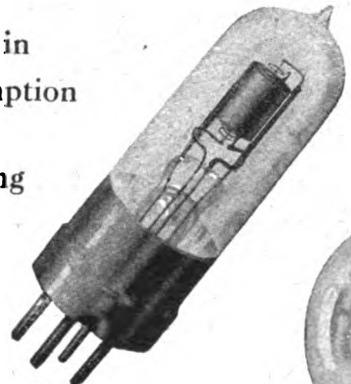

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Years of hard experience have gone to the perfecting of the Ediswan Valve, years during which many thousands have been produced for the Army, Navy, Air Force, Post Office, etc.

Write now for full particulars, prices, and overprinted literature. There is big business in Ediswan Valves—see that you get your share.

THE EDISON SWAN ELECTRIC COMPANY, LTD.

123/5 QUEEN VICTORIA STREET, E.C.4

Telephone—City 9882 (5 lines) Telegrams—Ediswan, London

London Showrooms—123/5 QUEEN VICTORIA STREET, E.C.4 *and* 71 VICTORIA STREET, S.W.1

Works—PONDERS END, MIDDLESEX

Branches—Aberdeen, Belfast, Birmingham, Bristol, Brighton, Cardiff, Dublin, Dundee, Edinburgh, Glasgow, Hull, Leeds, Leicester, Liverpool, Manchester, Newcastle, Nottingham, Southampton, Sheffield, Swansea

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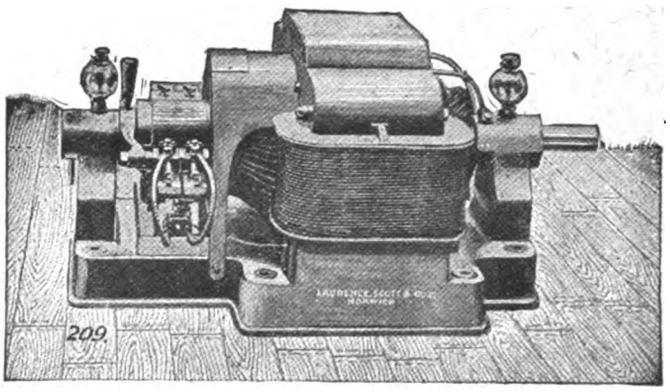
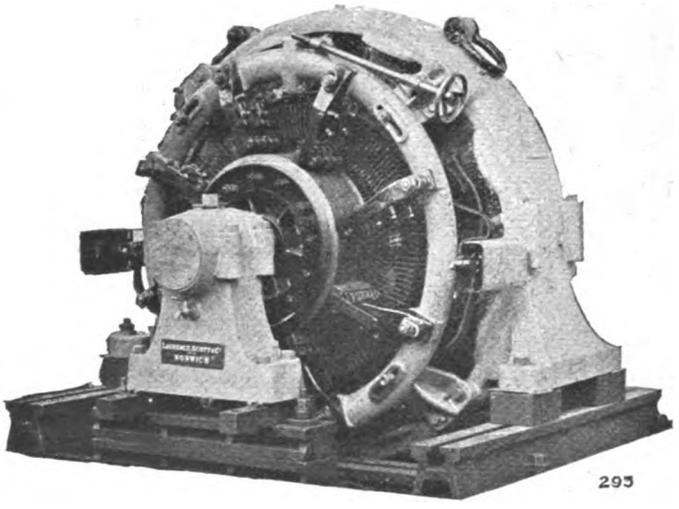
LAURENCE, SCOTT & Co. LTD

TEL. ADD.: GOTHIC NORWICH ✿ NORWICH ✿ 'PHONE Nos. 1362 & 1363

Established 1883.



1889.



1922.

CONTINUOUS-CURRENT MACHINERY ONLY.

ALL OUR STANDARD INDUSTRIAL MOTORS AND GENERATORS comply in every respect with British Standard Specification 168/1923. Low Temperature Rise and Heavy Overload Capacity.

Specify in all your enquiries Machines to comply with British Standard Specification (B.E.S.A. 168/1923).

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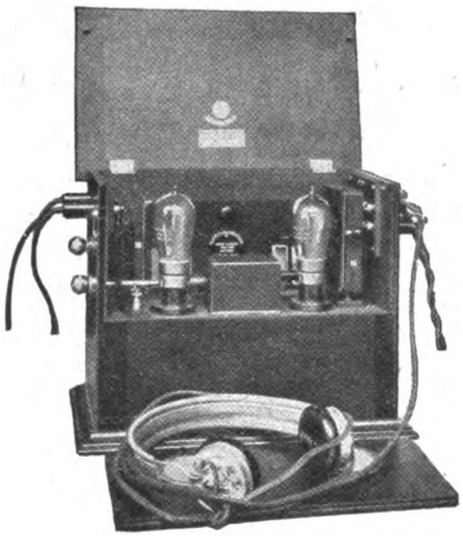
The Summer Appeal of Wireless



This is the MARCONIPHONE V2, which brings *all* British Broadcasting Stations within range of any part of the country.

The public demand for Wireless this summer promises to outstrip the winter demand. The joys and opportunities of listening-in under the open sky—in the garden, up the river, at picnics, at any kind of outdoor function—are being fully appreciated. Marconi's, the pioneers in Wireless publicity as in Wireless invention, are seeing to that.

Take advantage of this demand. Stock the Receiving Set that sells most easily. The public need no convincing as to the merits of the Marconiphone.

The Ideal Portable Receiving-Set

Have you had particulars of the New Marconiphone VALVE-CRYSTAL Model? It is the ideal portable receiving-set, with a range of 125 miles and over.

The Marconiphone

The Triumph of the Master Mind

BBC TYPE APPROVED BY POST MASTER GENERAL

Be ready for the rush. Ensure early delivery by placing your order *now*. For trade terms and all particulars apply to :—

MARCONI'S WIRELESS TELEGRAPH CO. LTD.

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NO WATER. **NO** CLOTH.

VISCO AIR FILTERS

FOR

TURBO ALTERNATORS, COMPRESSORS, MOTORS,

TRANSFORMERS, DIESEL ENGINES, VENTILATING PLANTS.

VISCO DUST REMOVAL PLANTS.

THE LATEST —— THE BEST.

THE VISCO ENGINEERING CO., Ltd.,

Telephone: Victoria 9024. 82, VICTORIA STREET, LONDON, S.W.1. Telegrams: "Curtmit, Sowest. London."

OUR CENTRAL STATION TYPE OF

PRAT DRAFT

AS INSTALLED AT BIRMINGHAM, SOUTHAMPTON, MAIDSTONE, GENNEVILLIERS, ETC., IS

RELIABLE - FLEXIBLE - EFFICIENT

AND MAKES AN IDEAL BOILER LAY-OUT

SOLE LICENSEE AND CONSTRUCTOR FOR U.K.

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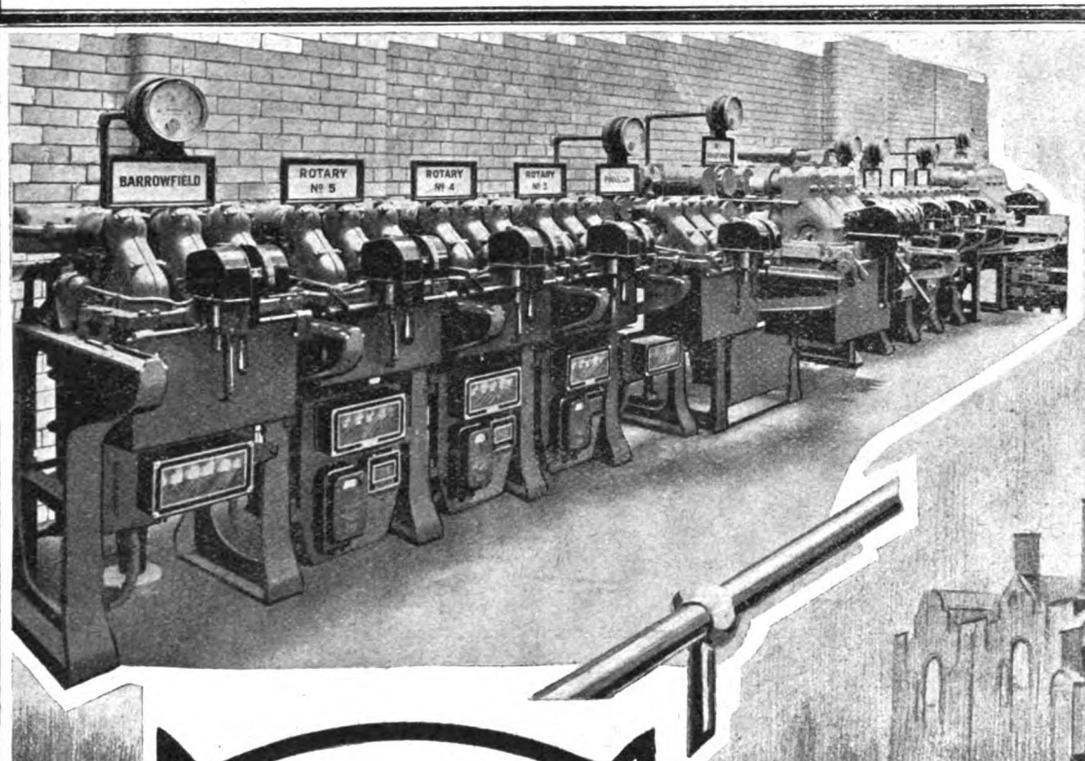
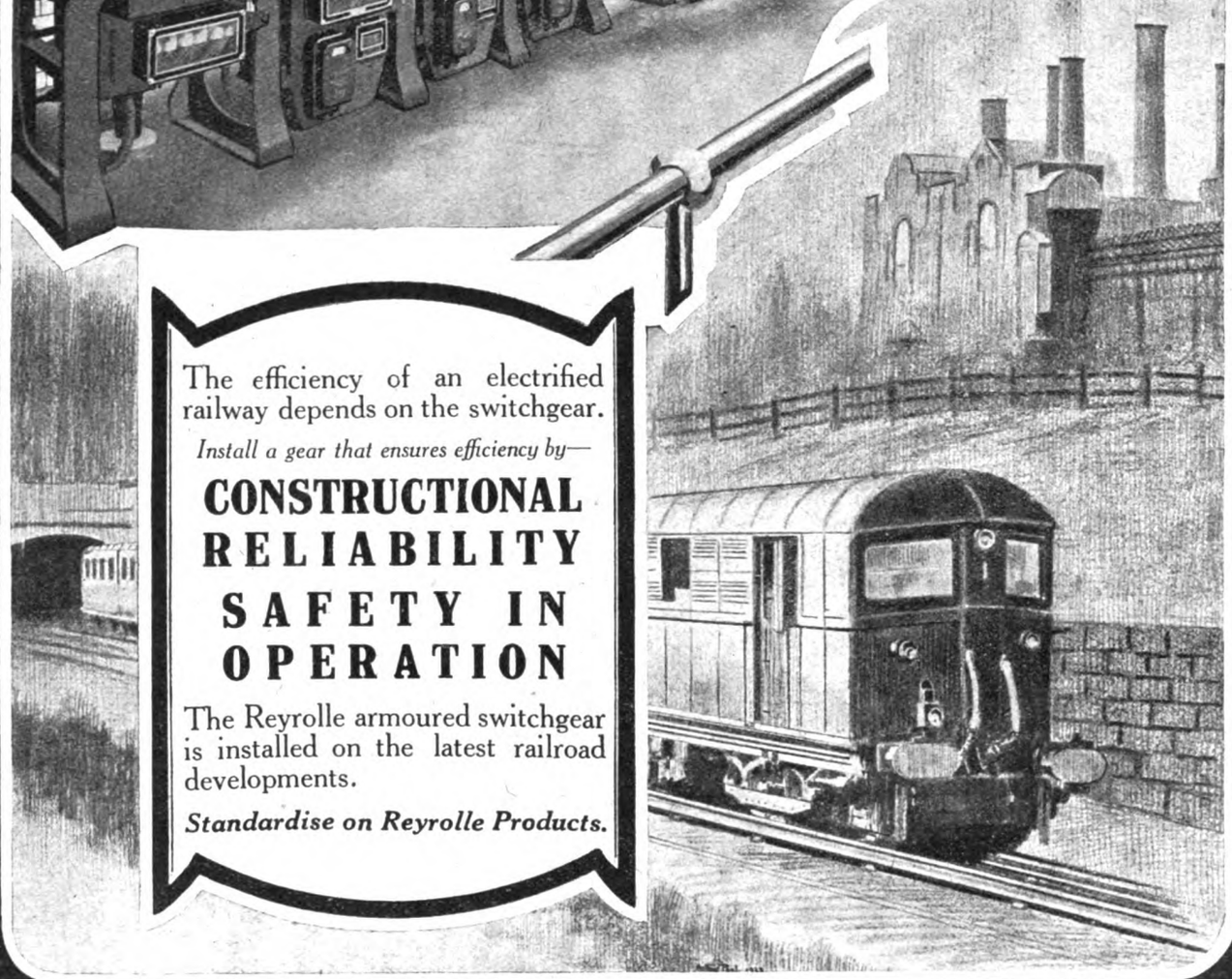
ARMOURED SWITCHGEAR.





The efficiency of an electrified railway depends on the switchgear.

Install a gear that ensures efficiency by—

CONSTRUCTIONAL RELIABILITY SAFETY IN OPERATION

The Reyrolle armoured switchgear is installed on the latest railroad developments.

Standardise on Reyrolle Products.

A. **REYROLLE** & Co LTD.

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Insulating Materials.

Avoid Unemployment by Supporting BRITISH INDUSTRIES.

Insulating Cloth	Varnished Paper
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of the highest grade and guaranteed efficiency are now manufactured by

THE "IOCO" RUBBER & WATERPROOFING CO., LTD.

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Price Lists and Particulars submitted on application.

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OHMMETER

The Pioneer of the small light, inexpensive type of true Ohmmeter

Has stood the test of time.

500 volt Generator **Scaled to 100 Megohms**

REDUCED PRICES.

THE RECORD ELECTRICAL COMPANY, LTD.

Instrument Makers

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installed in Jubilee Year—

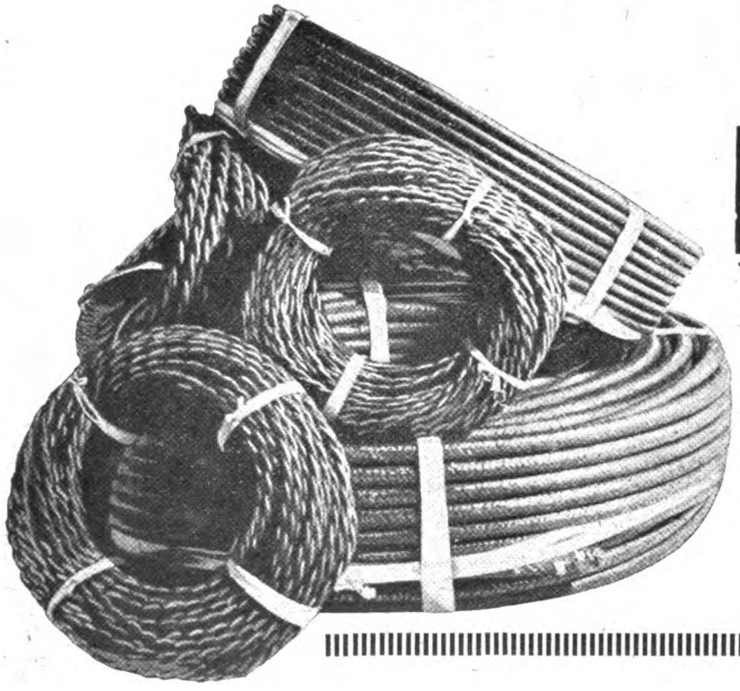
and as efficient to-day as ever

36 years ago the first wiring installation in the Town of Bedford was put in by Messrs. H. Bacchus, Ltd., with Henley Wires on their own premises. It was run in wood casing, and the current was supplied from their own plant. The same wiring was used when they changed over to the Corporation supply, and it is as good to-day as when it was first installed.

Truly, time tests all things !

The same qualities that made it possible for the Henley Cable of 36 years ago to be giving good service this year are found in the modern products—plus all that the intervening years of research and experience have added in reliability and enduring electrical efficiency.

To be sure of having electrical transmission that, once installed, you can forget—use



HENLEY

WIRES & CABLES

W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London, W.C.

The information contained above offers confirmation that this trade mark is your protection and guarantee of trouble-free wiring and cable service.

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REES ROTURBO D.C. DYNAMOS and MOTORS

comply in every respect with British Standard Specification (B.E.S.A. 168/1923)

LOW TEMPERATURE RISE
HEAVY OVERLOAD CAPACITY

REES ROTURBO machines have for over 30 years been built to comply with specification now adopted as a British Standard.

WRITE FOR PARTICULARS :—

The Rees Roturbo Mfg. Co., Ltd.

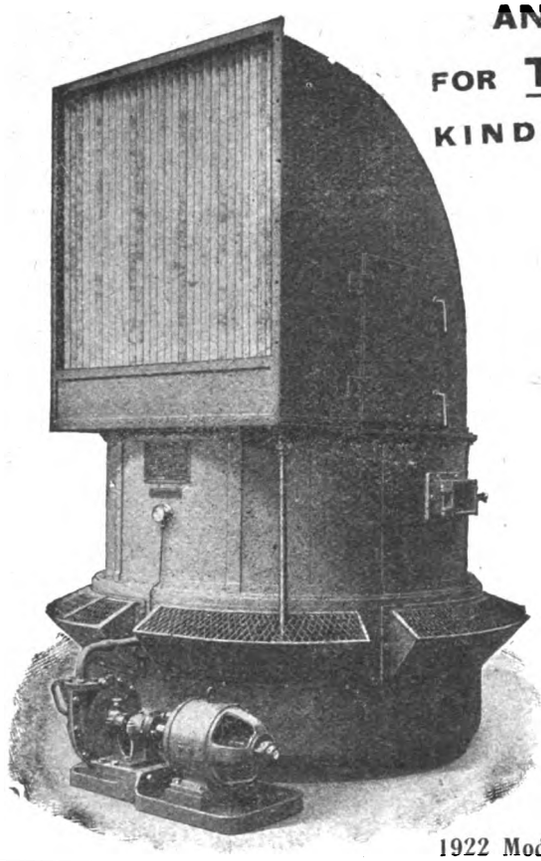
HYDRAULIC, ELECTRICAL and GENERAL ENGINEERS,

Head Office and Works **Wolverhampton, England**

"INVINCIBLE" (WET) AIR FILTER

AND HUMIDIFIER (FULLY PATENTED)

FOR **TURBO-ALTERNATORS** AND ALL KINDS OF **GENERAL VENTILATION**



1922 Model

The Air Current is directed through gills, where it is brought into intimate contact with constantly changing wetted surfaces, afterwards passing through a hurricane water spray and free moisture eliminating devices.

Air outlet guaranteed water free. Turbo alternators as clean when opened up after use as new.

WRITE FOR NEW ILLUSTRATED PAMPHLET.

We have supplied Filters to the principal Municipal Undertakings in Great Britain & Ireland. For big power houses such as in Collieries, Ironworks, Chemical Works, Cotton Mills, Electrical Railways, and Power Supply Coys., the Admiralty, and for Export to France, Japan, India, Australia, China, South Africa, New Zealand, etc.

We specialise in the manufacture of ducting and flume work.

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ACKROYD & BEST, Ltd.,

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(Works cover 4½ Acres.)

ACTUAL MAKERS OF :—

GLASSWARE for all lighting purposes, Clear, Opal or Coloured. Battery Jars or Cell Boxes, Electric Light Shades, Arc Lamp Globes, Lamp Chimneys, etc.

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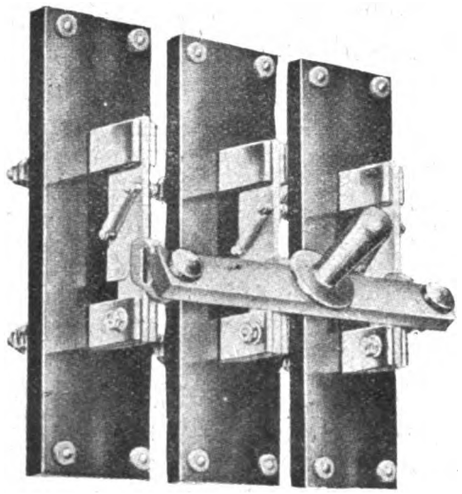


Specify Q.B. Knife Switches to B.E.S.A. Specification.

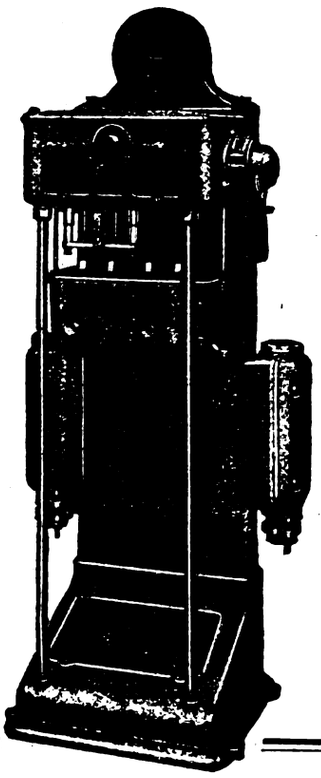
A new range of Angle and Straight type Knife Switches (single and double throw) designed to comply with The British Engineering Standards Association's Specification, No. 109/1923, for 30 to 500 amp. circuits. The long flicker blades cannot get out of alignment and are so designed that when the flicker breaks it is parallel to the break contact—thus minimising the effect of the arc.

Write for illustrated List L.W.O.2

HENLEY

Air-Break Knife Switches

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD.
BLOMFIELD STREET,
LONDON, E.C.2.



A.C.

THE new Brookhirst Oil Immersed Control Gears mark a notable departure from existing A.C. practice. The following features (common to the Star-Delta, Auto-Transformer and Rotor types) will be described more fully in later advertisements :—

1. All components embodied in a single ironclad unit.
2. Starting unit comprises a starter *and* circuit breaker.
3. A patent Overload Restrainer prevents the operation of the trips during starting except on a severe overload or "short." (Star-Delta and Auto-Transformer types only).
4. An Isolating Switch and Cover Interlocks (when desired) safeguard the operator against accidental shock.

Write for Leaflet F 118.

BROOKHIRST SWITCHGEAR

LIMITED CHESTER

Branches :—Birmingham, Belfast, Bristol, Glasgow, Leeds, London, Liverpool, Newcastle, Swansea.

C

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Sugg's STEATITE INSULATORS

are turned out of the solid material, not moulded, and are therefore

ACCURATE TO SIZE.

Steatite is a mineral which after being turned to shape and size, is fired at very high temperature, which renders it

PRACTICALLY NON-HYDROSCOPIC.

Insulators of Steatite are therefore far superior in every respect to those of any moulded or fibrous material.

Quotations for quantities of *any* design on receipt of drawings or patterns.

WM. SUGG & CO., LTD.,
Ranelagh Works,
CHAPTER STREET
WESTMINSTER, S.W.1

AUTOMATIC STORAGE

of COAL or COKE on to Stock Ground by means of our Automatic

ROPEWAY CONVEYORS

and Automatic Conveyance of Coal from Railway Wagons or Stock Ground directly into BOILER HOUSE HOPPERS

Designs and Estimates free

RICHARD WHITE & SONS
ENGINEERS,
WIDNES, Lancs.

Condor

THE QUALITY LAMP

ALL USERS FULLY INDEMNIFIED.

DELIVERY FROM STOCK

YOU CANNOT BUY A BETTER LAMP.

CONDOR LAMPS (GREAT BRITAIN) LTD.
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Telegrams: "CONDORLITE FINSQUARE."

WELL-KNOWN FIRM connected with the Electrical industry desires to represent British Manufacturer of the following :—

SWITCH & FUSE GEAR
HEATING & COOKING APPARATUS
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CABLES and WIRES

Well-appointed Showrooms in Victoria Street, S.W. Ample room for stores, and other rooms available.

Write Box 5062, Greenly's Ltd., 37/38, Strand, London, W.C. 2.

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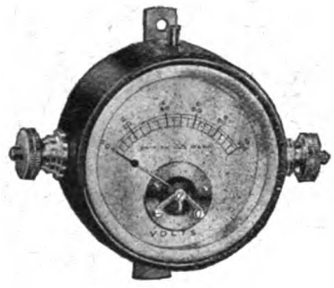
VOLTMETERS FOR WIRELESS

POCKET TYPE

To our comprehensive patterns of small meters we have added two new types.

The instrument case is of moulded insulation, and is shock-proof.

The windings are arranged for 100 volts (for testing dry battery) and by pressing a push button 10 volts —— (for testing accumulator). ——



SWITCHBOARD TYPE

PRICES:

Pocket Type, £1:0:0 each. Switchboard Type, £1:5:0 each

Liberal Discount to trade customers. *Prompt delivery.*

THE WALSALL ELECTRICAL CO., Ltd.

Telegrams: "Electrical," Walsall. **Walsall, England.** *Telephone: No. 45, Walsall.*

For Wholesale Buyers—London Stockists: LIONEL ROBINSON & Co., 3 Staple Inn, Holborn.

Telegrams: "Ferrydom," Holb. *Telephone:* 6323 *Holborn.*

The importance of selecting the right type of file for the task.

The right file for any task is one designed solely for that task.

The right file will have a longer and more efficient life. It will decrease cutting costs by removing more metal in less time. It will produce better work.

File efficiency lies in design. FIRTH FILES are designed, not merely made to rule of thumb.

FIRTH FILES are the result of generations of experience in manufacture and careful scientific study of tooth form and angle.

Thos. Firth & Sons are specialists in the art of cutting metals. They can supply the right file for every purpose.

Tell us your filing problems or difficulties.

Tell us the task, and we will send you a specimen file which will give maximum efficiency.

"EVERY TOOTH CUTS"

THOS. FIRTH & SONS, LTD.,

SHEFFIELD.

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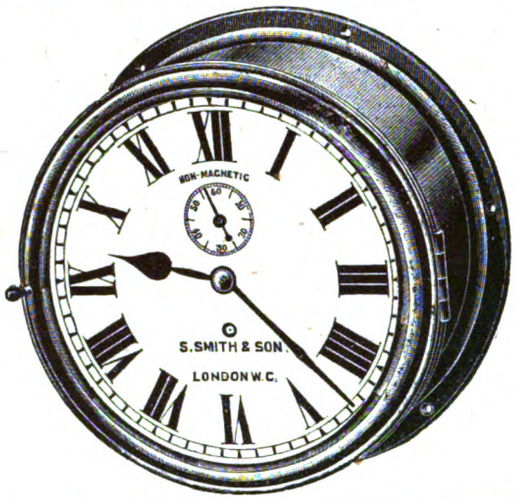
WATCHMAKERS Estd. 1851 "SMITHS"

See "Times" notice in reference to our latest production in fine Watches price 1,000 guineas

SWITCH-BOARD CLOCKS.



Solid Brass Cases. Non-Magnetic. Lever Movement. Sizes 6 to 20 inches Diameter.

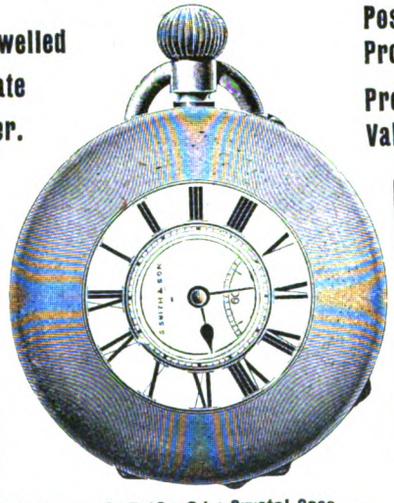
PRICES ON APPLICATION.

ALL ENGLISH "STRAND" WATCH

Fully Jewelled
¾ Plate
Lever.

Post-War Production.
Pre-War Value.

Awarded Highest Number of Marks for English Watches National Physical Laboratory, 1920-1921.



Awarded Highest Number of Marks for English Watches National Physical Laboratory, 1920-1921.

18ct. Full or Half-Hunting	£37 10s. 0d.; Crystal Case ...	£32	10 0
2nd Quality 18ct. full or Half-Hunting Case		31	10 0
" 9ct. " "		17	15 0
Sterling Silver " "		5	15 0
18ct. Crystal " "		25	0 0
9ct. Crystal " "		15	15 0
Sterling Silver " "		5	5 0

Other Chronographs from £2 2 0.
See guide (E1) to the Purchase of a Watch, just published.
Post free on Application.

S. SMITH & SON LTD ESTD. 1851
HOLDERS OF H.M. WARRANTS, WATCHMAKERS TO THE ADMIRALTY
6 GRAND HOTEL BLDGS. TRAFALGAR SQUARE W.C.

UNDERWOOD'S

WE HOLD THE BEST ASSORTED AND LARGEST STOCKS of Genuine

MOONSTONE GLASSWARE

and can offer some Special Lines at Reduced Prices.

C.M.A. CABLES. E.L.M.A. LAMPS.
REFLECTORS, SWITCHGEAR, MOTORS.
VACUUM CLEANERS from £6-6-0 subject.
FIRES, DOMESTIC APPLIANCES
and
ALL ELECTRICAL ACCESSORIES.

UNDERWOOD (MCR.) LTD.

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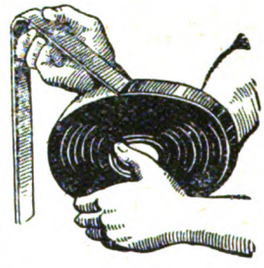
'Phone: 6750 (2 lines)

and at LONDON & GLASGOW

'Phone: 281 Stanningley.

L. H. GOTT



Manufacturer of all classes of

ADHESIVE INSULATING TAPE

Noted for Retaining the Adhesive and Insulating Properties under all conditions.

Write for Samples and Prices.

'Grams: "GOTT, Farsley." Bentley's Code.

NEW STREET, FARSLEY, LEEDS, ENGLAND.

INSULATING MATERIAL.

Lorival products cover a wide range of first-class insulators fulfilling varied requirements. Send us your enquiries, and we will determine the material most suited to your needs. Our laboratories and scientific staff are at your disposal.

Particulars from :—

LORIVAL MANUFACTURING Co. (1921) Ltd.

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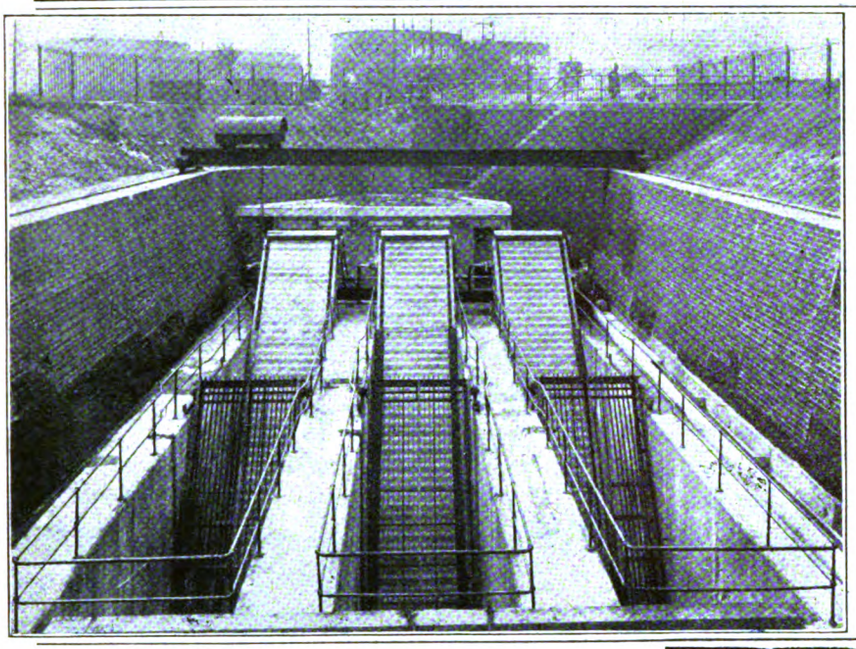
Patent Self-Cleaning

CIRCULATING WATER SCREENS

CLEAN CONDENSING WATER MEANS LOW COSTS

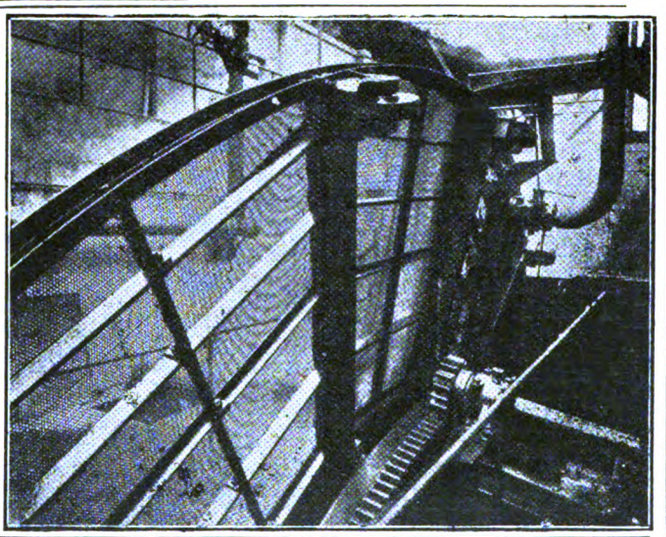


"BAND" TYPE

As installed at a SUPER POWER STATION in the North of England, with coarse grid screens for protection and rough screening.

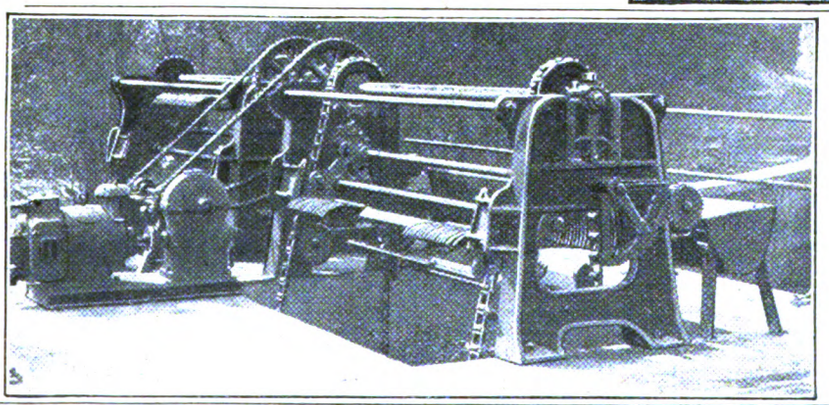
This type is used for tidal estuaries and other situations where the variation in water level is considerable.

One of four **"DISC" TYPE** supplied to the LARGEST POWER STATION IN SCOTLAND.



SCREENS IN OPERATION AND IN CONSTRUCTION FOR DEALING WITH COOLING WATER FOR OVER

1¾ MILLION KILOWATT OF TURBINE PLANT.



RAKING TYPE

Suitable for dealing with very coarse, material, as in sewage.

F. W. BRACKETT & CO., Ltd., — HYTHE — COLCHESTER

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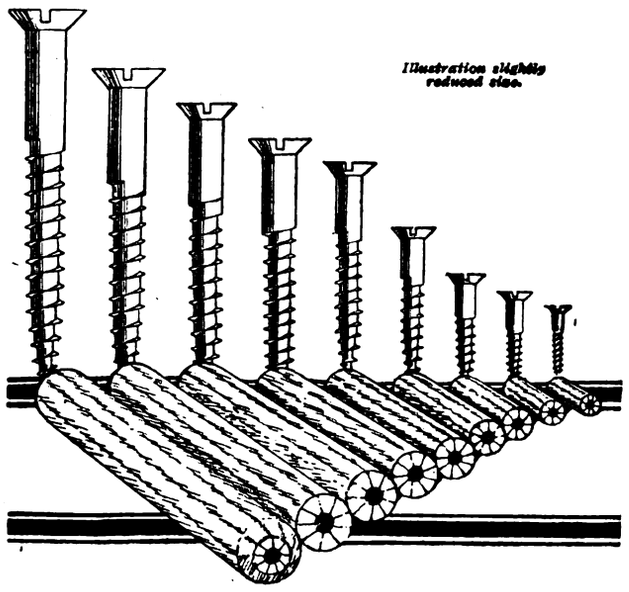


Illustration slightly reduced size.

There is a RAWLPLUG for every sized screw

RAWLPLUGS—the universally recognised device which enables screws to hold in any material—are generally sold in Outfits containing a box of No. 8 Rawlplugs in assorted lengths, a supply of No. 8 screws and a Rawlplug Tool. Most jobs are best done with a No. 8 Rawlplug. For very light fixtures such as electric or bell wires, a No. 3 Rawlplug can be used, while for heavy cabinets, heavy electric, gas or sanitary fittings, or light machinery, a No. 14 Rawlplug should be used, a single one of which will hold anything up to ½ a ton in brick.

Mechanics' Outfits are made up in the following sizes:—No. 3, 4/6; No. 6, 5/-; No. 8, 5/6; No. 10, 6/-; No. 12, 7/-; No. 14, 8/-; No. 16, 7/-; No. 18, 8/-; No. 20, 9/-; (Mechanics' Outfits Nos. 16, 18 and 20 have 50 Rawlplugs instead of 100).

Millions of Rawlplugs have been used by the Admiralty, War Office, G.P.O. and the principal Railways, Builders, Electricians, etc., throughout the country.

RAWLPLUGS WALL PLUGS

HOUSEHOLD OUTFIT (No. 8 steel). 50 Rawlplugs, Toolholder & Bit, supply of screws and hooks with full instructions. 3/6

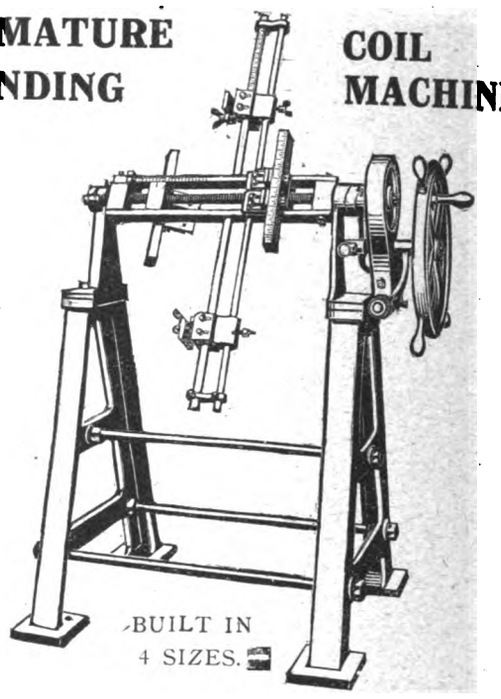
MECHANIC'S OUTFIT (No. 8 size). 100 Rawlplugs, special Toolholder and 2 Bits, supply of screws & hooks with full instructions. 5/6

THE RAWLPLUG COMPANY, LTD. Gloucester House, Cromwell Road, London, S.W.7.

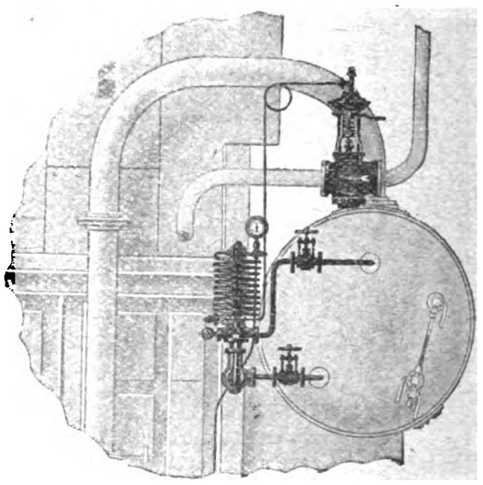
RAWLPLUGS IN ALL SIZES. Rawlplug Outfits (Nos. 3 to 20), and Refills are obtainable from all Ironmongers, Electricians and Stores. No. 8 size Refill boxes: 50 at 1/6 and 100 at 2/6

NEVILLE'S (LIVERPOOL) LD.

ARMATURE WINDING COIL MACHINE



Machines for—Field Coil Winding. Armature Banding. Commutator Turning and Grinding. Armature Coil Taping. Drying and Impregnating Plant. Winding Stands. Tension Reels. Trucks.



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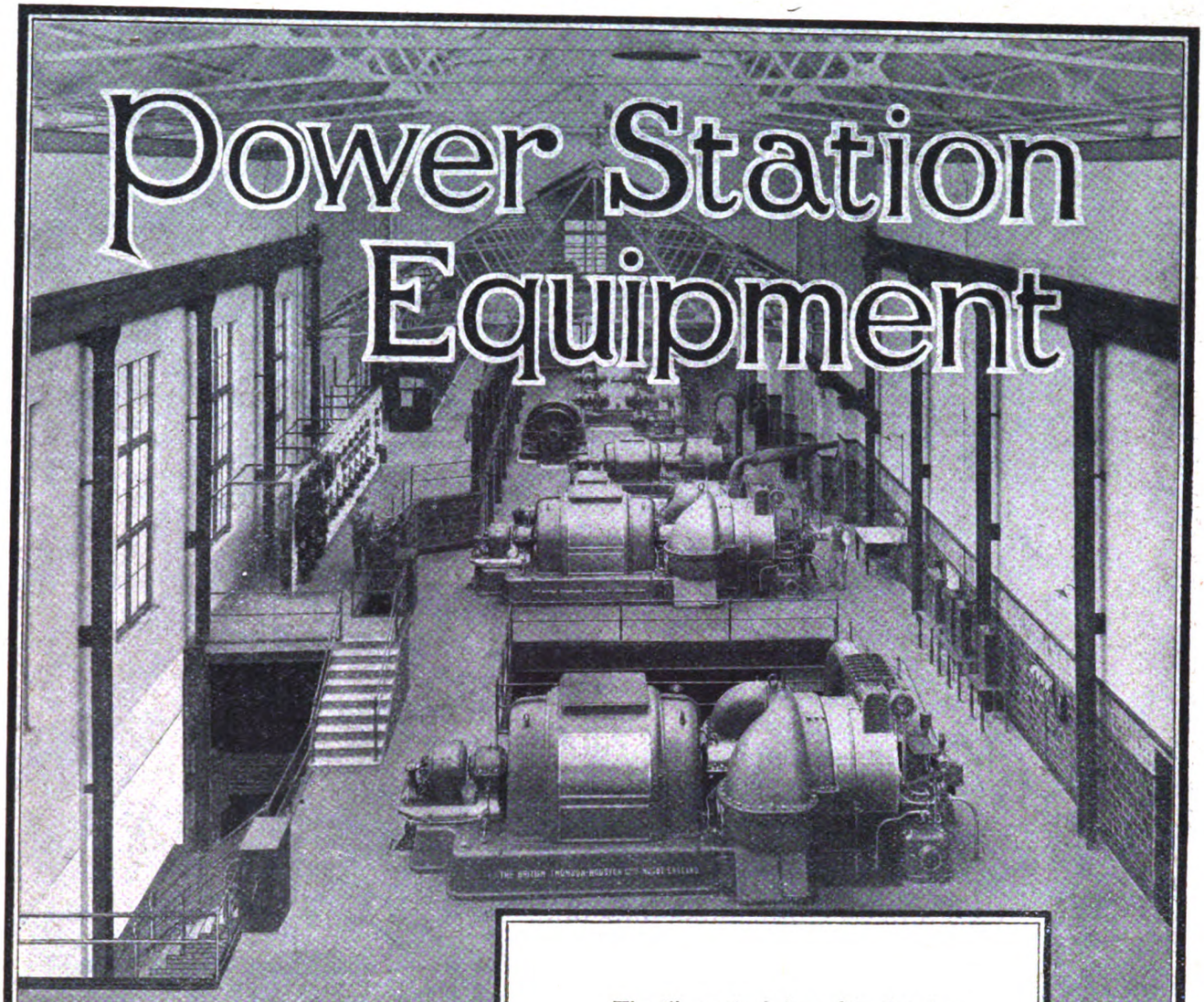

Turbo-Alternators
Generators
Rotary Converters
Switchgear
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Motors
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Etc.

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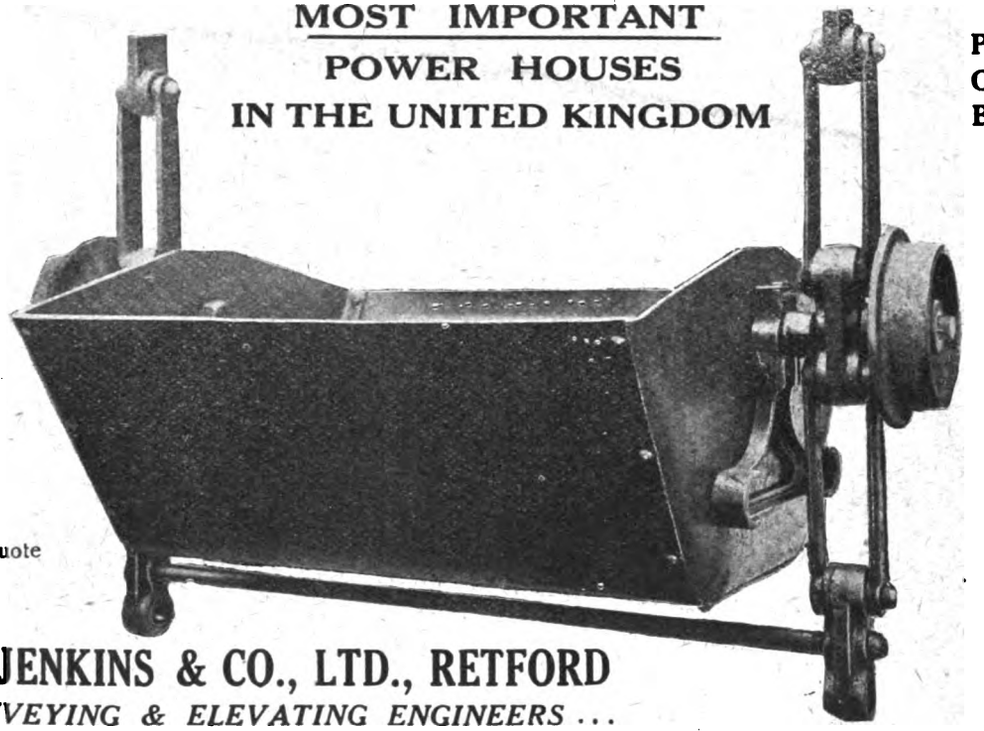

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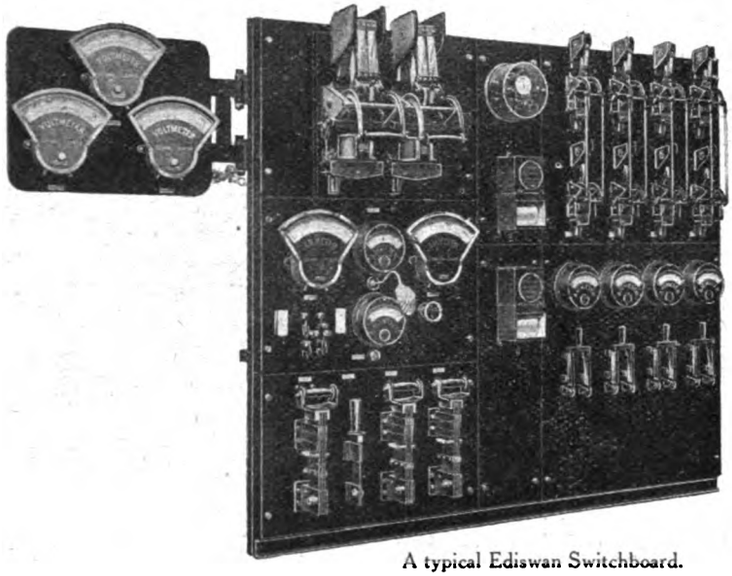
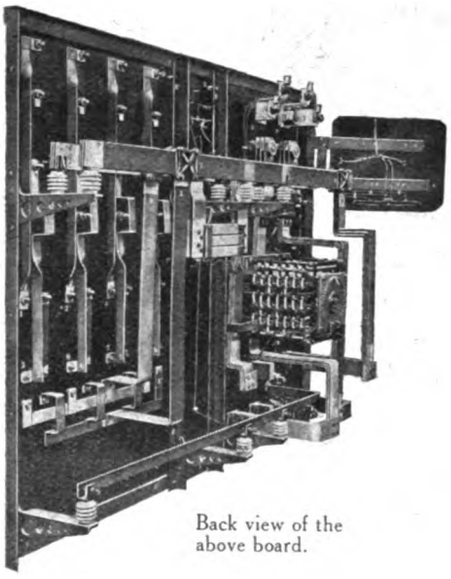


A typical Ediswan Switchboard.



Back view of the above board.

THE Switchboard illustrated here is a portion of a Main Switchboard supplied to a large Iron and Steel Works for the Blast Furnace Generating Station. It is designed to control a 1000 kW Turbo Generator and Balancer with distribution to lighting and power feeders on a D.C. 3-wire system. The other illustration shows the back of the board, where the finish, layout and design is every bit as good as the front.

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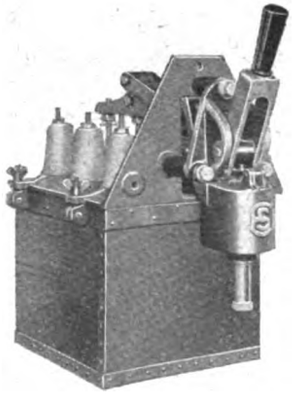

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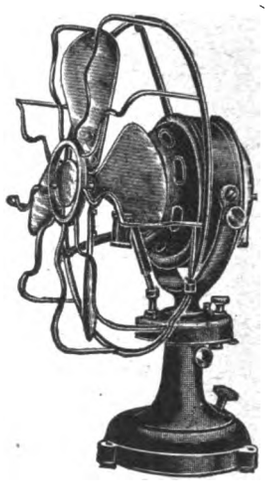

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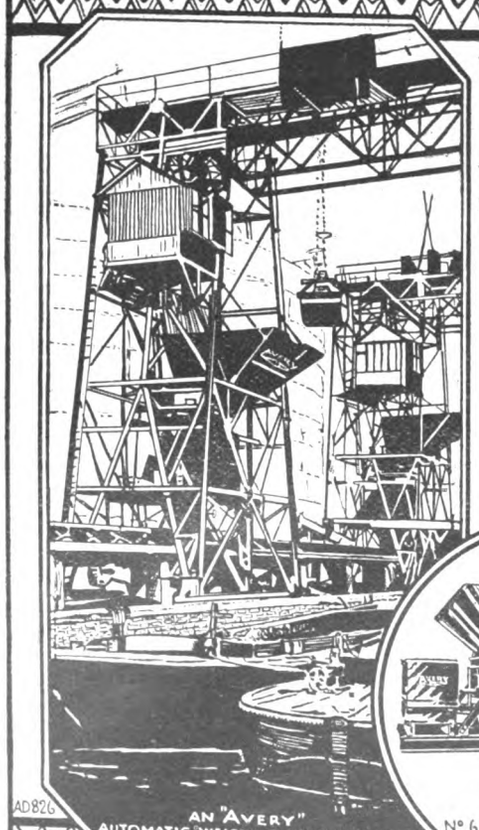

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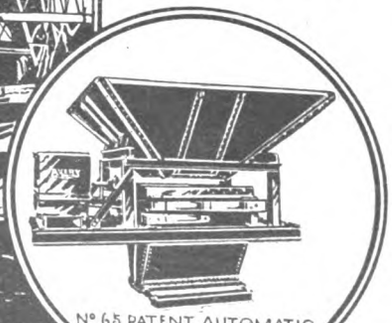

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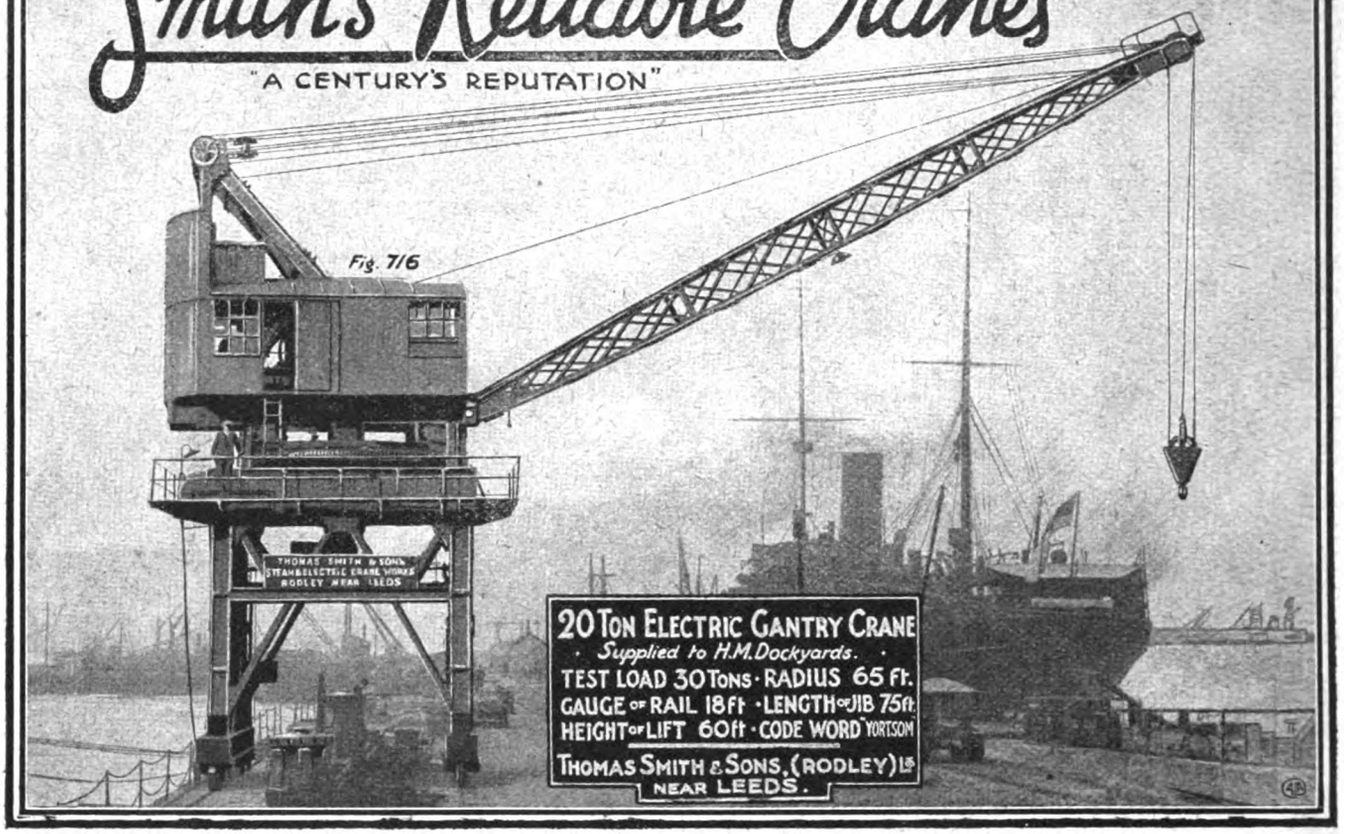
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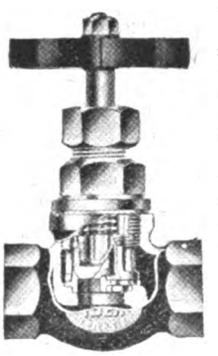

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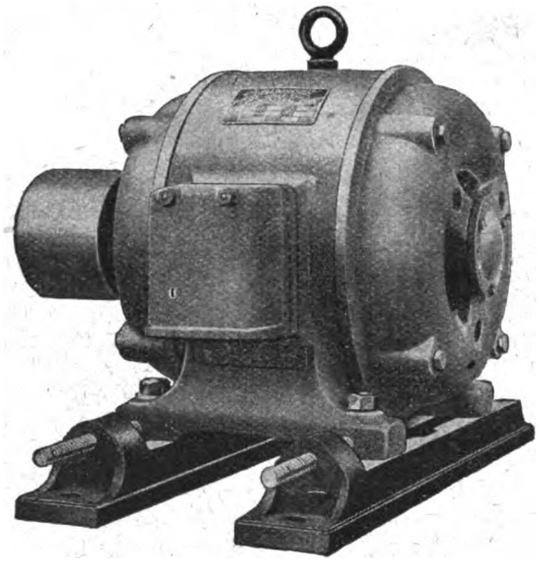

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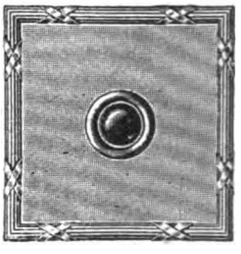

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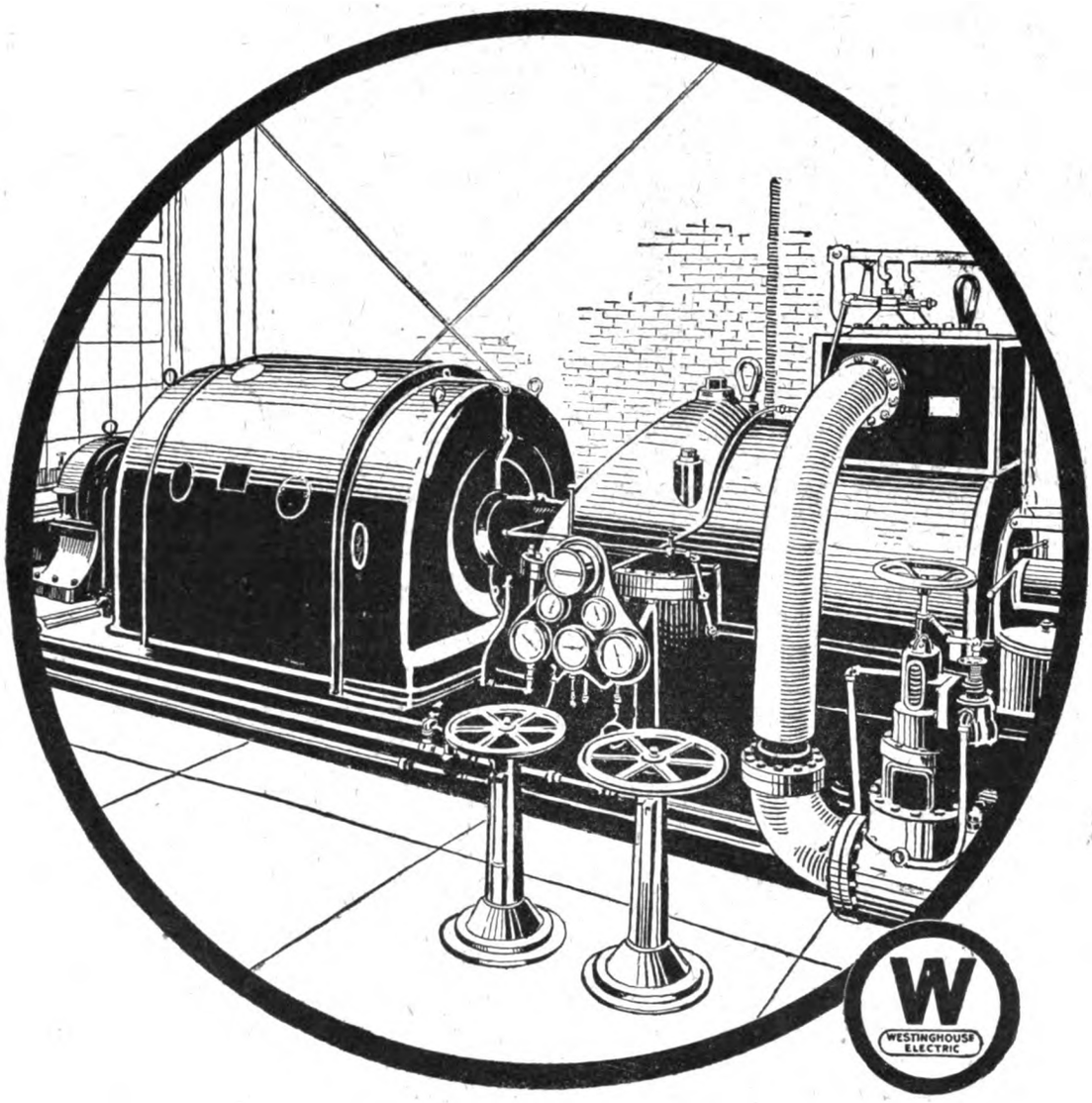

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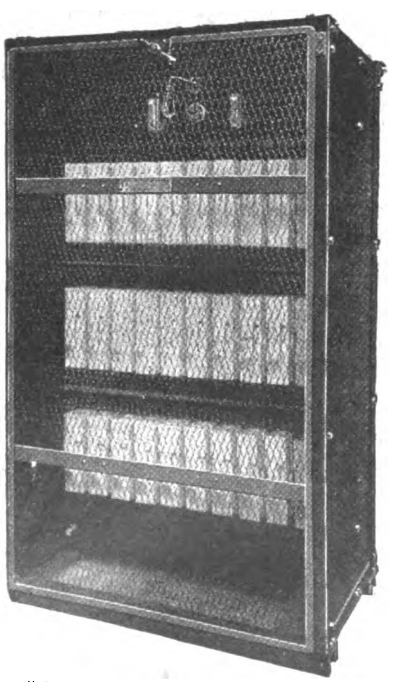

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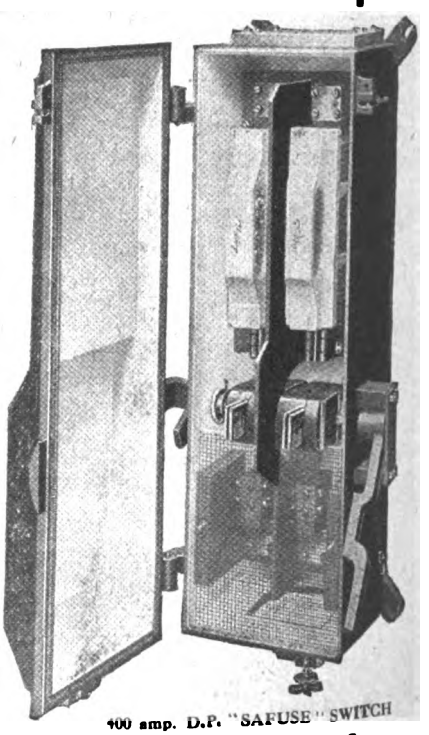

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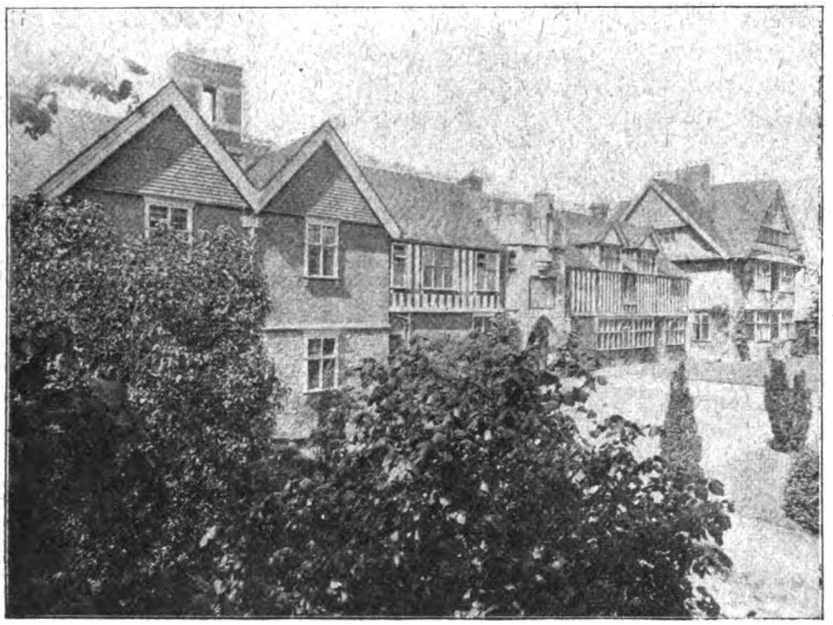

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Believe me with grateful thanks,
Yours truly,
(*Signed*) MOTHER SUPERIOR,
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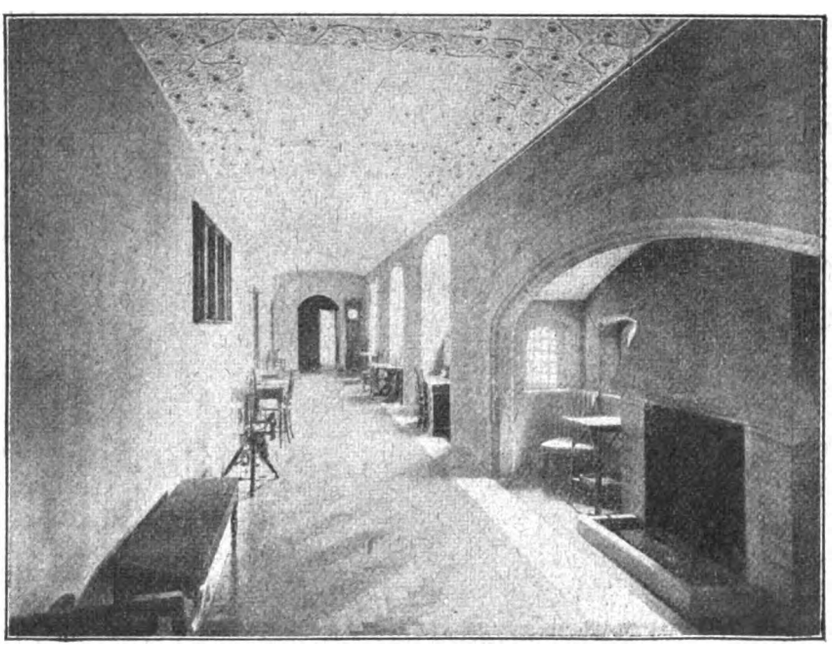

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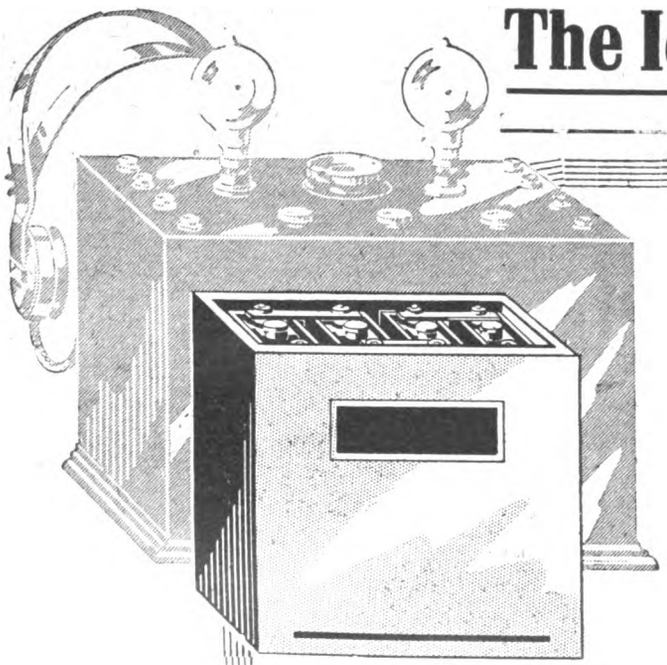

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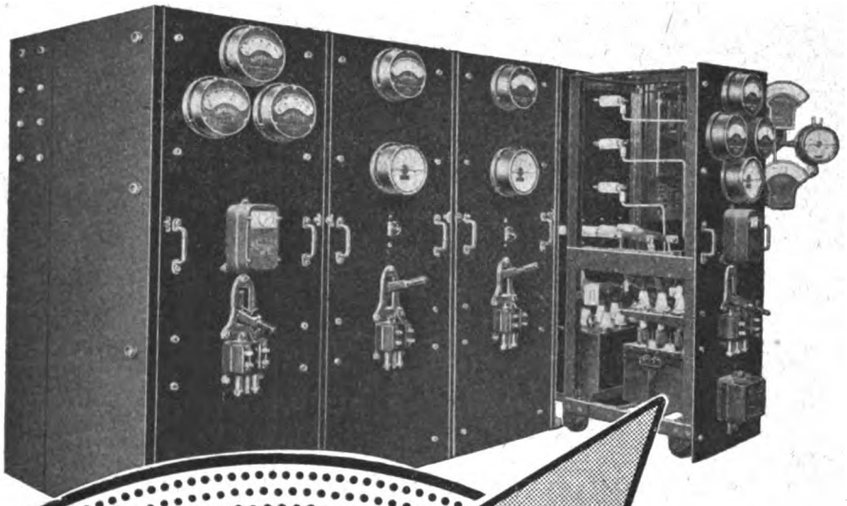

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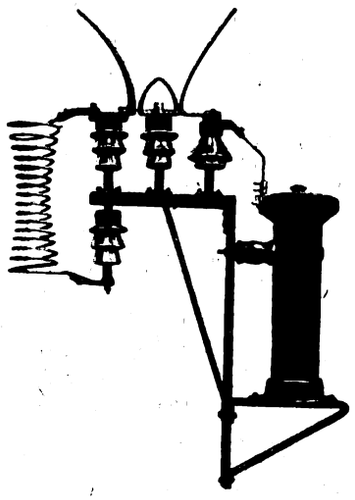

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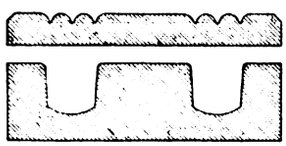

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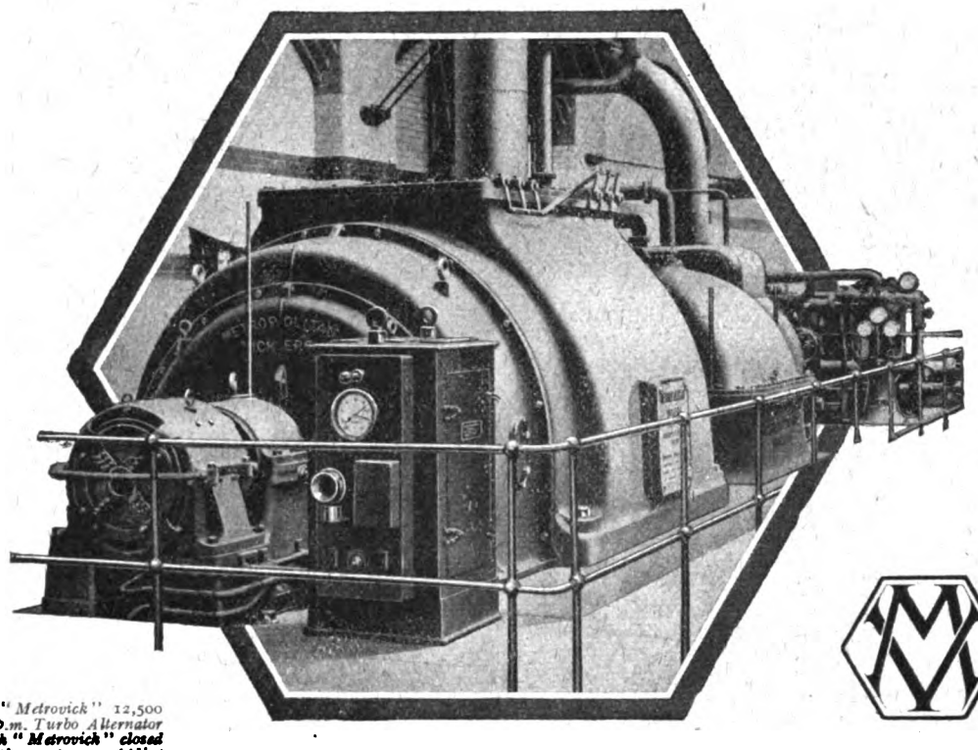

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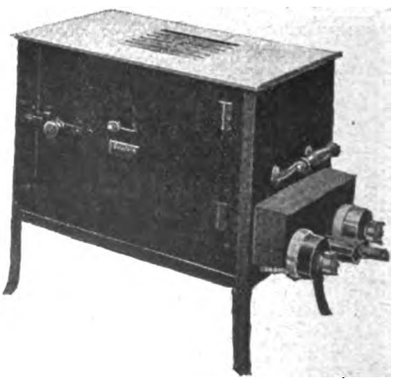

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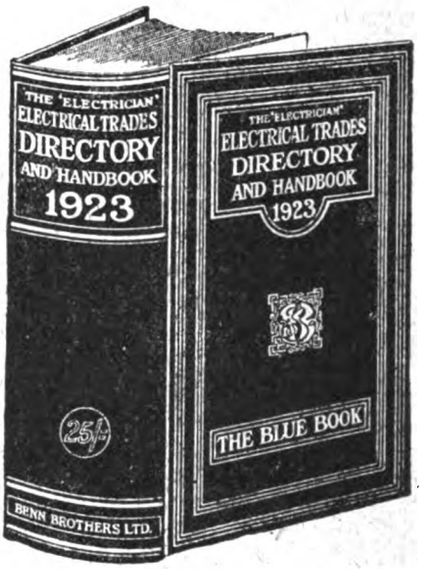

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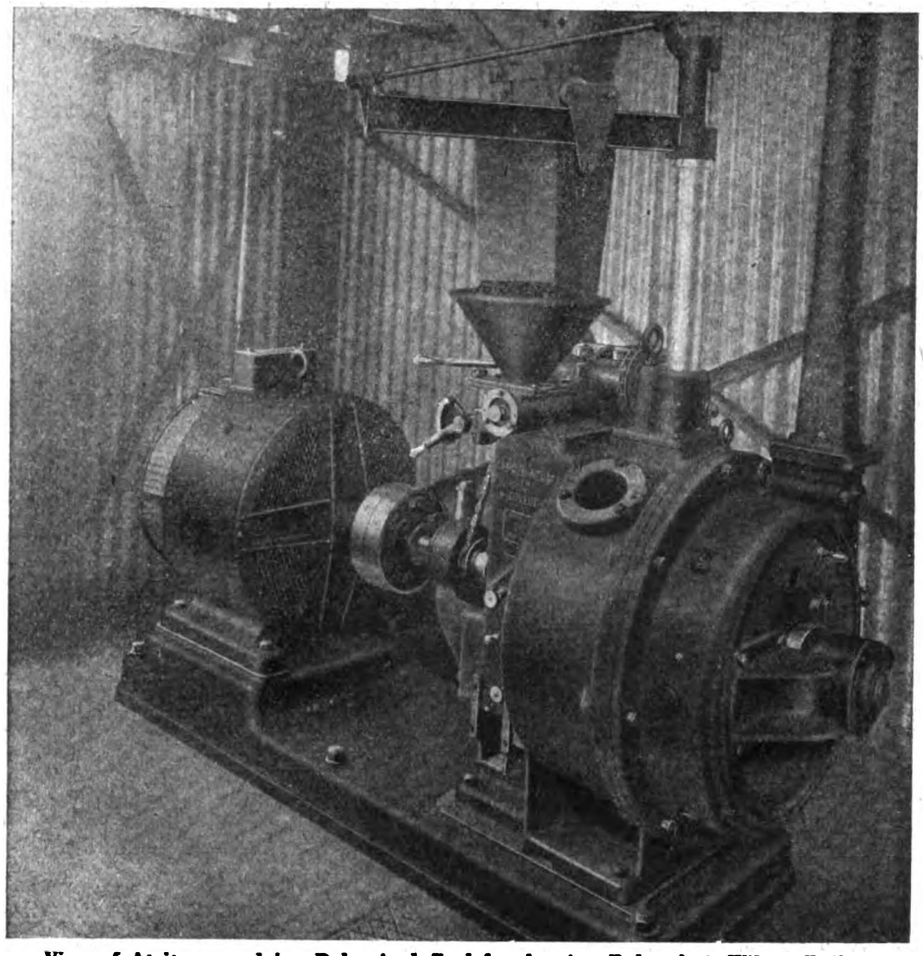

View of Atritor supplying Pulverised Fuel for heating Babcock & Wilcox Boiler.

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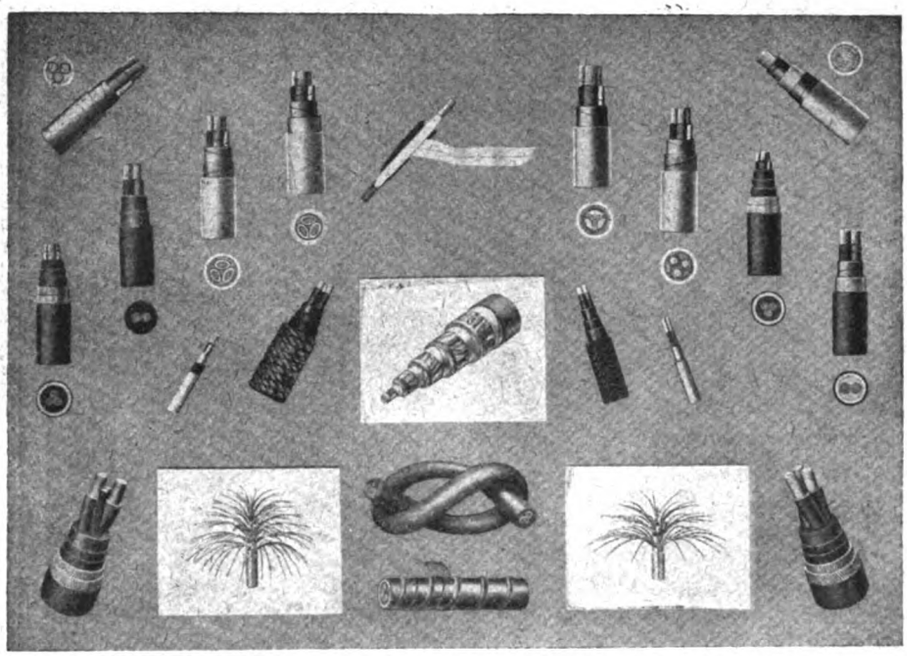

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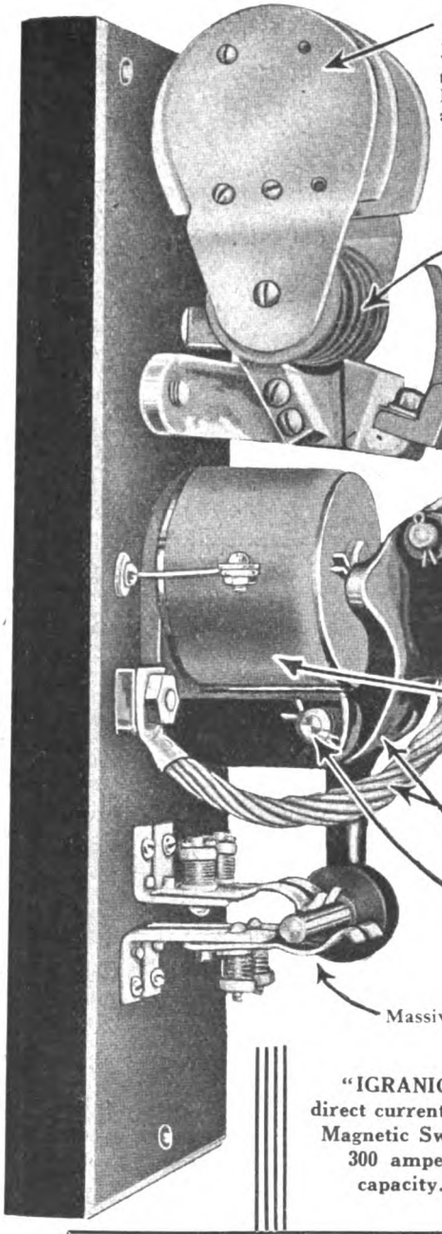
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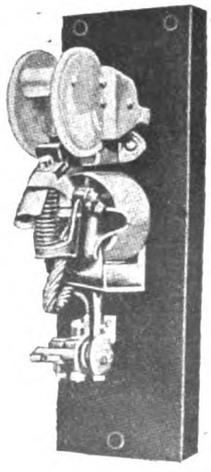

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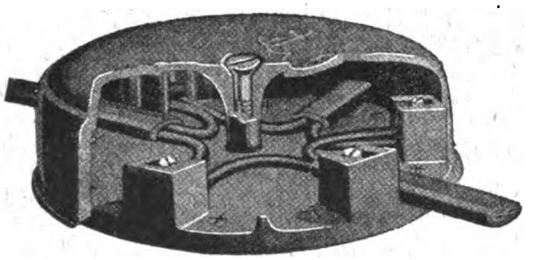

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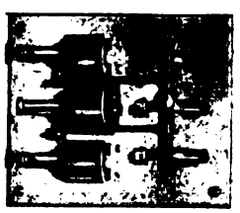

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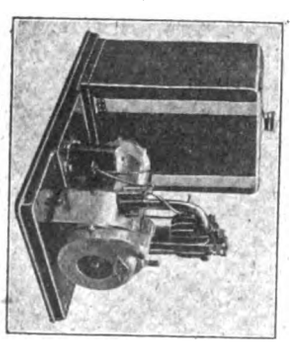

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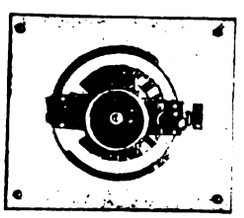

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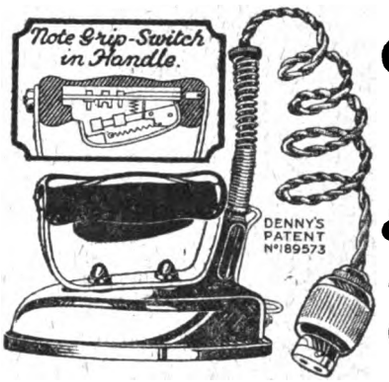

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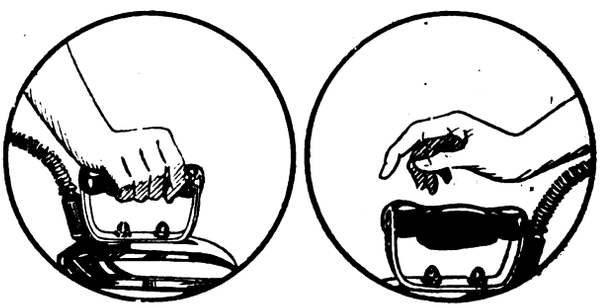

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Copies of Tender Form and Specifications, etc., will be available for inspection and purchase upon application to

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PRELIMINARY DEPOSIT.—A Preliminary Deposit of £50 is required to be lodged with each Tender.

The Commission does not bind itself to accept the lowest or any Tender.

Tenders on prescribed forms, properly addressed and endorsed, must be delivered to the undersigned in Melbourne, not later than noon, August 25th, 1923.

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RADIO ENGINEER, highly qualified, with scientific training and practical experience, wanted by prominent firm. State age, full particulars of qualifications, knowledge of languages, and salary expected.—Box N.A.A., ELECTRICIAN Offices, 8, Bouverie Street, E.C.4.

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Lot. 2.—Two compound boiler-feed Pumps by J. P. Hall and Sons, size 8½ by 13½ by 8½ by 18 in. stroke, 5,000 gallons per hour.

Lot. 3.—One boiler-feed Pump, by G. and I. Weir, 8 in. by 10½ in. by 18 in., capacity 4 500 gallons per hour.

Lot. 4.—Two Bellis-Siemens steam-driven D.C. generators, engine 200 H.P. compound, 115 lb. pressure, 380 r.p.m. dynamo, bipolar, compound wound, double wound armature, will run in parallel or in series at 240 or 550 V.

Lot. 5.—Two Bellis-Mavor and Coulson steam driven sets. Engine 400 H.P., 3 crank enclosed vertical tandem, compound type, 115 lb. pressure, Dynamo Multipolar, compound wound type, Voltage 460/550. 256 kW.

Lot. 6.—One steam driven Alternator, Engine by Willans, 3 crank compound type, 333 r.p.m., 115 lb. pressure, Alternator by E.C.C., 1 phase, 50 cycles, 200 kW.

Lot 7.—One Bellis-Siemens D.C. 500 kW set, 440-500 V, 3 throw compound.

Lot 8.—One 440 kW motor generator set by British Westinghouse, 475 B.H.P., 500/550 V one side, 440/460 V other side.

Lot 9.—One 300 B.H.P. motor by Bruce Peebles, 1906 design, 440 V, compound wound, Multipolar, d.c., speed 240/312 r.p.m., shunt regulator open type, 3 bearings, no pulley, slide rails and starting switch.

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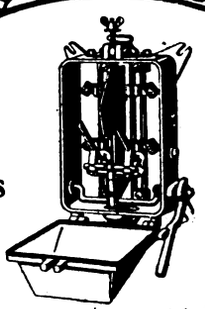

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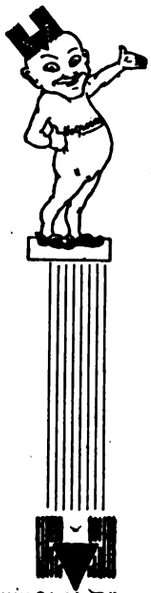

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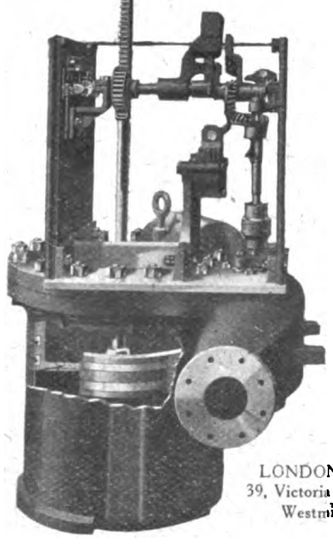

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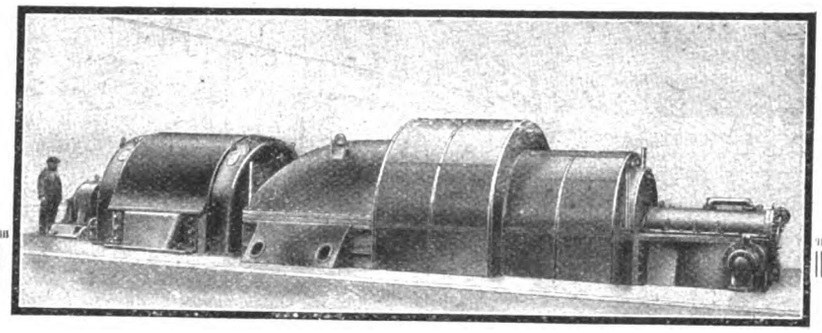

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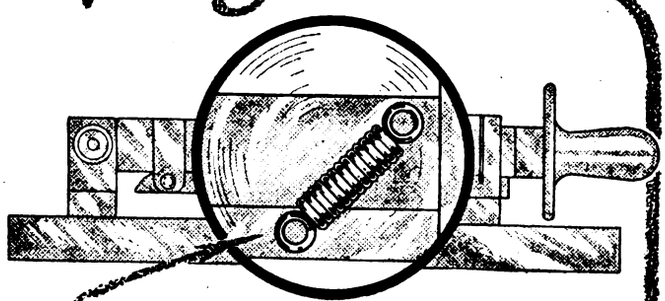

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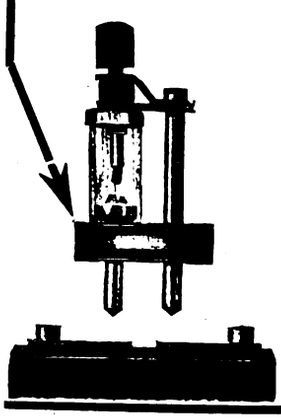

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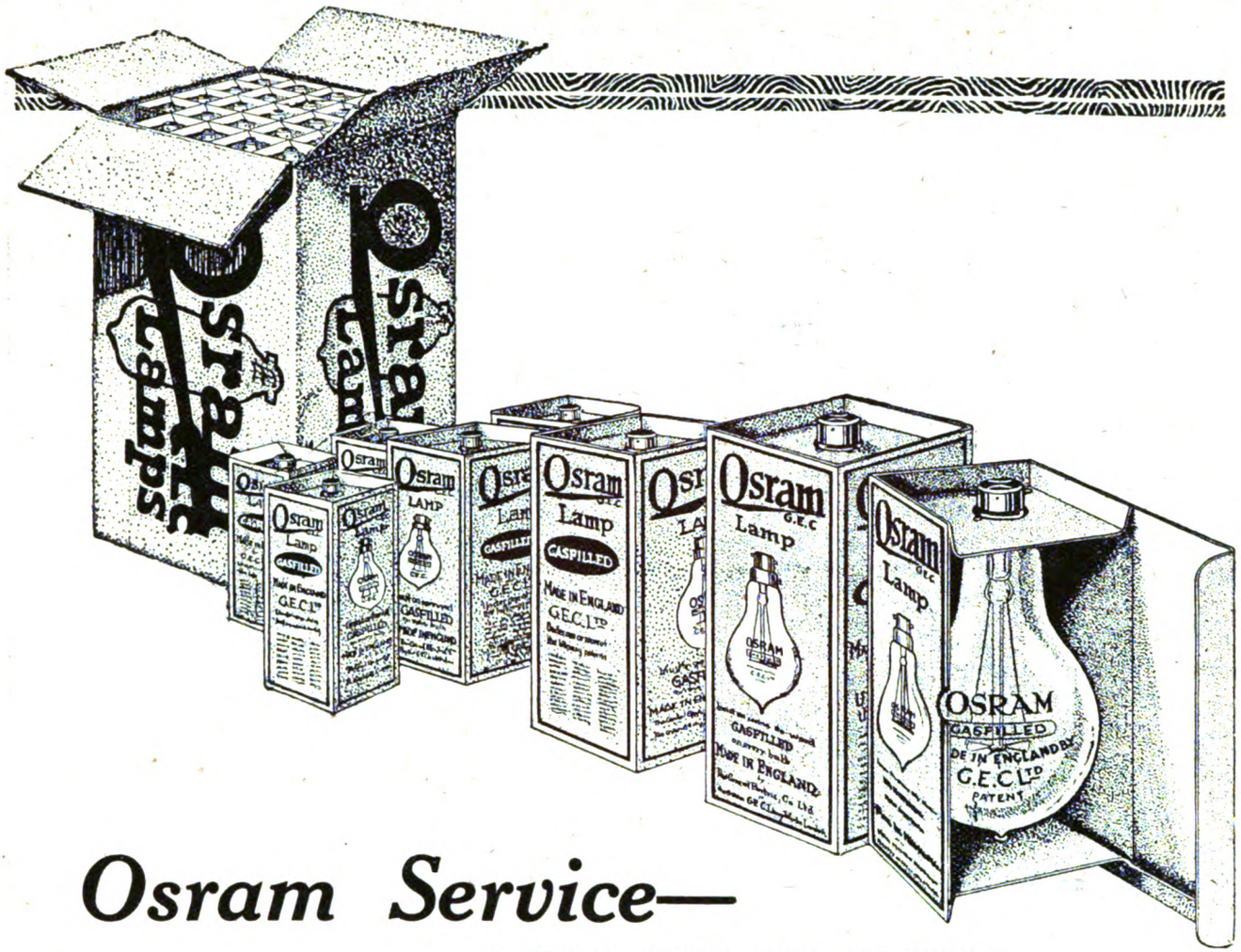

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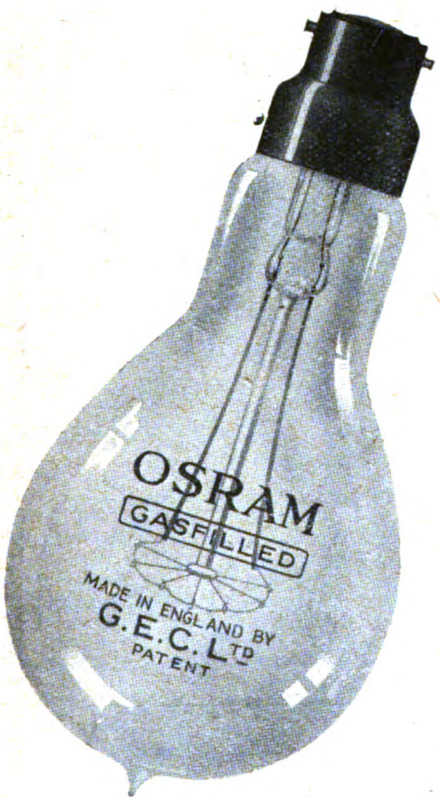

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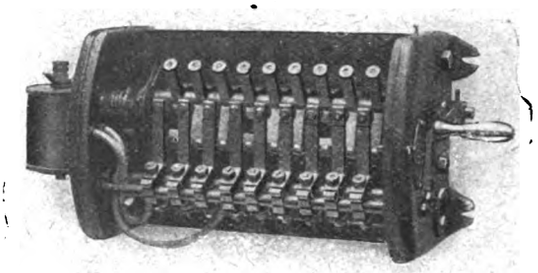
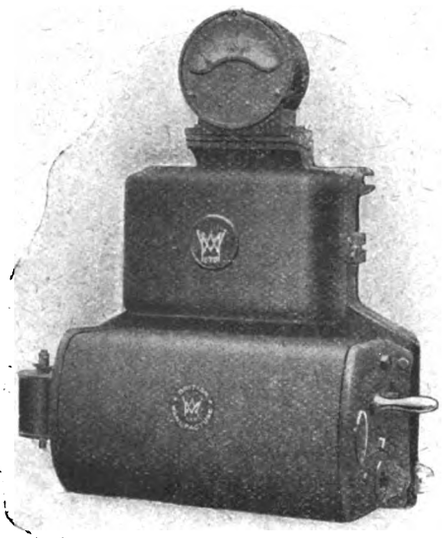


Starter with Low Volt Trip (cover removed).



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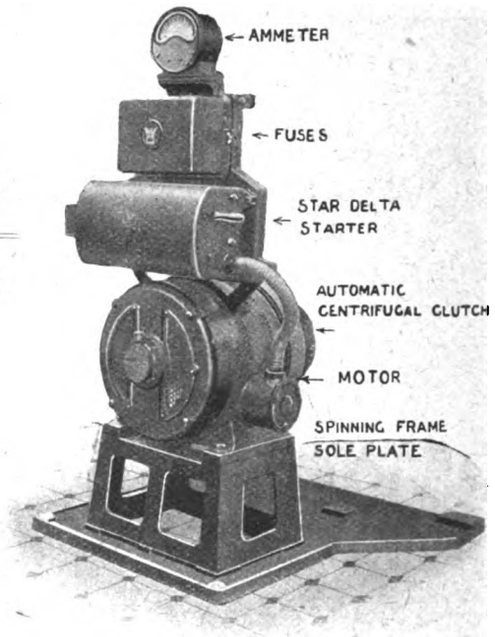

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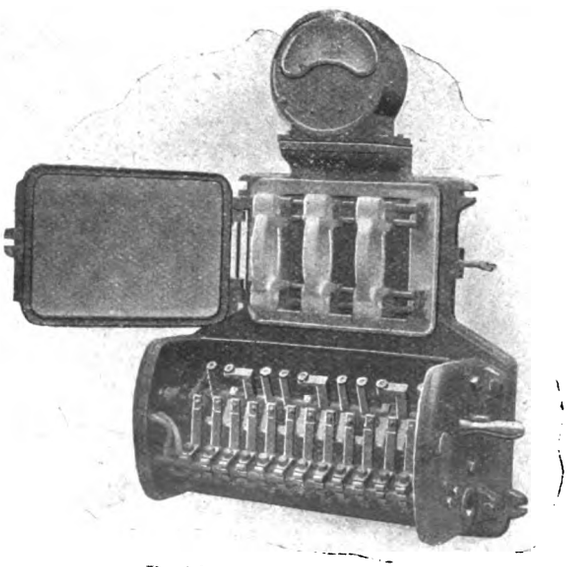

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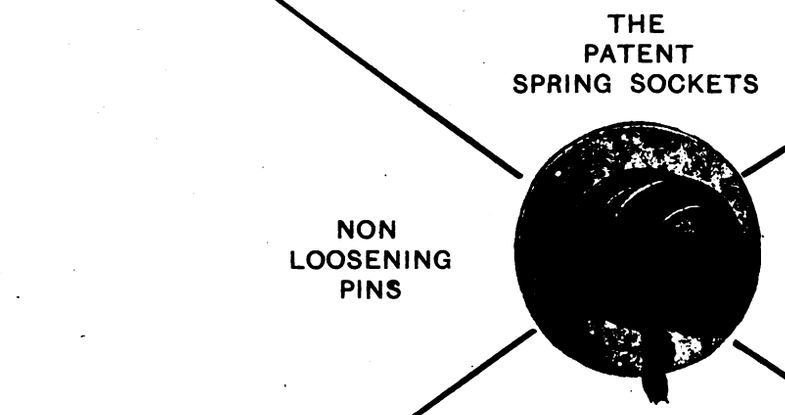

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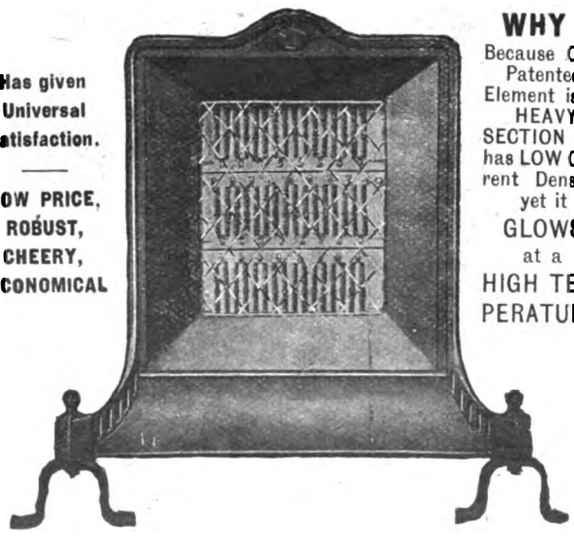

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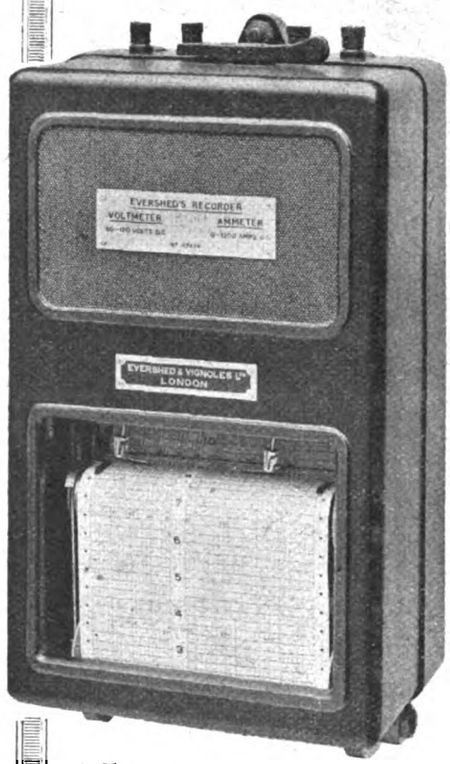

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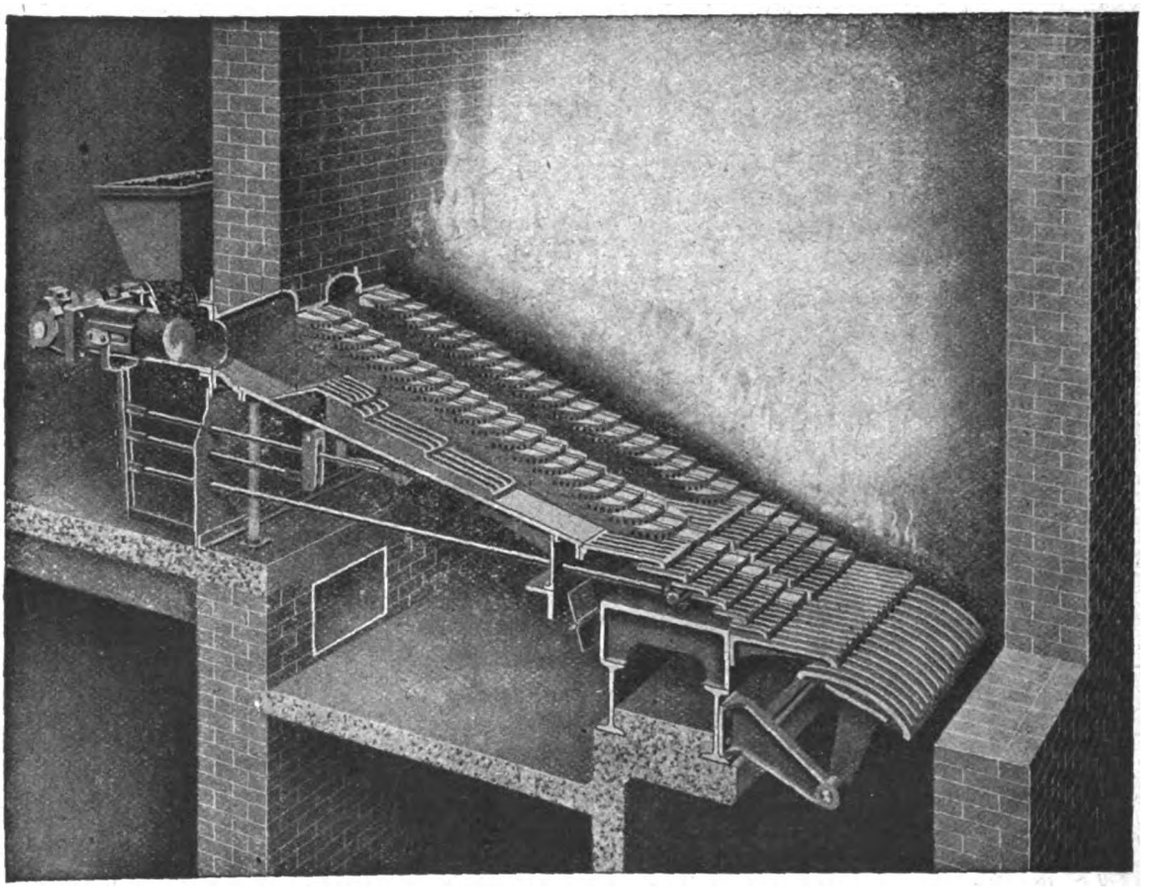

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THE ELECTRICIAN

ESTABLISHED 1861.

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CONTENTS.

NOTES OF THE WEEK 695
SELLING ELECTRICITY 697
Boiler House Practice in a Capital Station. By W. Ross. Illustrated 698
Latest Practice in the Design and Construction of Static Transformers. By J. W. Rodger, A.M.I.E.E. Illustrated 702
Fuel Economy in Small Power Stations. By L. L. Robinson .. 704
Efficient Steam Generation. By D. Brownlie 705
The Dynamicables 706
Halifax Corporation and the National Joint Board 707
Incorporated Municipal Electrical Association—
Presidential Address 708
"Showroom and Sales Department in a Small Town." By T. Hall 710
"Overhead Transmission." By J. E. Storr 711
"Modern Generation Applied to Existing Distribution." By F. W. Purse 714
Annual Report 717
Reactances for Electricity Supply. Details of G.E.C. Design. Illustrated 718
Pulverised Fuel at the New Detroit Station 718
A Useful Electrical Exhibition 719
The Latest Development in Gasfilled Lamps 719
CORRESPONDENCE 719
Parliamentary Intelligence 720
Legal Intelligence 720
Tramways and Light Railways Association 720
Books Received 720
Empire Trade 721
Forty Years Ago 721
Electrical Contractors' Association 721
I.E.E. London Students' Continental Tour 721
Imperial Notes 722
Foreign Notes 722
Electricity Supply 723
Personal Items 723
Tenders Invited and Accepted 724
Electric Traction 725
Business Items 725
Wireless News 725
Wages in the West Midland Area 725
Derry Electrical Employees' Wages 725
Companies' Reports, Dividends, etc. 726
New Companies 726
Forty Years Ago 726
Business Items 726
Commercial Intelligence 727
Prices of Metals, Chemicals, etc. 727
Patent Record 728
Arrangements for the Week 728

Notes of the Week.

The Convention—A Retrospect.

THE Scarborough Convention has come and gone; and may be voted an unqualified success. Even the weather was kind and the excellent organising work of the Council, and especially of Miss B. J. LANDFEAR and her assistants, made for the enjoyment of everyone. A clear head, equable temper and the ability to answer the most unnecessary questions are qualities for which Miss LANDFEAR has long been famous, but it may be added that this year her task was a more than ordinarily difficult one. To break away from tradition and hold the Convention at Scarborough was an excellent move, but it deprived Miss LANDFEAR of the assistance of a staff who knew both her requirements and local conditions. In saying this we do not wish to minimise the help she received from the Scarborough municipal authorities, but only to emphasise the need of rather more recognition than usual of her indefatigability. As is our custom we give in this week's issue a full and complete account of the Convention's proceedings, a thing done by no other technical paper in a single issue, as well as several specially written articles on vital subjects. The whole forms our annual Power Station Issue and it is intended to be read and kept for reference.

Overhead Transmission.

IN the old days electrical engineers used to generate a good deal of heat discussing the relative advantages of alternating and direct current. Were it not that now-a-days the thermal efficiency of those concerned is lower, an equal amount of heat might be generated on the cognate subject of the relative advantages of transmission by underground cables and overhead lines. The Paper read by Mr. J. E. STORR at the I.M.E.A. Convention last week on "Transmission and Distribution of Electricity by Overhead Lines" gave a useful, if lengthy, summary of the technical, legislative and financial position of this important section of electricity supply. This information was supplemented by Mr. W. B. WOODHOUSE, who indicated the lines along which research is being undertaken with a view to obtaining increased reliability. For the rest, the remarks of the various speakers simply indicated what they had done or exhibited their prejudices in one direction or another. This was a pity. For though the effect of overhead lines on the æsthetic amenities of and the vested interests of those who live in the Wirral Peninsula may be a highly important subject, it is not really a matter about which engineers mainly interested in technical problems, and not sojourners in that salubrious district, can expect to be wildly excited. Nor can experience gained in India be directly applied by the same engineers seeking information about the best methods to use in this country. In such a discussion where there is so much to clear up it would be well if speakers stuck to the point.

The Cost of Perfection.

THE position in this country with regard to overhead lines may thus be summarised. There are places where obviously they cannot be used (in large towns); there are places where obviously for economic reasons they must be used (in North Wales). For the rest the choice is largely a matter for each engineer to decide for himself and is not a matter which should be complicated by prejudice. A great point was made of the bad effect on continuity of supply of using overhead lines. But this is not an insoluble problem. Neither are wayleaves or birds or even Post Office red tape. In this country we are too inclined to require something that shall be as nearly as possible perfect from the very start and then grumble at its high cost. It should be obvious that if electricity supply is to be extended to sparsely populated districts cheap construction must be used and

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that if necessary some risks must be taken. They need never be very grave and as time goes on their gravity will diminish. But to make an early start it is worth while taking them.

Boiler House Practice—The Staff Problem.

A NOTABLE omission in the I.M.E.A. programme was any Paper dealing with the important question of Boiler House Practice. We have tried to repair this omission by the three articles which we publish elsewhere in this issue. Mr. W. Ross, power station superintendent at Glasgow, and Mr. L. L. ROBINSON give us their views on how a boiler house should be run in a capital station and in a small station respectively, while Mr. DAVID BROWNLIE once again takes up the cudgels in favour of continuous testing. We commend what they have to say to readers of THE ELECTRICIAN. Both Mr. Ross and Mr. ROBINSON comment on the staffing problem. The former suggests certain human qualities and the latter certain technical qualifications as being necessary. Mr. ROBINSON making the important point that the ladder to promotion is now rather by way of the chemical laboratory than by the switchboard. The boiler house may in fact be regarded as a separate manufacturing concern where (the product being heat) careful records are kept and acted upon. That these careful records may be obtained, continuous testing, as Mr. BROWNLIE points out, is necessary. Mr. Ross outlines the procedure at Dalmarnock and it will be seen that the system is quite complete. But perhaps the most important factor of all is the personnel. As Mr. Ross rightly remarks, even the firemen employed must not be simply brawny stokers. And, above all, it must be recognised that the payment of high wages to obtain good men and judicious expenditure on the necessary instruments are amply repaid in the improved results obtained.

Higher and Higher Steam Pressures.

THE tendency of steam pressures, like many other things, is to go higher and higher. As is well known, pressures up to 1 500 lb. per sq. in. have been successfully tried, and now a recent article in " Power " describes an experimental plant in which steam at a pressure of 3 200 lb. per sq. in. absolute and a temperature of 706 deg. F. is being used. The choice of this pressure is due to the fact that at these figures a critical point is reached at which water changes into steam, on the addition of heat, without change in volume. No ebullition therefore takes place and there is no priming. The question may therefore be asked: Are we on the eve of a revolutionary change in boiler house practice? Time alone will show whether this new system, which contains a new idea, will justify itself. But it is very much to be doubted whether anything is to be gained by forcing up unduly either pressures or temperatures with the existing type of plant. The Lancashire Electric Power Co. have shown what excellent results can be obtained at normal, almost sub-normal, temperatures and pressures and although that is no argument for staying where we are, it may at least be a check on heedlessly rushing forward before all the obstacles which have to be overcome are thoroughly examined. These problems are metallurgical as well as thermal and require the most careful investigation.

A Slight Misfire.

WE have some sympathy with the irreverent critic who described the discussion on " The Development of Cooking Apparatus " at the I.M.E.A. Convention last week as a revival meeting. There was some uncertainty as to whether we should be allowed to report the proceedings and we therefore attended in a private capacity, our interest whetted in the anticipation that there would be some awful revelations of the shortcomings of electric cookers. We noticed that at the beginning of the meeting the various manufacturers' representatives were glum and nervous; but at the end they had an excellent appetite for the tea, kindly provided by the Mayoress of Scarborough. For no Bottom roared more gently than the critics and the criticised may be forgiven for believing that there is not much wrong. In fact, the proceedings developed into propaganda for the cause of electric cooking, which in its way was all to the good, but hardly what we had come for. It is not surprising then that the veil of secrecy has been lifted and a short account of the various speakers' remarks will be found in our account of the Convention's proceedings. However, we do not despair of our sensation, for a *questionnaire* searching for defects is to be issued so that perhaps next year we shall not go away with our appetite for the dreadful, the gruesome and horrific unappeased.

An Unsatisfactory Figure.

The most interesting point brought out in the discussion was that in this country the sum total of the electric cookers installed is about 5 000. The unsatisfactoriness of this figure is only diluted by the further statement that cookers are now being connected at the rate of 100 a week. So that by this time next year the present figure will be more than doubled, especially as we hope the rate itself will accelerate. The least pleasing point about this state of affairs is that most of the cookers are installed on the mains of a few of the undertakings. This must be changed. It must be changed by the small undertakings becoming more enterprising, and by the large undertakings increasing the work they are already putting into the development of the domestic load. The equipment is there, the consumers are there. It is for those who are responsible for the management of our supply undertakings to bring the two together. Especially must they abandon the attitude that the time is not yet ripe for doing anything.

Overvoltage Protection Apparatus.

PROTECTIVE apparatus for power supply systems is so much in the public mind at the present time that an account of the development of overvoltage protective apparatus, given by Mr. F. SCHROTTKE in a recent issue of the " Elektrotechnische Zeitschrift," will prove of unusual interest. The author draws a somewhat cynical distinction between apparatus which will do the work for which it is designed and that which will not only fail to perform its duties but do real harm. He also presses an argument in favour of strong internal insulation as the best means of protecting generators and transformers. In that we think he is right, both on the grounds of simplicity and cost; and he is able to emphasise this by pointing out that where this has been done the equipment is operating satisfactorily without any further protection. This applies also to earthing devices which have not proved altogether satisfactory on power of more than 2 000 kVA. At the Golper station their use, after certain major troubles, has been discontinued, and the results have been all that can be desired.

External Protective Apparatus—Some Criticisms.

IF external protective apparatus is used he recommends employment of ohmic resistance in series with horn gaps, experience showing that this equipment has much to recommend it. Mr. SCHROTTKE describes one such equipment consisting of an oil immersed resistance and a contactor with a horn gap on the cover of the oil tank. The contactor short circuits the greater part of the resistance during normal operation, but opens it when overvoltage occurs within two cycles, thus unseating the full resistance. He also suggests the reduction of the voltage on an incoming wave and the smoothing out of its wave front by the use of a spirally wound choke coil, wound with a copper ribbon and a nichrome ribbon in parallel. He is against the use of condensers and uncertain about the employment of an earthed steel cable above the transmission line as a protection. The Paper generally is to be recommended as a thoroughly practical study of an important subject.

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Selling Electricity.

We believe it was Col. CROMPTON who said that the chief aim of the electrical engineer should be to sell electricity. The reason why is clear. The object of all our designers, manufacturers, wholesalers, contractors and selling staff is to produce and sell apparatus which either generates or consumes electricity. Though the market for both these classes of equipment is large and at present, at any rate, shows no signs of saturation, it is obviously limited. On the other hand each piece of apparatus, however small, connected to the mains, will before long consume an amount of electricity whose aggregate market value, even at the low prices we hope to reach, will exceed that of the apparatus in which it is being dissipated. In other words, electrical development consists not mainly in the production of plant and apparatus, but in extending the use of that "consumable store" electricity (to use an army phrase) which is required for their operation. The sale of apparatus and the sale of electricity are and must remain closely interlinked, but it must be insisted that while the former is a means to an end the latter is the end itself. And that is where the supply engineer comes in.

Breaking Away from Tradition.

This being so, Col. VIGNOLES is to be congratulated on breaking away from the tradition which requires that Presidential Addresses shall be either historical, prophetical or technical, and devoting his remarks to a subject—publicity—a proper knowledge and use of which is essential to secure the greater sale of electricity. Col. VIGNOLES is also to be congratulated on the matter of his address and upon the manner in which he delivered it. It was a singularly appropriate, though an unrehearsed piece of business, that an address with such a definite text should have been delivered from a pulpit. It was no less good stage management that the Address should have been followed by a Paper on "Showrooms and Sales Departments in a Small Town," by Mr. T. HALL, the discussion on which emphasised many of the President's points.

A Virgin Field of Supply.

It is axiomatic that the future prosperity of British electricity supply depends on the development of the domestic load. A realisation of this fact has been forced upon many of the more energetically managed undertakings by post war industrial conditions. These conditions, as is well known, have resulted in a drop in output and in revenue. That things have not been worse is due to the enterprise of the managers concerned and to the fact that each undertaking has in the domestic load a practically virgin field for development. So far so good. But unfortunately an energetic development of the domestic load is the exception rather than the rule, and this is particularly the case with the smaller undertakings which reaped less advantage from the trade boom and have been therefore less affected by the slump. Many of these, as Mr. ROBINSON truly said, are absolutely asleep. But these are just the undertakings which have most to gain from the development of the domestic load, and it is therefore essential that they should wake up, not only for their own good but for that of the electrical industry. For these undertakings Mr. HALL's Paper should be a much needed alarm clock, and we hope that the engineers, and especially the committee men concerned, are by now thoroughly awake. One alderman frankly confessed that he was, and the discussion, which was much better sustained than many we have heard, showed that the need for energy is realised.

Publicity the First Essential.

What is needed is, in fact, publicity. As Col. VIGNOLES truly said, "To create a demand for electricity the public must be told what to do with it." The public must be educated to feel the need of the services which electricity can render; "must be taught, must be told, must be reminded, must be shown and told again how to use electricity."

A Solution for the Servant Problem.

The time is ripe, more than ripe, for such a campaign of education. A Committee is sitting to deal with what is called the servant problem, and it is dealing with it very unintelligently. But whether this Committee succeeds in increasing the supply of servants, which is not in the least likely, or whether it simply succeeds in making matters worse than they are already, the wife of the small householder is beginning to realise that her domestic problem must be solved by other than human aid. The trained servant is expensive and pernickety to the extent that she will not work as the sole member of a staff. The untrained servant is expensive, useless and as destructive and peripatetic as the locust. If, therefore, some means, cheap, easy and reliable, can be found for doing without the servant the housewife would welcome it with open arms. We can place the means at her disposal if we will; the rest is a matter of education. For, to quote the presidential address once again, "The public are ready for electric cooking, the conditions are suitable, now is the time; but the mass of public opinion to be moved is great; how can it be done?" And this argument brings us to a truth, which was admirably summed up by Mr. ROBINSON in the discussion on Mr. HALL's Paper, that "Selling is more important than technicalities." What then is the best way to start a selling campaign? That is a question which each supply engineer must consider and answer.

A Result that Must be Improved.

This matter does not have to be considered for very long before it is obvious that the publicity undertaken must be of two kinds—internal and external. A vote taken at the meeting at which the Presidential Address was delivered showed that about 50 per cent. of those present were using electric cookers. This is better than it was, but it is certainly not good enough. No supply engineer can expect successfully to develop his cooking load unless not only he cooks by electricity himself but all his staff do so as well. The extension of the domestic load and of the publicity force by this simple means is an easy matter and should be undertaken without delay. But the staff must pay the full price for the electricity consumed even if the apparatus is given them for nothing, otherwise their experiences are not typical. Of equal value in a different direction is the work of the Electrical Apparatus Committee of the I.M.E.A. This Committee is helping manufacturers to perfect the designs of cookers, and the discussion which took place during the Scarborough meeting show that satisfactory advances are being made.

An Easy Task.

The education of the public is easy if a little energy be thrown into it. The British Electrical Development Association exists for this purpose, and each engineer can do a great deal to help them and himself. Having once recovered from the shock of doing something new and strange, propaganda will be found as interesting as it is ultimately remunerative. But while these local efforts are being made, as undoubtedly they should be made, it must not be forgotten that next year there will be such an opportunity for educating the public in the possibilities of electricity as has never existed before. The British Empire Exhibition at Wembley will collect people from all parts of the country eager to see all sorts of electrical marvels. It would be a pity that they should not be adequately shown the latest electrical marvel—electricity in the home. We therefore hope that all supply undertakings will co-operate in the scheme inaugurated by the British Electrical Development Association for creating an impression in the uses of electricity that will not be forgotten in a generation, and that few of them will follow the example of Willesden, which is apparently going to do nothing. That they should so co-operate is essential not only for their own prosperity but for that of the industries of the Empire as a whole.

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Boiler House Practice in a Capital Station.

By W. ROSS, Power Station Superintendent, Glasgow.

It will be generally agreed that boiler house practice in a capital station is a subject of outstanding importance at the present time. This article is contributed in the hope that a short account of the experiences at the Dalmarnock power station of the Glasgow Corporation Electricity Department may be of interest, not only to central station engineers, but also to all concerned in the electricity supply industry.

The methods outlined in the article must not be taken as representing the general practice in large power stations, but rather as indicating briefly the methods evolved for the operation of the boiler house at Dalmarnock.

As the position of the boiler house in relation to the turbine room, coal and ash sidings, etc., has an important bearing on the scheme of operation adopted, it is desirable that the reader should have a clear conception of the general layout of the Dalmarnock works.

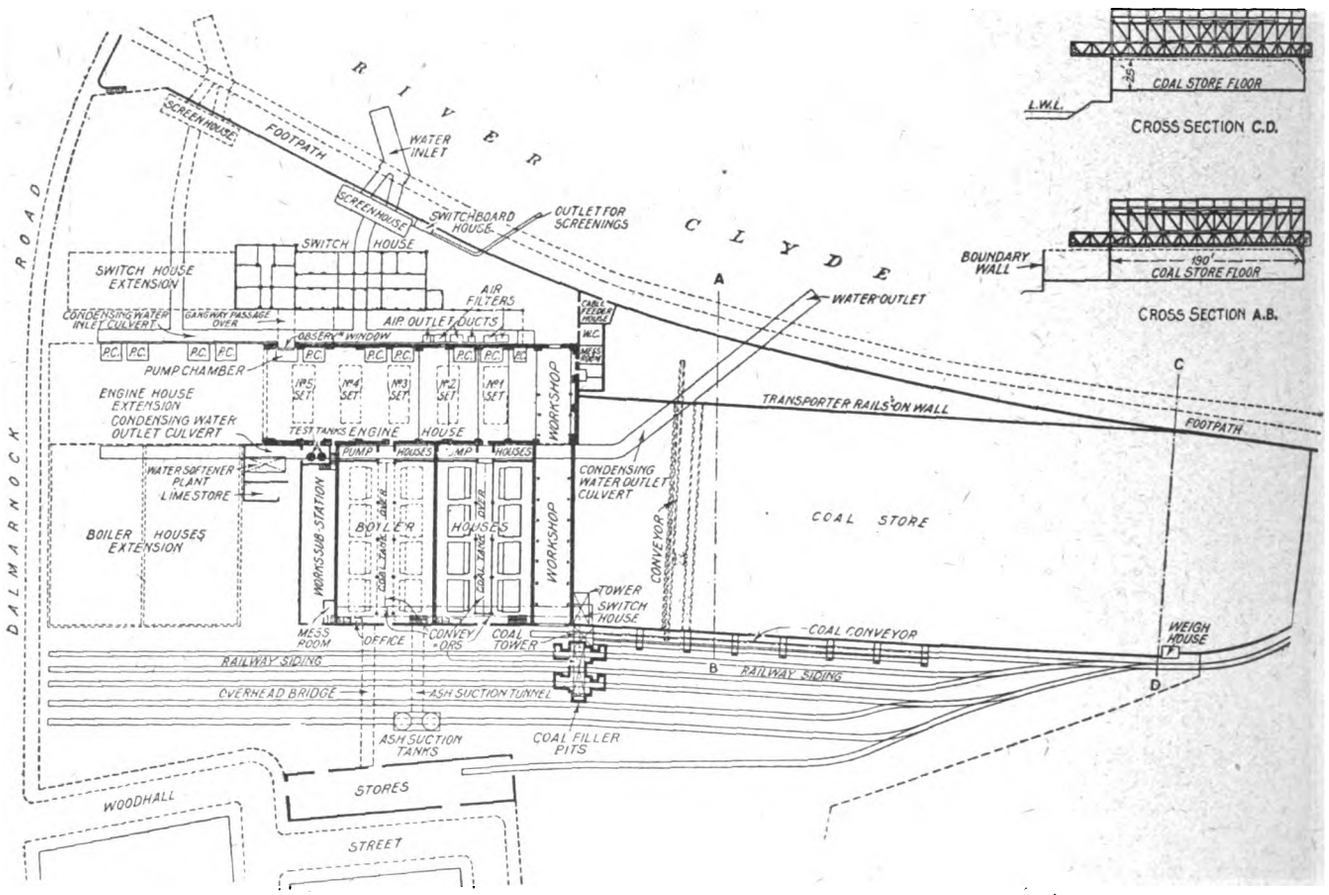

FIG. 1. GROUND PLAN OF THE DALMARNOCK GENERATING STATION.

The Layout at Dalmarnock.

A ground plan of the Dalmarnock works is shown in Fig. 1. From this it will be seen that there are two boiler houses at present erected. These are built at right angles to the turbine room. Each boiler house contains eight boilers, which are installed in two rows of four, with a centre firing aisle. The firing aisle is of sufficient width to allow of the withdrawal of the stokers. The firing floor is on the same level as the turbine room floor. The feed pumps are situated between boiler houses and turbine room, and the feed tanks are placed over the pumps. This arrangement permits of a deep basement for ash handling, and provides accommodation for ash hoppers of large size. The air space also is ample for comfortable working. The coal bunkers, which are directly overhead between the two rows of boilers, are filled by bucket and tray conveyors direct from the coal tippers or from the coal store. A feed tank and feed pumps are provided for each row of four boilers, and an arrangement has been made whereby any row of four boilers can be isolated and run with the feed tank and pumps in conjunction with a turbo-alternator set as a complete unit. This arrangement has proved very useful for test purposes, as, with the calibrated tanks which are installed, the total water evaporated by the four boilers and the steam consumption of the turbine can be ascertained with great accuracy.

The Plant Installed.

The boilers are of Babcock and Wilcox C.T.M. type, and have a rated normal capacity of 50 000 lb. per hour from feed water at 150 deg. F., to steam at 275 lb. per sq. in., superheated to 700 deg. F. There are three furnaces to each boiler, and each furnace is fitted with a chain grate stoker. The coal before being passed through a chute from the bunkers to the stokers is weighed by means of an Avery automatic weighing machine. As there is a weighing machine for the coal to each stoker, any discrepancy in the weighing machine readings is immediately noted, as it is unlikely that the three machines which measure the coal supply to one boiler will go out of order at the same time.

A complete boiler unit is made up of the boiler, superheater, economiser, and forced draught fan. One chimney and one induced draught fan is provided for each pair of boilers. In addition to the usual pressure and draught gauges, each boiler is equipped with Cambridge and Paul thermocouples, which indicate the temperature of the steam, up-take gases and stack gases, and a "WR" CO_2 indicator. Two B.T.-H. steam flow meters are also provided to give the output of the boiler.

The feed temperatures, both inlet and outlet, of the economisers are ascertained by means of electrical resistance type thermometers. Connections from these thermometers are taken to a central plug board in the

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GLASGOW CORPORATION ELECTRICITY DEPARTMENT .... STATION. .... day ....

BOILER HOUSE LOG SHEET.

TIME.	No. 1 Steam Flow ×1000	No. 1 Steam Temp. °F.	No. 1 Gases Inlet °F.	No. 1 Gases Outlet °F.	No. 1 Gases CO_2 %	No. 1 Water Inlet °F.	No. 1 Water Outlet °F.	No. 2 Steam Flow ×1000	No. 2 Steam Temp. °F.	No. 2 Gases Inlet °F.	No. 2 Gases Outlet °F.	No. 2 Gases CO_2 %	No. 2 Water Inlet °F.	No. 2 Water Outlet °F.	No. 3 Steam Flow ×1000	No. 3 Steam Temp. °F.	No. 3 Gases Inlet °F.	No. 3 Gases Outlet °F.	No. 3 Gases CO_2 %	No. 3 Water Inlet °F.	No. 3 Water Outlet °F.	No. 4 Steam Flow ×1000	No. 4 Steam Temp. °F.	No. 4 Gases Inlet °F.	No. 4 Gases Outlet °F.	No. 4 Gases CO_2 %	No. 4 Water Inlet °F.	No. 4 Water Outlet °F.	AIR. °F.	Steam Pressure lbs. □"
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TIME.	No. 5 Steam Flow ×1000	No. 5 Steam Temp. °F.	No. 5 Gases Inlet °F.	No. 5 Gases Outlet °F.	No. 5 Gases CO_2 %	No. 5 Water Inlet °F.	No. 5 Water Outlet °F.	No. 6 Steam Flow ×1000	No. 6 Steam Temp. °F.	No. 6 Gases Inlet °F.	No. 6 Gases Outlet °F.	No. 6 Gases CO_2 %	No. 6 Water Inlet °F.	No. 6 Water Outlet °F.	No. 7 Steam Flow ×1000	No. 7 Steam Temp. °F.	No. 7 Gases Inlet °F.	No. 7 Gases Outlet °F.	No. 7 Gases CO_2 %	No. 7 Water Inlet °F.	No. 7 Water Outlet °F.	No. 8 Steam Flow ×1000	No. 8 Steam Temp. °F.	No. 8 Gases Inlet °F.	No. 8 Gases Outlet °F.	No. 8 Gases CO_2 %	No. 8 Water Inlet °F.	No. 8 Water Outlet °F.
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	12 M.N.	9 A.M.	4 P.M.	12 M.N.
No. 1 Turbine Lbs.				
,, 2 ,, ,,				
,, 3 ,, ,,				
,, 4 ,, ,,				
,, 5 ,, ,,				
Water Softener.				

	Coal Consumed Lbs.	Water: Condensate Lbs.	Water: Make Up Lbs.	Water: Total Lbs.	Water: Lbs. Water, Lb. Coal	Water: Lbs. Water, 10,000 B.T.U. From & at 212° F.	Average Calorific Value B.T.U.	Steam: Av. Press. lbs. □"	Steam: Av. Temp. °F.	Economiser Water: Av. Inlet °F.	Economiser Water: Av. Outlet °F.
12 M.N. ... 9 A.M.											
9 A.M. ... 4 P.M.											
4 P.M. ... 12 M.N.											
12 M.N. ... 12 M.N.											

Boiler Eff. =

Economiser Eff. =

Fig. 2. Reproduction of Boiler House Log Sheet used at Dalmarnock.

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boiler house, from which the readings can be ascertained by plugging in an instrument.

The Staffing Problem.

The staffing of the boiler house of a modern generating station presents a problem entirely different from that which had to be faced when appointing a boiler house staff, say, a decade ago.

At Dalmarnock there are two boiler house superintendents whose duties cover a period from 6 a.m. to 10 p.m. each

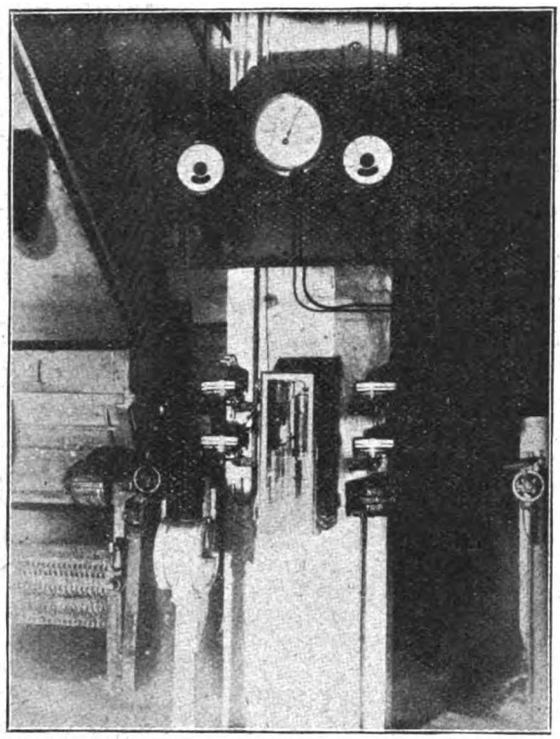

FIG. 3.—VIEW TEST PILLAR ON BOILER FRONT.

day, each superintendent taking charge of one shift of eight hours. These superintendents are responsible for the economical operation of the plant and for its maintenance in first class order. The plant is continually under their inspection, and any trouble encountered which they cannot overcome themselves must be immediately reported to the resident engineer. The boiler house superintendents also periodically carry out tests in co-operation with the test engineer, and conduct experiments to secure, if possible, more successful methods of operating the plant.

Qualifications of a Boiler House Superintendent.

The success of a boiler house superintendent depends in a great measure on his practical experience, and it must not be thought that ability to handle a stokehold crew is all that is demanded of him. It is essential that he should have a good knowledge of the chemistry of combustion and be able not only to understand the technicalities of a boiler test sheet, but also to apply in a practical manner the lessons to be learned from such test figures. Four firemen are employed per shift, with one additional spare man working a bridge shift. The total number of firemen employed is thirteen, and as there are only two firemen on night shift, this leaves two men to act as relief men.

The foregoing gives a brief account of the plant, its general layout, and the staffing arrangements, and should assist the reader in following the explanation of the general methods of operation which follow.

General Methods of Operation.

The load carried at Dalmarnock presents no special features, and is similar in most respects to that of any large municipal undertaking. No energy for traction purposes is supplied. The load factor of a working day is about 50 per cent.

In a station like Dalmarnock, where steam is generated from coal, there is certain information which the station engineer must have if the greatest value is to be got from the fuel burned. The total heat units available in the coal must be known, and, taking this figure as a basis, the losses at the various points before the steam enters the turbine must be ascertained. These losses must be summarised, and a record of the figures kept so that the engineer can see where economies can be effected.

A Separate Manufacturing Concern.

As a matter of fact, the boiler house of a generating station can be looked upon as a separate manufacturing concern, whose business is to produce steam from the raw materials, coal and water. In treating the plant in this way it is essential that the product from day to day should be strictly comparable. To ascertain the pounds of water evaporated per pound of coal consumed is not sufficient, as the quality of the coal supplied may, and does, vary from day to day, and the feed temperature may also be variable. At Dalmarnock the boiler house product is reduced at the end of each day to pounds of water from and at 212 deg. F. per 10 000 B.Th.U.'s, thus making every day strictly comparable. It will be observed that to be able to reduce the evaporation to this standard entails a fair number of instruments, as well as a certain amount of time and labour, but it is contended that if the instruments are efficiently handled and the boiler house staff keen, then the first cost and maintenance of such instruments, which is by no means heavy, is amply repaid.

Coal Sampling.

At Dalmarnock the coal sampling is done in a systematic manner. The spare fireman or trimmer, whichever is told off, goes round the boilers once each hour and takes samples direct from the coal hopper. At the end of the

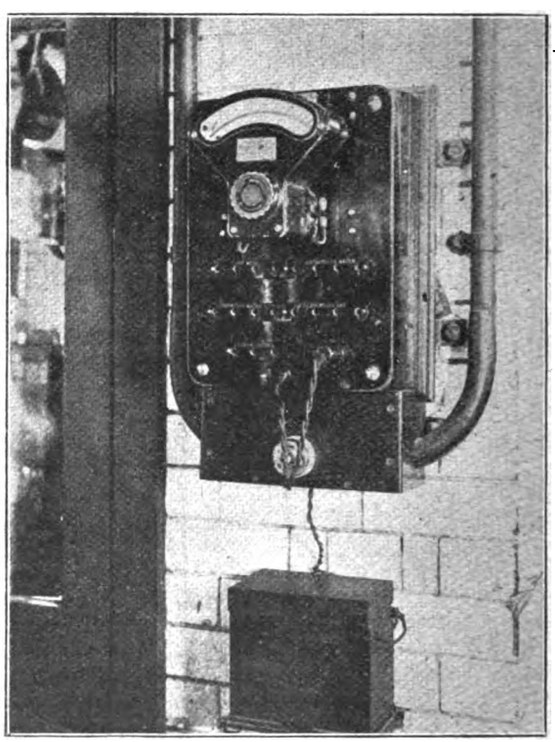

FIG. 4.—INSTRUMENTS FOR LOW TEMPERATURE READINGS AT CENTRAL POINT.

day, the usual quartering is gone through, and a 7 lb. sample is placed in an airtight tin and sent to the test engineer for analysis. The sample is tested for ash, moisture, and calorific value, the latter being ascertained by means of a bomb calorimeter. No allowance is made for hydrogen, and the total value is reduced to calorific value as fired. This gives the average heat value of the coal actually burned under the boilers during that day,

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and forms the base from which all the calculations are carried out.

As already stated, pyrometers are fitted to each boiler giving the gas temperature at inlet and outlet of the economiser, also the temperature of the steam. These instruments, along with the steam flow meters, are read each hour. That is to say, that for each hour of the day, a reading is taken and logged on a sheet (separate from the usual engine-room log sheet), giving the steam flow and temperature, inlet and outlet gas temperature at economiser, percentage CO_2 in gases, and inlet and outlet temperature of feed water at economiser. This is done for each boiler, and if necessary a reading can be taken on the coal weighers and an approximately correct efficiency worked out. Under normal working conditions the coal meters are read only at the end of each shift.

Water Measurement.

To come now to the water, strictly speaking there is no measurement of water between feed pumps and boiler, but as each turbo-set has its condensate passed through a Lea recorder direct to its own feed tank, and as the make-up

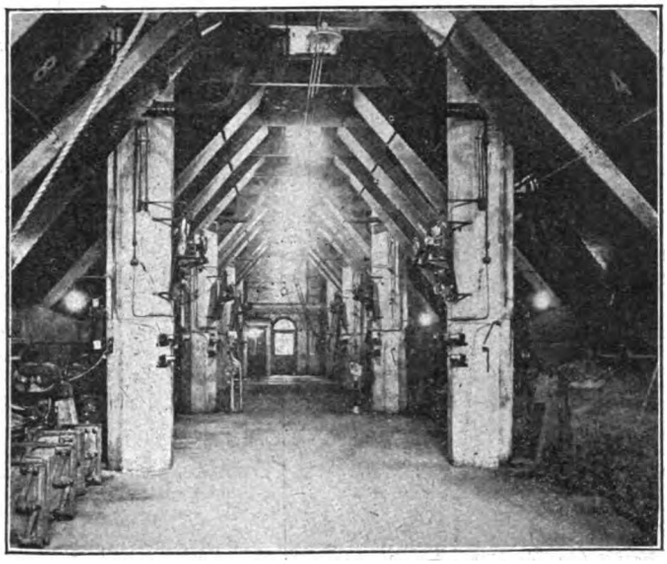

FIG. 5.—GENERAL VIEW IN THE BOILER HOUSE.

water is also metered, the sum of the Lea recorder readings, plus any make-up, gives the water evaporated for the preceding period.

With all the foregoing figures tabulated, the efficiency of each boiler house is worked out daily and a close record kept.

Location of Instruments.

The location of boiler house instruments is a matter which deserves a great deal of attention, and also has a bearing on the results obtained. In quite a number of cases attempts are being made to follow the practice of centralising all the instruments on a control panel, where they are under the eye of the engineer-in-charge only. While this may be an ideal arrangement for the electrical side, the writer thinks it is a great mistake in boiler practice. Of the various items of plant which go to make up a generating station, the boiler plant is the part which requires the most attention, and as long as coal in its solid form is used as fuel this will always be the case. When oil firing or pulverised coal firing become general, then perhaps some kind of governor will be evolved for controlling the steam output. Where the instruments are centralised, it would be almost essential that some system of signals between control panel and each boiler should be established, and the engineer-in-charge would then become a mere control board attendant. This is not the duty of a boiler-house engineer, nor is it the purpose of the instruments to give an indication of the steam generation only. By placing the instruments adjacent to each boiler, the boiler-house engineer is in the position, not only of noting the instrument reading, but also of noting the conditions which produce the readings, and thereby gets into the position of being able to anticipate changes. It has also the effect of encouraging the firemen to further efforts, and, if the men are of the right kind, will eventually mean that each fireman will himself act as an assistant boiler-house engineer. This will bring us nearer in a practical manner to the suggested American system of having college graduates as firemen.

Importance of Type of Firemen.

Another matter which requires careful consideration is the type of fireman employed. It is not wholly a question of paying higher wages. The conditions under which the firemen work must be considered, and in the modern boiler house there is no reason why the conditions in the boiler house should not be equal almost to those of the engine room. The firing floor must be kept clean and free from lumber, and invariably the firemen will respond. Once they have been encouraged to keep the boiler house tidy, it will be quite an easy matter to interest them further in the proper use of the plant and materials at hand.

Boiler Operation.

The boilers at Dalmarnock are rated at 50 000 lb. actual evaporation, but with induced draught alone they are capable of being overloaded to 160 per cent. of the normal rating, and advantage is taken of this margin by keeping the minimum number of boilers at 100 per cent. rating on the range. As far as possible the boilers are operated at or near the 50 000 lb. mark, and as the load conditions change, they are cut in or out to meet the altered demand. (This does not apply to fluctuations in load caused by meal hour stoppages.) The operation of boilers at fractional loads is not encouraged. By this means the boilers are nearly always steaming at the point of maximum efficiency. A careful record is kept of the number of hours each unit has been steaming, and, after about 600 hours' work, the boiler is taken off the range, blown down, and thoroughly cleaned. Where soot blowers are installed this is, of course, not necessary, and it is quite noticeable that those boilers show constantly a much lower uptake temperature.

The feed water make-up is drawn from the river and is passed through a water softening plant before entering the feed tanks. In practice, this water softening plant has been fairly successful, but the installation of evaporators is now contemplated. It is becoming more evident every day that with the high evaporation rates now used, clean feed water is essential. Although tube renewals due to blistering are not frequent, it is felt that with evaporators there will be an added sense of security.

All motor control boards are provided with two separate sources of supply, with a section switch between each, and in the event of one supply failing, half the motors in each boiler house would be shut down, but these can be immediately restarted by closing the control board section switches. One steam driven and one electrically driven feed pumps are usually in service at the same time.

Instruments as Money Savers.

In a modern boiler house, where the coal and ashes are handled by mechanical means and the boilers are fitted with automatic regulators for feed water, it may seem that the duties of the firemen are very light. This may be, but it must be remembered that the various instruments fitted are installed with the idea of saving money, and as the instruments themselves have no bearing on the combustion of the fuel, the firemen's time is taken up with watching the fires and controlling the draught. In other words, with the present-day firemen it is not so much a matter of brawn and muscle as of brain, and invariably it means a man of better type than the old-time coal shoveller. In Dalmarnock a great deal depends on the firemen, the boiler house superintendent being only the teacher or director.

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The Design and Construction of Static Transformers.

Some Views on Latest Practice.

By J. W. RODGER, A.M.I.E.E.

Developments in the design of electrical plant and apparatus cannot fail to be of interest to engineers.

To the designer or specialist, particular developments in his or her own sphere are made all the more interesting by a knowledge and an appreciation of the reasons underlying and, often, enforcing or necessitating them. It is felt that were greater publicity given to these reasons, bald statements or records of developments would be noted with more appreciative interest by many. It will therefore be the object of this article to examine, to some extent, present tendencies and features of note in the design and construction of power transformers, together with those reasons which have influenced them and led to their general acceptance as being representative of the best modern practice.

Effect of Demand on Design.

The numerous and extensive additions to various power distributing schemes, necessitating the use of electrical pressures in excess of those at which it is at present found economical to generate, have greatly extended the use of that indispensable link between generator and e.h.t. network—the static transformer.

Growing demand has given incentive to many improvements in design, and although other influences—restrictive legislation being the most serious—have tended to handicap and delay development in e.h.t. working in this country, notable progress has been made in recent years.

British transformer manufacturers, though faced with the fiercest foreign competition, have secured and successfully completed many most important contracts both at home and abroad. This bears testimony to their capability to grapple with the most difficult problems of transformation and distribution.

It has been demonstrated to those responsible for the electrical equipment of large power stations that it is both possible and practicable to construct, with the maximum of efficiency, transformers in single units equal in capacity and reliability to the main rotating generating sets to which they are connected.

Transformers of 20 000 kVA capacity have been constructed for use in this country on 33 000 V systems. Large power transformers have been built by British firms for operation on supply systems abroad at line pressures of 110 000 V. With a view to investigating thoroughly phenomena connected with the use of higher tensions, special units have been designed and constructed to give pressures of 250 000 V above "earth"; units are now being constructed to give working pressures up to 500 000 V above "earth."

Design and Construction Comparatively Simple.

The design and construction of large transformers to meet satisfactorily the conditions obtaining in this country is a comparatively simple matter. A line voltage of 33 000 V would appear to be the generally accepted limit of pressure for general power transmission, and it cannot truthfully be said that pressures of this nature present any appreciable difficulties to transformer manufacturers worthy of the name. On the Continent and in America, where the distances of transmission are greater, there are many systems where both this pressure and our maximum kVA capacity have been exceeded.

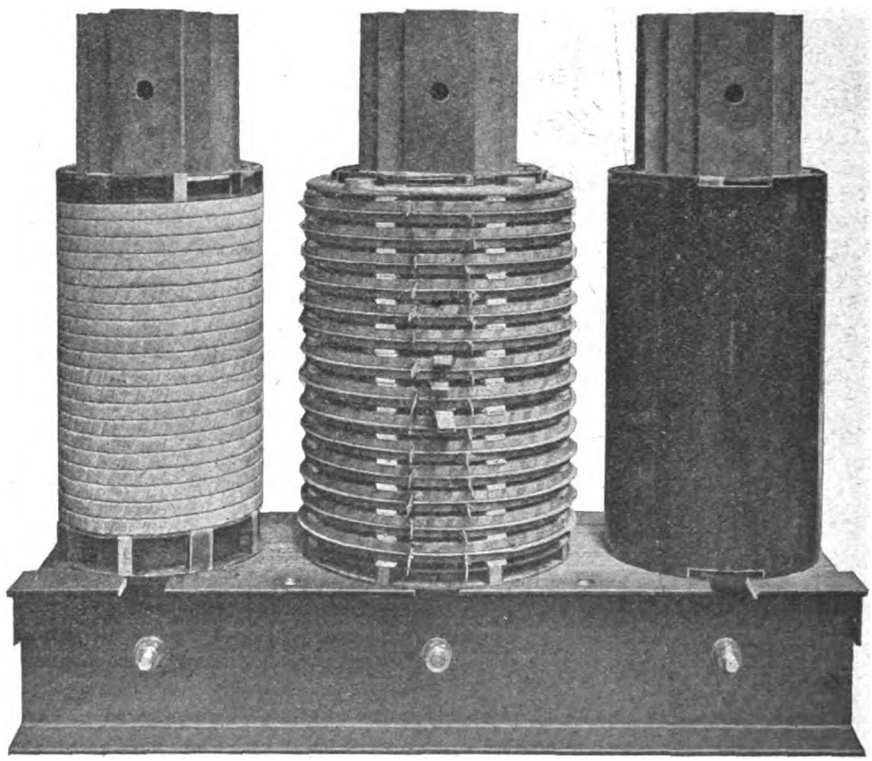

FIG. 1. A CIRCULAR COIL, CORE TRANSFORMER TYPICAL OF MODERN PRACTICE.

Three-phase transformers of 60 000 kVA capacity have been built abroad, and line pressures of 100 000 V are fairly common. In America, the Southern California Edison Company have lines operating at 220 000 V, and there are many other systems having working pressures of 110 000 V and above.

Counteracting Abnormal Stresses.

The increase in size of generating stations and the consequent increase in the magnitude of the power which may be concentrated at any point in the system, together with the use of higher operating pressures, has increased

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the importance of the abnormal stresses to which transformers may be subjected as a result of faults, short circuits, heavy load fluctuations or pressure surges occurring in the circuits to which they are connected.

It is therefore essential in the design of transformers for use under modern conditions of service to provide a construction in which the magnitudes of the stresses—mechanical or electrical—imposed on the windings or core as a result of these external disturbances, are reduced to values consistent with the strength and disposition of the materials used.

The main problems to be dealt with in design are those introduced by the use of higher voltages and larger units. Fortunately, the difficulties presented by the former are, to some extent, offset by the constructional features found most convenient in the latter. In e.h.t. transformers of relatively large capacity it is, comparatively, easier and less expensive to arrange for satisfactory insulation of the windings than in the case of transformers of smaller capacities where coil rigidity and mechanical robustness are only obtained with difficulty owing to the use of conductors with smaller and less suitable sections.

Requirements of Modern Practice.

The requirements of modern practice—reliability, high efficiency and minimum initial cost—are best met by

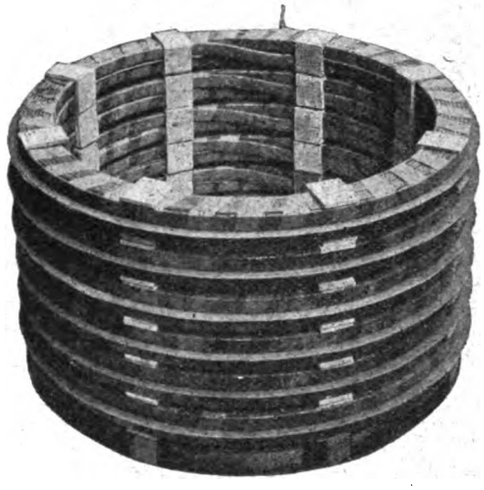

FIG. 2.—DISC COILS FOR CORE TYPE TRANSFORMER.

what is now accepted as being the most suitable type of construction for e.h.t. power transformers, namely:—the oil-immersed, concentric circular coil core type.

Other types of construction have their own limited spheres of usefulness. In the earlier days of the electrical industry, when lower voltages, single or two-phase systems and small units were the vogue, there were manufacturers who committed themselves to the manufacture of "Shell-Type" transformers. A close examination of the numerous recent installations indicates quite clearly that this type will gradually go out of general use just as, with the general recognition of the superiority of oil immersion, the air-cooled and air-blast types have become practically obsolete.

A Typical Modern Transformer.

The design and construction of a transformer representative of the very latest modern practice is illustrated. Fig. 1 shows a three-phase, circular coil, core type transformer partly assembled; Fig. 2 shows a group of high tension disc coils for the transformer.

A short description of the points of interest in construction is given below:—

The core is built of high-grade silicon steel sheets, specially treated, insulated and assembled with a view to obtaining a minimum core loss. Efficient cooling is obtained by the use of ample ducts between the inside of the L.T. winding and the core. Interleaved joints are used throughout the magnetic circuit in preference to those of the "butt" type. The former method of construction assists in the reduction of loss and, at the same time, gives entire freedom from the noises in operation and the excessive vibrations to which the latter type is prone.

Specially designed steel clamps hold the core laminations securely without impeding the free vertical flow of oil through the various ducts. Vertical tie bolts of ample strength passing through short robust clamps of channel section placed across the outer yoke faces at top and bottom effectively brace the whole construction and, at the same time, facilitate the provision of a safe and easy means of lifting the transformer.

It should be noted that the core is proportioned with a view to obtaining a robust and rigid mechanical construction. Correct core construction is the basis of good design; badly proportioned cores result in mechanical stress on the core and coil insulation, which should be avoided.

In the transformer illustrated, the core legs are comparatively short and of large section; as a result, robustness is ensured and effective cooling obtained by the comparatively short lengths of vertical oil ducts.

These desirable features are, at times, overlooked and sacrificed by some manufacturers with the object of obtaining specially low core losses. By the use of cores with long legs of small section, comparatively low core losses may be obtained at the expense of increased copper loss, but the reliability is impaired by the less robust construction and the larger mass of windings to be insulated, supported and cooled.

Winding and Assembly.

The method of winding and assembly is indicated in the illustrations.

The lower tension coils are of the single layer spiral type, placed next to the core legs and inside the groups of high tension disc-type coils. Cylinders of considerable mechanical strength and of high insulating value are used between the windings, and also between the lower tension windings and the cores.

The coils are supported at top and bottom by blocks of insulating material resting on the horizontal faces of the yokes and core clamps. Improved inter-coil spacing is obtained by the use of insulating arrangements specially designed to give positive support to all conductors at frequent intervals without impeding the oil flow.

Uniformity of the mechanical and di-electric strengths of the insulating and spacing materials used is obtained by building up the various pieces from thin layers. These layers are subjected to such heat and pressure as will make them into a homogenous mass. This treatment has the great advantage that the products, having been formed under the influences of heat and pressure much higher than those met with under working conditions, are absolutely unaffected by the temperature encountered in service. Furthermore, the nature of the material is such that prolonged immersion in oil has no effect upon it.

Regulation of Internal Stresses.

In order to make more clear the advantages accruing from the use of a type of construction as illustrated, it will be of assistance to examine generally how internal stresses may be regulated by design.

The stresses introduced by faulty core design have already been referred to. Mechanical stresses resulting from external short circuit and heavy load fluctuations are produced by the leakage fields between and around the primary and secondary windings. These fields are produced by the currents flowing in the secondary windings and their intensity and distribution are governed by the current, the number of turns, the coil and core dimensions, and the spacing and grouping of the secondary in relation to the primary. Certain stresses are set up therefore independent of the coil arrangement. The direction of these stresses, however, is subject to the arrangement adopted.

For example, with "sandwich" grouping of primary and

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secondary windings, the direction of force is axial. As a result the tendency is towards forcing apart the coil groups, and heavy bracing at the ends is essential to prevent distortion of the outer coils.

With concentric grouping, the direction of the force is radial. This results in compression on the inner winding and tension on the outer. If the coils are rectangular, the force acting between windings tends to force the outer coils to take up a circular shape. On the other hand, if the coils are circular, there is no tendency towards distortion as the forces are uniformly applied and taken up.

Further, if the windings are so arranged that their electrical centres are coincident, there is no force tending to move the coils in a direction parallel to their axis, and the necessity for the provision of heavy bracing to take up end thrusts is therefore obviated.

Tapping Arrangements.

It may be noted here that if tappings are required, it is of importance to bring these out in such a manner that the symmetrical arrangement of the windings is not interfered with. They should therefore be brought out at the middle of the limbs, as it is impossible to arrange that the electrical centres of the windings will coincide under all conditions if the tappings are brought out at the end of the winding.

The most important electrical stresses in transformer windings arise from conditions which produce di-electric flux concentrations, and rupturing of insulation occurs when the voltage gradients resulting from these flux concentrations become excessive. Pressure surges following line disturbances tend to produce undesirable di-electric flux concentrations; the magnitude of these, however, can be controlled and their effects kept within safe limits by correct procedure in design.

To achieve this result, the winding arrangement must be such that a uniform and continuous path is presented to the flow of any disturbance If this provision is neglected dangerous concentrations will result at points where changes in the constants of the circuit take place.

Continuity and uniformity are assured by the use of the single group, concentric coil arrangements, but are unobtainable with the "sandwich" arrangement owing to the interspacing of high and low voltage groups.

It will be gathered from the foregoing that the general adoption of the concentric circular coil method of construction has taken place as a result of the advantages made apparent on close theoretical investigations.

The majority of transformer designers, recognising the overwhelming advantages of this method, have adopted it exclusively, varying its practical applications in accordance with the dictates of their experience.

Fuel Economy in Small Power Stations.

By L. L. ROBINSON.

With modern boiler plant and modern turbines worked at fairly high steam pressures and with a reasonable provision of condensing water the small power station can approach much more closely to the thermal efficiency of a capital station than was considered possible only a few years ago. I do not propose to use this fact as an argument in favour of prolonging the life of small stations because there are many and weighty considerations apart from the cost of fuel which commend the use of capital stations situated where possible outside densely populated areas. Very many small stations, however, are not giving the economic results which they should do—say, 10 per cent. to 15 per cent. of the B.Th.U.'s in the coal as received in units output. Probably the reason for this has little to do with the plant but rather with the way in which the plant is handled, because, in the past, power station assistants have been selected upon their qualifications as electrical men rather than as fuel economists, mechanical engineering experience and a sound knowledge of inorganic, and a reasonable knowledge of organic, chemistry. The combustion of coal is a chemical engineering business: it is the most important business in the power house to which all electrical matters are merely of secondary importance.

In a small power station the engineer-in-charge should be the most important man, but he is not so if he regards his position as one merely of responsibility for keeping the supply going.

Qualifications for Engineers-in-Charge.

Engineers-in-charge have generally reached that position by the ladder which leads up from the regulating table through the switchroom, and they lack the knowledge which is necessary for scientific economic working. This has not been anybody's fault. It is because there has not been a corresponding ladder leading up through the boiler house. The average and larger power houses to-day are staffed with at least one chemist or fuel economist, and the justification for such an appointment has been forcibly demonstrated by the improvement of thermal efficiency in such stations. Where this has been done, and where four engineers-in-charge are kept for 48-hour working, it is a good plan for the relief engineer-in-charge to spend all the time he is not engaged on shift assisting the chemist. In this way all the engineers-in-charge can be taught the scientific side of fuel economy work.

Some of the best technical colleges are waking up to the fact that there is room for fuel economists and are turning out some splendid men. It is to this class that we must look for future engineers-in-charge, and the electrical ladder to that position will be scrapped. In future, when a man reaches the switchboard attendant's job he will stay at that point, and it will not serve as a means of access to the higher position unless the man shows very extraordinary ability and has had a thorough training in fuel technology.

Greater Faith in Scientific Working.

The management also must have greater faith in scientific working than has been displayed in the past. It should be the object of the manager so to arrange the duties of his staff that the works are run practically as one long continuous "official test." Only so can weak spots be discovered before they have cost a lot of money. It is not much good knowing the pounds of coal per unit output at the end of long periods. It is necessary to know it fairly accurately for at least each eight hours' shift and especially for each day's run.

Essential Scientific Checks.

Proper scientific checks necessitate the provision of certain instruments, which will cost a good deal of money, but it is money well spent. The essentials are coal weighers, water meters, CO_2 recorders, draught gauges, pyrometers and thermometers and a good laboratory outfit, such as chemical balance, bomb oxygen calorimeter, drying oven, crusher, etc. None of these are any good without the brains behind them to keep them in good order, to analyse the figures properly obtained, and to put them in proper form for weekly scrutiny and criticism by the management.

In a small station, with four engineers-in-charge of the right sort, all this work can be done by the relief man and the engineer-in-charge on the night shift. It gives an added interest to monotonous shift work and entirely dispels that horrible feeling that comes on between 3 a.m. and 5 a.m. each morning of the old-fashioned shift work.

I believe that low salaries, which have not attracted the right class of men, have been the chief cause of a relatively low efficiency in power stations. If higher salaries had been offered better trained men would have been attracted to the industry and the improved efficiency would have far outbalanced the cost. Salaries are on a reasonable basis to-day. It is to be hoped that they will not be cut by false economists to the detriment of the industry.

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Efficient Steam Generation.

The Necessity of Continuous Boiler Plant Testing.

By DAVID BROWNLIE, B.Sc. (Hons.) Lond., F.C.S., A.M.I.Min.E., A.I.Mech.E., Mem.Am.Soc.M.E.

There has recently been some considerable correspondence in the columns of THE ELECTRICIAN with regard to the possibility of obtaining 85 per cent. efficiency on a certain boiler plant; but it will be as well to remember that the average power station boiler plant in Great Britain, or anywhere else, is probably not working all the year round anything like 70 per cent. net working efficiency, and that 75 per cent. is entirely exceptional.

It cannot be too often emphasised that it is the continuous "week-in and week-out all the year round" figures—according to which the annual coal bill is actually incurred—that really matter, and I am afraid that most power station engineers have one full-dress eight-hour trial when the plant is first installed at which 80 per cent. or over is obtained by the prodigious efforts of a special trained staff from outside, and then ignore the performance of the plant for ever after.

There are still many power station and other steam plant engineers who have a vague sort of idea that they are running at, say, 75 per cent. boiler plant efficiency or even more than this, and have carried on for years under this comfortable delusion. Hence the extreme irritation evinced when someone at rare intervals reads a paper giving the exact working details obtained in practice from any given process, whether it be steam boilers in general mechanical stoking, "Mond" gas, or mechanical gas producers.

Present-day Power Station Efficiency

I should say that the average power station boiler plant to-day is working all the year round at 67½ per cent. net working efficiency, and 77½ per cent. is an attainable figure with reasonable average conditions, especially as regards quality of coal and peaked loads, and excluding, of course, special methods such as pulverised fuel. That is to say, there is a possibility of the saving of no less than about 13 per cent. of the coal bill of the electrical power industry by the adoption of proper methods of running the boiler plant.

These methods may be stated concisely as continuous testing on right lines all the year round as part of the regular routine of running the power station. Also, in my opinion, it is not sufficient merely to keep such a record of the whole boiler plant, although certainly not 10 per cent. of power stations make any attempt to accomplish even this, but it is essential in addition to *keep an entirely separate record of each individual boiler and its accessories*, that is the amount and analysis of the coal used, the amount of water evaporated, the detailed analysis of the flue gases, and a complete series of temperature and draught readings at the vital points of the plant. Until this is done it is impossible to ensure that each boiler is working at the best efficiency, and some money is bound to be wasted, even on a station run on otherwise extremely efficient lines.

Giving the Horrors.

This may sound rather like the revolutionary ideas of a demented fanatic, and is certainly enough to give the horrors to the average power station engineer or his Electricity Committee, who deliberate long and seriously as to whether they shall buy, for example, one solitary combustion recorder, value £50, for a station with ten boilers, and a coal bill of £200 000 per annum.

Let us examine the matter arithmetically for a few moments. The average-sized modern power station water-tube boiler in Great Britain can be taken as 50 000 lb. evaporation (and I say nothing of boilers four or five times this size), equivalent to the burning of, say, 2½ tons of coal per hour, or 300 tons per week of 120 hours full load, equivalent to, say, 15 000 tons of coal per annum, valued at £20 000, for example. If this boiler is working at 67½ per cent. efficiency, the amount of money to be saved by the adoption of continuous testing and general scientific methods, and consequent running at 77½ per cent. efficiency, is £2 600 per annum, that is, £50 per week.

Capital Expenditure on Instruments.

The capital expenditure required in the way of an automatic coal weighing machine, feed water meter and accessories, modern type of automatic flue gas analysing machine, draught gauges, and a complete range of distance electric pyrometers, say ten pointers, wired to a small central switch board, will certainly not exceed, say £600.

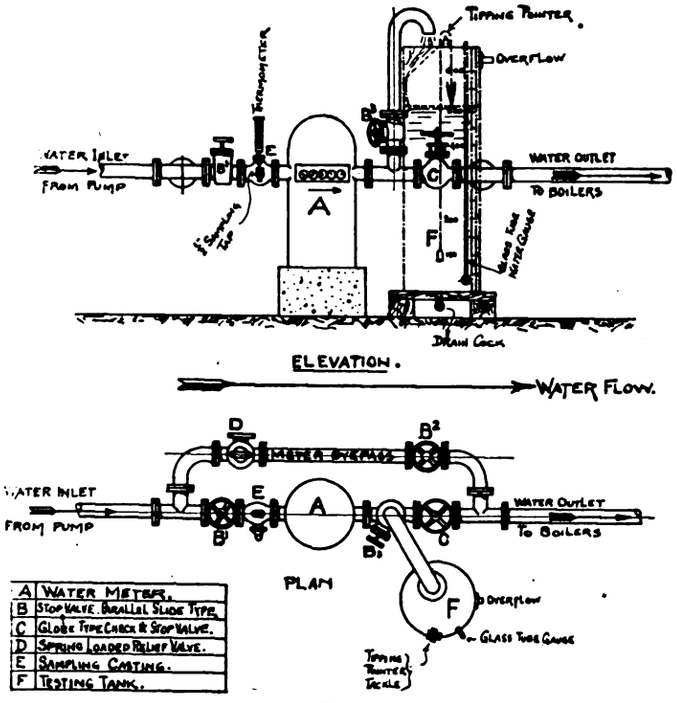

FIG. 1.

I think we can take a reasonable average British power station as four boilers, or at any rate, an evaporation of 200 000 lb. of water per hour to steam, that is an annual coal bill of 60 000 tons a year, valued at £80 000, which at 67½ per cent. efficiency means a possible saving of over £10 000 per annum. The total capital cost, therefore, of fitting up each boiler independently with a complete equipment of testing instruments would not exceed, say £2 400. We should then have to have a laboratory to analyse the coal, etc., regularly, costing, say £300, or in round figures, a total of £3 000, allowing everything on the ultra-generous principle. Interest and depreciation on this could be taken as 12 per cent., say £360 per annum.

Then there would be necessary a trained chemical engineer whose duty it would be to do nothing else but control the working of the boiler plant according to the battery of instruments, carrying out also the analysis of the coal, and keeping an entirely separate log for each individual boiler. Such a man would cost, say, £750 per annum, so that the total annual expenditure would be about £1 200, including laboratory upkeep, and the saving £10 000. If there is any flaw in this reasoning I shall be glad to hear of it.

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Astonishing Reluctance.

One thing I can never understand is the amazing reluctance, coupled, if necessary, with determined and relentless opposition, both by the average power station engineer and the members of the Electricity Committee, who, of course, generally know nothing about the matter anyway, to paying a man to do nothing else but attend solely to the efficiency of the boiler plant in a scientific manner. The idea of paying someone, say, £10 or £15 per week to do "nothing but look after boilers" always strikes the ordinary person as a wicked and wanton waste, and a gross extravagance. I must say the exact psychological reason of this fairly beats me, especially in view of the fact that in most large power stations it would even be a paying proposition to have a whole row of University professors at £1 000 per annum each, one to every boiler.

Need for Continuous Testing.

Continuous boiler plant testing must of course be carried out on right lines in order to get the best results. The automatic weighing of the coal to each boiler is now becoming commonplace in modern stations, certainly a cheerful sign as far as it goes. I think, however, a big improvement would be some automatic arrangement whereby a few pounds of coal would be shot out into a small store bin, say, every 15 minutes, so as to obtain at the end of the day a thoroughly average sample of the coal being supplied. This should be combined with a small mechanical mixing and crushing apparatus, so that the daily samples from each boiler—to the extent of several hundredweight—could be mixed and crushed without trouble, and a small sample of several pounds taken for the laboratory. The oxygen bomb calorimeter only should be used for the heating value of the coal, and a muffle furnace for the ash determination. It is the continuous measurement of the feed-water, especially independently for each boiler, which seems to cause the most opposition. There is in practice no difficulty about the matter at all. In general, the pressure type of meter, of which there are many varieties on the market, is best for this purpose, the open flow type being more suitable for the turbine condensate, and perhaps, as a check, measuring the feed-water supplied to the whole boiler plant.

Testing Arrangements.

The arrangement I have found by experience most suitable for the pressure type of meter in this connection is illustrated in Fig. 1, reproduced from my book, "Boiler Plant Testing," the meter being between the feed pump and the economiser. In this a bye-pass is included, not only to shut the meter out of the circuit in case of accident, but also so that the meter can be tested for accuracy at any time in a few minutes by means of a calibrated test tank forming part of the equipment. *E* is an arrangement to take a sample and the temperature of the feed-water, and the valve *C* acts also as a check valve as well as a stop valve, to prevent the boiler pressure coming back on the meter at the end of the stroke of a reciprocating pump, which is apt to make the reading inaccurate. The working of the bye-pass and the safety valve *D* will be obvious, and when it is required to test the meter, the valve *C* is shut and B_3 opened, so that the water is diverted into the test tank, which may be any desired capacity, say 5 000 lb. The meter reading is taken before and after, when the tank is filled to a mark, and the accuracy thus determined in ten minutes or so, if necessary as the plant is working.

The latest type of gas analysing machine should be installed on each boiler, so as to give not only a continuous record at the rate of 20 analyses per hour of CO_2, but also of carbon monoxide and unburnt gas, or of oxygen as well. The modern electrical distance pyrometers are already familiar, but I should on the whole recommend recording instruments for each pointer, if necessary, in preference to the ordinary plug and indicating outfit.

I can only say again finally that the best results will not be obtained unless each boiler is rigidly regarded as an entirely separate and independent unit, and any departure from this principle will reduce the efficiency.

The Dynamicables.

A Record of the Work of an Interesting Society.

In THE ELECTRICIAN for June 30th, 1883, appeared a notice (as will be seen by reference to our "Forty Years Ago" column in this issue) of the formation of a society of electricians whose object was dining and social intercourse. This society still exists, and has long been known by electrical men as "The Dynamicables," for, as our original notice stated, it has from time to time gathered into its folds many of those convivial spirits, in which the electrical industry is rich, who like to meet and wyne. But in the early days its work was not wholly social, and its influence on electrical progress has therefore been profound. For this reason, and because it has contained within its ranks the majority of those who have risen to eminence in the profession, some account of its genesis and history may be interesting forty years after.

The Throes of Formation.

The idea of a society of this kind was first mooted on March 28th, 1883, when, at the invitation of Mr. W. D. Gooch, engineer to the Winter Exhibition at the Royal Aquarium, a meeting of gentlemen interested in electric lighting took place, and a dinner was arranged to discuss the advisability of holding a similar feast at intervals at which gentlemen connected with electrical engineering might meet to talk over matters of mutual interest. It was resolved that the establishment of such a dining association would much advance the mutual interests of electrical engineers by allowing free discussion of all topics connected with their professional necessities, as well as communication on a social basis with a view of co-operation.

In this atmosphere of harmony the chairman was thereupon instructed to arrange for a second dinner, and to communicate with as many gentlemen as possible connected with the electrical profession with a view to carrying out the idea on a broad basis. This second meeting was held on May 4th, 1883, by which time the society had been dubbed "The Arc-Angels." Draft rules were discussed; and it was decided that the association should be instituted for the purpose of giving those connected with electrical engineering an opportunity of meeting in a social manner to discuss matters of mutual interest.

The first committee consisted of Mr. Musgrave Heaphy, Mr. Johnson, Mr. Shearer, Mr. Southwell, and the honorary secretary, Mr. W. D. Gooch. Among the original members of the society, in addition to those just mentioned, were Colonel R. E. Crompton, Sir S. Kenneth Mackenzie, and Mr. James Mathieson.

Ohm-Sweet-Ohm.

At a third meeting of the society on May 18th, it was resolved that the association be called the "Dynamicables," and an interesting rough minute which has come into our possession shows that none of the members present voted for the original name, that three would have liked to call the society "Ohm-sweet-ohm," and two "Ororo." These, however, were outvoted by the seventeen who plumped for "Dynamicables," though some of these were uncertain as to the way in which the title should be spelt.

The committee at this stage consisted of Colonel E. R. Festing, representing the Services; Mr. E. Spagnoletti, representing the railways; Colonel R. E. Crompton, the manufacturers; Mr. J. Slater, the architects; Mr. H. Edmunds, finance; Mr. C. H. Cooke, the literary side; Mr. Musgrave Heaphy, fire insurance; Mr. W. H. Massey, engineering, with Mr. W. D. Gooch, honorary secretary. Mr. Moulton, afterwards Lord Moulton, was also added. The personnel of this committee ebbed and flowed from time to time, and it is a little difficult to keep track of it without becoming tedious.

Historical Signatures.

An interesting feature of the original minute book is the signatures of those attending the meetings. From these we gather that among the early attendants, besides those we have

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mentioned above, were Prof. Gisbert Kapp, Mr. S. Z. de Ferranti, Mr. Walter T. Glover, Prof. J. A. Fleming, Prof. George Forbes, Mr. C. H. W. Biggs, Mr. Harry Furniss, caricaturist, Mr. D. E. Hughes, who like Mr. Furniss attended as a visitor, Sir William Crookes, Mr. Alex. Siemens, Prof. W. Grylls Adams, Mr. H. J. Dowsing, Mr. Edward Hopkinson, Sir W. H. Preece, General C. E. Webber, Mr. Latimer Clark, Prof. Fleeming Jenkin, while Lord Kelvin, then Sir William Thomson, officiated as chairman on May 9th, 1884, and was the first president of the society.

The only surviving original members of the Electric Arc Angels who are still Dynamicables are Colonel R. E. Crompton and Prof. George Forbes. The first of these is a regular attendant at the dinners. Others who are not now members but are still living are Conrad W. Cooke, H. J. Dowsing, Henry Edmunds, Killingworth Hedges, W. H. Massey and F. L. Rawson.

The Dynamicables as a Professional Body.

Those who know the Dynamicables purely as a dining club, where social intercourse of the best kind can be enjoyed, will be interested to learn that in the early days papers were read and discussed at the meetings, and that various important matters connected with electrical engineering were dealt with in this way.

The Dynamicables and the Electric Lighting Act.

Amongst the matters which thus came up for discussion was the Report of the Electric Lighting Act Committee of 1882. Other subjects were "The relative advantages of Provisional Orders as against licences for electric lighting from point of view of the undertakers, the local authorities and the public," "The formation of a committee to watch the action of the Metropolitan Vestries in connection with any alteration of the present laws pertaining to the use of overhead conductors," "The most desirable basis on which to arrange with the consumers of electric light as to installation, expenses, etc.," "The relations which ought to subsist between size of conductors and strength of current," and "The taking of measures to ascertain the nature and scope of all Bills introduced into Parliament with reference to overhead wires, and of motions in respect of same brought forward at vestry meetings in contemplation of action thereon." On the more technical side we note that such questions as "Have secondary batteries passed through the experimental stage so as to warrant their use for electric lighting purposes?" "The best method of testing incandescence lamps for life, candle-power and energy," and "The causes of the collapse of the Electric Lighting movement" were dealt with.

The latter question indeed gave the society a great deal of anxiety, and at a Council meeting on October 31st, 1884, it was suggested that a committee be formed to consider the Electric Lighting Act for the purpose of making definite proposals to the proper authorities with a view of obtaining amendments in it, and on the same date it was proposed that the subject for debate should be "Whether the Electric Lighting Act of 1882 should be amended or ended." This burning subject was subsequently debated at a joint meeting of the Dynamicables and the Society of Telegraph Engineers, an early example of this useful form of gathering. As a result a deputation of the Dynamicables waited on Mr. Joseph Chamberlain regarding the Act, the President of the society, Sir William Thomson, acting as spokesman. According to a later minute it appears that this deputation was duly received, and a committee was appointed to consider what future action should be taken as a result, so that apparently its reception was not very favourable.

Propaganda.

However, the agitation against this obnoxious measure still continued, and one of the steps taken appears to have been the raising of subscriptions and the signing of petitions by householders who desired a supply of electricity and could not obtain it "under the present restrictions of the Electric Lighting Act." The way in which this subject was hammered away at by the society sufficiently indicates that the credit for getting rid of this hampering legislation belongs largely to it.

Domestic Matters.

In 1886 the question of a permanent home was mooted, and the recommendation was carried that a tentative experiment of premises at 2, Victoria Mansions be made. Hereafter the business meetings of the society appear to have been held at what is called in the minutes as "The Clubroom."

Another matter of domestic interest was that on April 2nd, 1886, it was suggested that the name of "The Dynamicables" should be changed. Apparently, however, this did not come to anything. The alternatives of the Electro-Dynamic Society and the Wilde Club were suggested, and on May 7th, 1886, the President was authorised to describe the society as "The Dynamic Society" when he felt inclined.

By January 27th, 1888, the society appears to have moved to premises at The Sanctuary, Westminster, where one of the conditions in the lease was that their name did not appear upon the door.

The Lighter Side.

On the lighter side, the minutes of April 25th, 1884, contain a long account of a discussion which took place as to a place of meeting. Apparently the waiting at Eberle's Hotel (the usual place) was very bad, and the society could not be accommodated at the Health Exhibition. The Holborn Restaurant was full up, and the Criterion could not be used because the room was not illuminated by electric light. *O! si sic omnes.* Finally, Eberle's Hotel had to be given a second chance, the secretary being instructed to write to the manager protesting against the bad waiting, but history does not record with what result.

On December 5th, 1884, Mr. Latimer Clark was appointed to the chair before it was discovered that he was not a member of the Council. The procedure must have been like that at an informal meeting, while on February 6th, 1885, letters of regret were sent to the editors of THE ELECTRICIAN and the "Engineer" that they had not been invited to be present at the interview with Mr. Chamberlain which is referred to above.

Dissolution and Resuscitation.

In 1889 the society having abandoned the great work of getting the Electric Lighting Act of 1882 amended, appear to have shot their bolt and to have quietly dissolved. This was no doubt partly owing to the fact that the Society of Telegraph Engineers, by then the Institution of Electrical Engineers, had become the representative body of the profession on technical and legislative subjects. The Dynamicables, however, were not to disappear altogether, and at a meeting and dinner held on April 20th, 1904, at Whitehall Court, with General Webber in the chair, the minutes of the anniversary meeting of April 5th, 1889, were read and confirmed, and the society was re-established as a dining club for purely social purposes, with Mr. Sidney Sharp as honorary secretary. The resuscitation of the Association was largely due to Mr. C. H. W. Biggs who was appointed honorary treasurer.

The Present Society.

The present constitution of the society, which is now in the full flight of its energy and usefulness, is that the membership is limited to 101. Four or more dinners are held annually each year, it being a rule that any member who fails to attend a dinner for a period of twelve months ceases to be a member.

We cannot conclude without paying a tribute to the initiative and humour of the later Mr. S. Sharp, the honorary secretary, who was largely responsible for the success of the present Dynamicables. His writing and reading of the minutes were a great feature of the gatherings.

Mr. R. H. Tree, chief clerk of the Institution of Electrical Engineers, who has been associated with the Dynamicables since 887, was appointed Secretary in 1904, and has in his possession the original minute books and registers of the association. The above article has been compiled from these records, and our thanks are due to Mr. Tree and to the Committee of the Dynamicables for permission to publish this interesting information, which is not without its bearing on electrical history.

Halifax Corporation and the National Joint Board.

A deputation consisting of Ald. Walker, chairman of the National Joint Board, and Mr. Robertson, of District Joint Board No. 2 Area, representing the employers' side, and Messrs. J. H. Parker and W. A. Jones, representing the employees' side, was recently appointed by the National Joint Board to meet the representatives of the Halifax Corporation to request that they should reconsider their dismissal of the former technical staff of the electricity department, and, if possible, reinstate the dismissed officials and also in the future pay the salaries and observe the conditions of service recognised by the National Joint Board.

The deputation was received by representatives of the Halifax Corporation who, however, refused to discuss the question of the dismissal of the staff, and further, would not make any definite promise regarding the payment of salaries. They stated they would consider the new scale of salaries and conditions of service when these were available.

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INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

Scarborough Entertains a Record Gathering—Publicity—Overhead Transmission—Cooking—Distribution—"Shopking"—Dancing.

Monday, June 18th.

The twenty-eighth annual convention of the INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION opened at Scarborough to-day, under the presidency of Lieut.-Col. W. A. Vignoles, D.S.O., borough electrical engineer of Grimsby. During the day and early evening most of those who had expressed their intention of attending, to the number of nearly 500, arrived, and the proceedings began by a reception at the Town Hall by the Mayor and Mayoress of Scarborough. It would take too much space to record the names of even the principal of those present, and it will therefore be better to record the more notable absentees. These included Mr. C. H. Wordingham, who is unfortunately seriously ill, Sir John Snell and the other Electricity Commissioners, and Mr. Frank Gill, who was expected in his capacity as President of the Institution of Electrical Engineers. An interesting feature of the proceedings, upon which we have already commented, is that the Association of Bill Posters is also holding their annual convention at Scarborough this week.

Tuesday, June 19th.

This morning the first formal meeting of the Association was held, the gathering taking place at the Central Hall, Queen Street, instead of in the Town Hall, owing to the large number attending.

In offering an official welcome to the Convention, the MAYOR OF SCARBOROUGH (Councillor G. Whitfield) said the I.M.E.A. were pioneers in the sense that from the commercial point of view we had only touched the fringe of electrical development. To be without electricity would mean chaos in industrial life, and he therefore realised very fully how distinguished and important body he was addressing. In Scarborough they had not reached the stage of running their own electrical plant, and, as the price charged was 1s. per kWh, electricity was not so popular in the town as it might be.

The PRESIDENT, in returning thanks for the welcome, explained that the Mayor had been most helpful in making the arrangements for the Convention.

The PRESIDENT then delivered his Presidential Address, which we give in abstract below. In the course of its delivery, he elicited the fact that 50 per cent. of those present were using electric cookers, a result that was greeted with applause.

Col. W. A. Vignoles' Presidential Address.

"The day must come when electricity will be for everyone, as the waters of the rivers and the wind of heaven. It should not merely be supplied, but lavished, that men may use it at their will, as the air they breathe."—EMILE ZOLA.

In "a text" a translation of which is placed at the head of the address, Zola has put into literary form the much quoted catchwords of "a cheap and abundant supply" of electricity, Humanity is however, not at this instant ready for such a supply, as while the user of power learned during the war to appreciate what a public supply of electricity could do for him, the domestic consumer and the shopowner do not, at present, in the mass appreciate the extent of the help which electricity is waiting to give them. Therefore, however cheap, and however abundant the supply of electricity, it would not, at present, be used in the lavish manner described by Zola.

Zola apparently considered that electricity should be supplied free, but as the representatives of commercial undertakings members cannot contemplate this. But the large majority of those present are anxious that their undertakings should supply electricity at the lowest possible price, consistent with sound finance, and a small profit to provide a reserve, but without contributions to the rates.

Growth of Interest in Cooking.

As the outcome of a suggestion in a paper read at last year's Convention, a special Committee, now called the Electric Apparatus Committee, was formed which was originally intended to deal with the joint purchase of cookers by undertakings. It was however soon discovered that the demand for bulk purchase did not arise, because so few undertakings were ordering any cookers at all, and the activities of the Committee have therefore been concentrated on obtaining information on electric cooking and cookers, and circulating this information to undertakings. The result has been eminently satisfactory, and there has been a continuous growth of interest in the subject among the engineers of supply undertakings. A further satisfactory feature is that most of the Company Associations accepted the invitation to appoint representatives to this special Committee, and in consequence the influence of the Committee has been considerably increased.

The cause of the interest shown is not far to seek; it arises from the drop in output, and in revenue, experienced by many undertakings, owing to the falling off in the power and lighting loads with bad trade and the necessity for economy; naturally engineers in these circumstances are anxious to find alternative sources of output and revenue.

First Fruits of Publicity.

As a result of the work done by this Committee a number of undertakings are dealing seriously with this question of electric cooking. Hire schemes have been arranged, and where arranged numbers of cookers have been let on hire.

Here are the first fruits of a publicity campaign among our own members, and in order to carry that campaign a stage further, the Electrical Apparatus Committee have arranged an exhibition during this Convention of cookers and water heaters. This exhibition will conclude the Association's internal Publicity Campaign, and it is hoped that the representative of every undertaking will see that the apparatus now on the market is a great advance on the cookers offered in 1914, and is suitable to recommend to the public. It may be added that much time, money, and brains have been expended on reaching the present state.

The Need for Internal Education.

It is suggested that, after the Convention, each undertaking if they have not already done so, should make a start by educating their own staffs, members of Committee, and local contractors, and inviting them all to use electrical cooking. Attention can then be given to the general public, but the engineer, staff, Committee and contractors will all talk more convincingly from actual experience.

The time is opportune for such campaign among the public; the consumer, though he may not yet know it, wants electricity because it will save labour for his womenkind, and because he wants the cleanliness that cannot be obtained with any other methods. Further, those building houses, and bungalows at present often wish to save in first cost by cutting out chimneys, and flues, and only providing for electric cooking; by catering for this need we can assist in the solution of the housing problem.

The Mission of Electricity.

But electricity will not only help the cause of housing by saving in first cost, electricity has a great mission to carry out, a mission to improve the health of the people, and to reduce the drudgery of housework. Electricity can be a great benefactor to the human race, giving the householder a pure atmosphere to live in, an easy means of cooking under perfect conditions, reducing waste of food, and making the lives of those who do their own housework more endurable.

The fact is that electrical engineers have mainly been content too long to be mere "suppliers" of electricity, and imagining that they have done all that was necessary to ensure the success of a commercial business.

Creating the Demand for Big Business.

It is not in such a spirit that the great businesses of the commercial world have been built up; it has been by creating the demand. To create the demand for electricity the public must be told what to do with it. So we must educate the public in the uses of electricity, until it appreciates and feels the need of the services which electricity can render. Electrical men must become "lavishers" of electricity, or rather, as that is an ugly word, and we cannot give anything away, "sellers" of electricity instead of "suppliers," and we must

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devote to the selling all the resources of modern scientific salesmanship.

Only the Fringe Touched.

The efforts made up to the present, even by those undertakings who are selling electricity scientifically, have only touched the fringe of the possible domestic business; the field to be sown, and reaped, is enormous, far exceeding the power load in most towns. If only 25 per cent. of the possible business, which may easily be 2 000 to 3 000 kWh per house, is secured, the effect on working costs must be considerable, making a price of ¾d. to a ½d. possible, with a corresponding increase in prospective business. But to secure this business to every undertaking, it is not sufficient for the individual concerns to lower their prices and hope for results, erecting a sign "We supply Electricity for Heating, Cooking, or Cremating"; the public must be taught, must be told, must be reminded, must be shown, and told again how to use electricity. The dead weight of public opinion is enormous, and it takes a great effort to put the mass of it into motion.

Massing Public Opinion.

At present the massed opinion of the public is that electricity cannot be equalled for lighting purposes, and that no modern house is complete without electric light, in fact even gas companies are beginning to admit this. Public opinion will soon be, if indeed it is not now, that electricity for occasional heating is good, nay, very good; a massed opinion on electric cooking however does not exist, because the numbers using electric cooking is comparatively small. It must be admitted though, that the opinion frequently expressed by people who have no direct knowledge of the matter, that electric cooking is expensive, and that despite the many admitted disadvantages, gas is the only practical substitute for coal.

A Pregnant Question.

Now anyone who has used electricity for cooking, where the rate per unit is reasonable, knows that these last opinions are wrong, and it is our business to instruct the public rightly on this matter. But are we all in a position to do so. Is everyone in this room using electric cooking? Many years ago a meeting of electrical engineers was asked the question, how many of those present were using electric cookers in their own houses; the percentage was small. To-day it would be far higher, but surely it should be 100 per cent. The public are ready for electric cooking, the conditions are suitable, now is the time; but the mass of public opinion to be moved is great; how can it be done?

The Need for Local Effort.

Local efforts, good solid educative work is necessary in each district if the mass of public opinion is to be moved, but these local efforts should be co-ordinated in some way throughout the country. The Electrical Apparatus Committee referred to above, while not primarily established for publicity work, is doing good service under the chairmanship of Mr. R. B. Mitchell of Glasgow, and is keeping all undertakings in touch with the developments that have been and are being made in electrical cooking apparatus. This work is in itself, as previously explained, internal publicity of the greatest value.

Helping the Manufacturer.

The organisation which includes area sub-Committees covering the whole country, will help manufacturers to perfect the designs of cookers that are on the market, and to eliminate the few faults that may still exist in the best designs. But local publicity efforts can be directly co-ordinated by an area publicity campaign; such campaigns have been organised by the B.E.D.A. during the last twelve months with good results, pending the launching of a national campaign for the whole of Great Britain.

It was considered that the time was not opportune, nor were the available resources sufficient, for a national campaign this year, and it was thought better to wait for the British Empire Exhibition in 1924, when a unique opportunity will occur for not only a national British demonstration, but an Empire demonstration of the value of a public supply of electricity.

What Will be Done at Wembley.

A scheme for taking advantage of this opportunity has been worked out by the B.E.D.A., and has been described in a communication sent to all the supply undertakings in the country. The scheme is intended to provide a series of exhibits at Wembley, which it is hoped will create an impression of the uses of electricity on the public mind that will not be forgotten in a generation. This scheme will be only a part of a great exhibition, in which electricity will undoubtedly predominate; the machinery section will be largely devoted to electrical plant, and the B.E.D.A. scheme is intended to introduce the note that will draw the attention of every visitor to the public supply of electricity. To be successful, the scheme must be carried out by the combined effort of the supply undertakings, and must be an effort worthy of the great industry, an effort that will draw the attention, that will keep attention, and will impress the British public with the idea that electricity must be to them as their daily bread.

If such a scheme can be carried out, the finest publicity that is possible will be secured, the mass of public opinion will receive a thrust which should set it into at least slow motion, and undertakings will receive a direct return for the money spent.

The Exhibition and the Empire.

When we think of the British Empire, we are apt to think only of portions of the Empire overseas inhabited by coloured races, governed by Englishmen wearing sun helmets, and to forget that each of our towns is a part of the Empire, and each one of us a citizen of the Empire; but it is so, and if we can do anything that will make for the prosperity of the Empire we shall benefit ourselves.

The greatest exhibition ever held is being organised by representatives of the greatest Empire the world has ever seen; an Empire only held together by the loose bonds of mutual interest and sentiment; if these bonds slip the Empire will come to an end, and with it will pass the commercial prosperity of these islands. The Empire Exhibition is being held to strengthen those bonds, to encourage mutual trading within the Empire, or trading between the Empire and foreign nations; European trade has diminished for reasons that are well known, exports are down, unemployment is rife, and there is a large amount of suffering in consequence. The Exhibition will assist lands overseas under stable British governments to develop, and enable these countries to increase their demands for our exports in return for imports that they will send us. It is a truism that Britain cannot feed her own population, and that we can only live by trading; if this fails, bankruptcy and starvation must take place.

If the exhibition is a success, the increased trade will reduce unemployment, there will be more prosperity in the Empire generally, and in consequence there will be more demand for those special products which each town respectively deals in; thus Glasgow will build more ships, Grimsby will sell more fish, while Scarborough will receive more visitors. Thus there are selfish reasons for supporting the British Empire Exhibition.

Re-creating the Spirit of the Pioneers.

But let us then turn our heads resolutely away from these selfish reasons, and support the Empire Exhibition in the spirit of those eager souls, who sailing from these small islands to every part of the world, founded the British Empire.

All roads next year will lead to Wembley, to the British Empire Exhibition; and the B.E.D.A. scheme is intended to convey the electricity supply message to everyone of those millions of people, who, travelling on those roads, will eventually pass through the electric pavilions. The British Empire Exhibition will be the outstanding event of the coming year; in that there is an opportunity that will not recur, and a critical stage in the post-war history of the British Empire has been reached. Unless England can regain our trade it must go under, no economy campaign will save us; it is just impossible for the present population to live in Great Britain under satisfactory conditions unless trade revives.

But there are signs that the worst has been past, that trade is improving, the exhibition may give just that impetus which will enable the Empire to move definitely towards prosperity. Surely electricity supply, which is so vital to the life of the nation, will assist in the promotion of this Exhibition; an exhibition which has the support of every unit of the Empire large or small, from Canada round the world to the Solomon Islands and Australia, on to India, and back to the Windward Isles, and help to make it that success which may make the difference between death and life to the British Empire.

In proposing a vote of thanks to the President, Councillor E. C. RANSOME (Ipswich) suggested that the Convention next year might be held at Wembley in connection with the British Empire Exhibition. The vote was seconded by Councillor A. SINNINGTON (Bristol), and, in reply, the PRESIDENT said that

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Councillor Ransome's suggestion would be considered at the annual general meeting.

A Paper on "Showrooms and Sales Department in a Small Town," by Mr. T. Hall (Burton-on-Trent), was then read in abstract and discussed. We give an account of the proceedings below:—

Showroom and Sales Department in a Small Town.

By T. HALL, Chief Electrical Engineer, Burton-on-Trent.

Many papers have been read before the Association upon the development of the domestic load. Encouraging progress has been made, but much propaganda and service work remains to be done. Each supply engineer should fix a tariff suitable to the conditions in his own district. The average tariff for cooking purposes appears to be about 1d. to 1½d. per kWh, at which figure business should be secured.

Working with the Contractor.

Manufacturers have shown enterprise in developing domestic appliances, and the E.D.A. is carrying on valuable propaganda work. But few towns of moderate size sufficiently appreciate the value of showrooms and the business-getting side has not received the attention it deserves. Some undertakings consider they are up against the old proposition of municipal trading. But with tact this can satisfactorily be overcome, as has been the case in Burton, even though there is no statutory power to sell fittings and appliances. As a result of meetings held with the electrical contractors, an agreement was eventually drawn up whereby the department could sell fittings and apparatus from the showrooms with certain stipulations.

The chief points in this agreement (which is given in an appendix to the original paper) are: (*a*) All goods sold go through an approved contractor, who attends to invoicing and collects the money; (*b*) the client is asked to state which contractor he wishes to deal with, and no preference to any one contractor is given; (*c*) the gross profit on all sales is equally divided between the Corporation and the contractor. The system has been working for eight years to the satisfaction of the contractors.

It may appear strange that half the profit should go to a contractor for a sale of which he has no knowledge until he receives the sale slip; but the contractors in return do good service by bringing clients to the showrooms and thus assisting the development of the sale of electricity.

Showroom Essentials.

A showroom must be in a central and easily accessible position. It is most important to ensure that consumers obtain apparatus suited to their needs and advice should be given and specifications and estimates rendered free of charge.

In Burton a large number of people take advantage of this offer, and it is rare that an installation is carried out through the medium of the department where a heating circuit is not installed. The general public is still ignorant of many uses of electricity, but once people have visited the showrooms and inspected the various domestic appliances actually in operation they soon become keenly interested. The great object is to get the public into the showrooms, to educate them as to the advantages, uses and economy of electricity in the home, and to tell them what other consumers are doing; after such a visit the consumer will be inclined to experiment for himself.

Window displays are exceedingly important. Windows should not be too crowded, and the price should be attached to every article shown in order to correct the impression that "electricity is so terribly expensive." Naturally the windows of an electrical showroom should be lighted as perfectly as possible. In addition to the main showroom, model dining rooms and kitchens should be arranged. The showroom should not be allowed to develop into a stockroom. A variety of types of each article, without undue repetition, should be on view and neatly arranged. In talking to a consumer the salesman should always be in a position to show and explain the object discussed. All apparatus should be labelled with the price, and there should also be placards stating the cost of operation *in pence*. Full use should be made of the latest types of electrical illuminated signs.

The Financial Aspect.

The cost of running a showroom and sales department in a small or moderate sized town is a small item and the profit on sales alone should cover expenses. But even if this is not the case, it would be quite wrong to condemn the showroom as uneconomical, as the profit from the sale of electricity used in apparatus sold or sent out on hire must be considered.

A showroom is the best form of advertising, and the first consideration is that the showroom and sales department should give service to the public. Naturally, the staff should be thoroughly familiar with all the chief applications of electricity and the apparatus shown and every encouragement should be given to the public to seek advice. A record of all enquiries and complaints should be kept in a Consumers' Enquiries Book. Members of the staff should themselves live in an "all-electric home." The public cannot be expected to adopt and use electrical methods if the men engaged in the industry hold aloof. In Burton all electric cooking stoves are wired and fixed free of charge and a stove complete with 4-pint quick-boiling kettle is furnished at a rental of 5s. a quarter with electricity at a flat rate of 1½d. per kWh. Consumers are highly satisfied with this arrangement.

At the conclusion of the original paper the author gives a balance sheet of the sales department in Burton for the year ending March, 1921, which shows a satisfactory profit, and the text of the agreement with local contractors is given in detail. A plan showing the suggested arrangement of a model showroom, sitting room and kitchen is also appended.

Results of Six Months' Work.

In the course of his opening remarks, Mr. HALL mentioned that arrangements have been made for his sales manager to have electric cooking apparatus in his house, and as a result of that he could definitely trace the installation of 12 cookers in other houses in the same district. The department had only been pushing cookers for six months, but it had now actually on the mains 60 cookers, and they were going into houses of the 10s., 12s. and 15s. per week type. He hired out anything in the way of apparatus and now sold 500 000 kWh per annum for cooking and heating; the tramway load was only 600 000 kWh per annum. He had altogether 2 000 consumers, and had sent out, through the showroom, 600 2¼ to 3 kW fires, 352 electric irons, 200 kettles and boiling utensils, and 655 electric fittings, standards, etc., apart from vacuum cleaners, fans and sundry domestic appliances.

DISCUSSION.

Mr. L. L. ROBINSON (Hackney) said there were a great many undertakings in the country which still adopted the old policy of supplying electricity only to those who came and asked for it. Nowadays the business end of the undertaking was more important than the technical, although great credit was due to those who had brought generating machinery to its present state of perfection. But whatever could be done now could only result in a small reduction in the fuel bill, and, even then, generally at the expense of capital cost. The thing that would reduce the selling price of electricity was intelligent salesmanship constantly directed to improve the load and diversity factor. Lack of direct selling powers must be a handicap to such a progressive man as the author. After all, what they wanted to sell was not electricity but the thing electricity would give, i.e., service, and to sell service efficiently it must be sold direct. It staggered him to see all the forms that had to be filled in at Burton in order that the work might be done through a contractor. In his case, if a person wanted a cooker he simply filled in a form at the showroom and the cooker was at his house the next day. The supply undertaking could best help the contractor by putting all the standard and easy going work in their way, but they must reserve to themselves the right to sell.

What Every Undertaking Wants.

Mr. W. A. GILLOTT said to develop the domestic load it was essential to have a showroom and hiring facilities and suitable publicity. The public did not know what electricity could do and they needed education; the only way in which this education could be given was to show in a practical manner exactly what could be done. The showroom must be in a main thoroughfare and simplicity in window displays was essential. He also always made a special point of having a kitchen in the showroon and of showing in pence per hour or pence per operation what the cost was. There was a great deal of profit to be made from the domestic consumer, and that was the reason for the success of the gas companies. The most notable case of the advantage of a showroom was a busy town where 200 electric cookers were ordered within three weeks of the opening of the showroom.

From the Women's Point of View.

Mrs. HAMMER (Hackney) said she would like to say a few words from the ladies' point of view. She agreed that it was necessary to educate the ladies in the uses and advantages of

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electricity, and one of the ways of doing this was by good window displays in a shopping thoroughfare. In her own district she was pleased to say that that had been most successful. This window dressing, however, must be simple. A woman was not interested in switches and fittings and the internal parts of apparatus. The apparatus shown must not be too clever. A well lighted window after dusk was a great bait, provided there was a good colour scheme, and, as a matter of fact, a good colour scheme was essential both in daytime and after dark. There should also be a statement of what the apparatus did and what it cost, and, if possible, some models at work. Another great essential was personality on the part of the salesman or saleswoman, coupled with good service right into the home.

Contractors and Wiring and Selling Powers.

Mr. A. H. SHAW (Ilford), referring to his own work in connection with a showroon and wiring department some years ago, said it was so successful that the gas company got an injunction against him for working it without legal powers, and it was shut down. He wondered whether the author was not acting illegally in sharing profits with contractors, because he had no powers to sell. He rather thought some of the contractors were sorry for the action they had taken over selling by undertakings, because it was curtailing their business. The rental wiring scheme was not altogether successful in Ilford and the Corporation could not adopt hire purchase.

Getting the Confidence of the Public.

Mr. F. M. LONG (Norwich) said the main thing was to get the confidence of the public. To do that was half the battle. In Norwich he had full powers, where supply had been started by a company who did the wiring. Therefore no great contracting element had arisen in Norwich. He did not find people averse to a wiring scheme on a permanent rental basis, and he had wired a large number of houses in that way. He had also lately made a move as regards cooking, and had been surprised at the result. He charged ¼d. extra per kWh for hired apparatus. About 160 cookers had been sent out since January, and they were now going out at the rate of 10 per week. That had been done without any advertising, but a demonstrator went round immediately after the cooker had been put in to see that everything was all right and that the household understood it. Another visit was paid 10 days later to see that it was working satisfactorily. These cookers were going mostly into small houses where servants were not kept, and he thought there was a big future for cooking in such places. The wiring was cab tyre sheath cable run in one length and tacked up so that it was an easy matter to move the cooker. It was thus found possible to instal the cooker and everything complete for less than £3.

Sales Conferences of Employees.

Mr. F. S. GROGAN suggested that the author should have a meeting of all his employees and of the employees of the tramways department, and encourage them to bring anyone they could to the showrooms, and if any sales resulted, give the particular employee commission.

Education in Economical Cooking Stressed.

Mr. J. W. BURR (Swansea) thought the arrangement made with the contractors at Burton was admirable, and he had been working on similar lines. He agreed that a part of the showroom should consist of a fully-equipped kitchen with the latest type of cooker in it, and the education of the consumer in economical electric cooking was important. He had found that the electricity consumed to cook the same amount of food by different people varied between 2½ and 7½ kWh.

Mr. S. CLEGG (Lincoln) said his experience led him to believe that the best cooking business would be done in those houses where the lady of the house superintended the cooking, rather than in the larger houses where there was a tendency for opposition to be offered. At any rate, a start might be made with the smaller type of house.

Councillor H. COATES (Watford) said his wife had asked him specially to mention the need for showing the housewife how to change a fuse.

Mr. J. K. BRYDGES (Eastbourne) said the criticism levelled against his own showroom was that it did not show a profit, but he combined an inquiry office with the showroom, and his argument was that an inquiry office was necessary in any case. He regarded the paper as so important that he suggested additional copies should be printed so that they could be distributed amongst assistants and members of council.

No Showroom at Leeds.

Councillor GIBSON (Leeds) said that his town was in a peculiar position, inasmuch as it had an installed capacity of 63 000 kW and an output of 73 million kWh per annum, and yet had not a showroom. It had, however, now been decided to open a showroom, and a manager had been appointed. He had personally felt for some years that there should be a showroom in Leeds if the greatest development of the uses of electricity was to take place.

This concluded the morning's proceedings. After lunch the majority of those attending went on a short charabanc tour, which gave them the opportunity of seeing some of the beauties and also some of the slums of Scarborough. After a visit to the top of Oliver's Mount, where the town war memorial is being erected, an excursion which allowed the vehicles to exhibit their climbing capacity and those present to hear all about the bombardment of Scarborough with actual illustrations, the party returned to the Italian gardens on the sea front, where the official photograph was taken, and then made their way back to their hotels.

In the evening a reception was given by the Mayor and Mayoress of Grimsby, and the members of the Electricity Committee at the Royal Hotel. This was largely attended, and dancing continued to a late hour.

Wednesday, June 20th.

To-day the meeting was held at the Town Hall, when a Paper on "Overhead Transmission," by Mr. J. E. Storr, was read and discussed. This Paper, with an account of the discussion, is given below:—

Transmission and Distribution of Electricity by Overhead Lines.

By J. EDWIN STORR.

Transmission in dense centres of population may be economically dealt with by underground systems, but for wide and country districts and for inter-connection of existing power stations overhead construction has the advantage. Capital expenditure on mains is already greater than on generating plant, and is likely to be more so in future.

Initial detailed survey of the route is most desirable. A direct route can seldom be realised, as it is necessary to make detours to avoid buildings, woods, water, etc. Routes with a minimum of angles and special supports mean the cheapest outlay. Other considerations are shelter from climatic conditions, long spans to facilitate the solution of wayleave problems, the separation at suitable distances of lines from telephone wires, etc.

Some Technical Considerations.

Extremely high voltages are not needed in this country, and it has hitherto been assumed that 33 kV should be the maximum. But this limit may be exceeded in the future. There is now under construction a composite line to operate at 66 kV. By good mechanical design dangers from birds, snow, or sleet storms and gales can now be avoided. The selection of voltage and spacing, usually a compromise of formulæ, initial cost and maintenance, must also be carefully balanced. In design the size of conductor is first determined, next the most economical span. Long spans reduce the number of insulators (the most vulnerable point), and are best for dealing with undulating country. Line supports must withstand simultaneously stresses due to weight of conductors and wind; flexibility of intermediate masts provides relief from overstress should conductors break on either side of the structure. For intermediate positions on straight runs stays are not usually necessary, for angle and terminal supports stresses are taken by stays or strutts. Single unsupported wood poles are only suitable for small loads. Recent designs of "A" poles in wood are specially braced to afford stability of structure.

Stability of masts depends on the nature of the soil, and the depth in the ground is usually one-sixth of the pole-length. Wood poles do not usually need special foundations but steel masts are best erected in substantial concrete foundations if ground conditions are questionable; sometimes an extended bearing surface may suffice. Side thrust blocks may be contrived, or earth filling may be reinforced by two layers of stone laid on edge. For compressive loading the author suggests 20, 70 and 100 lb. per sq. in. for (*a*) sand, marshland or made ground, (*b*) gravel or alternate layers of loam and clay, and (*c*) rock. The maximum pressure on the retaining soil comes at one-third the depth of the buried portion. Concrete work on cross-country runs is costly. Alternatives are iron

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base plates, extended wood baseblocks, or slabs of stone. Shrinkage of wood from the wet to dry state, causing water-space between pole and concrete, is a danger. It is best to employ some plastic material at the ground line. The concrete top should be finished to throw wet away from the pole, and at the junction a band of preservative should be used.

Maintenance Points.

In planting a drilled hole usually suffices. Special tools for the purpose are available, and poured concrete will make a satisfactory job. Tubular poles and lattice work should be given a preservative coating, e.g., a mixture of tar and oil applied hot. The B.E.S.A. have specified fir poles and winter-felled red fir is the best timber for overhead lines. It is best not to drill or cut into wood below ground level as holes admit moisture. The B.E.S.A. specification also mentions suitable impregnatives for preserving poles. The G.P.O. assign a life of 30 years to poles impregnated with creosote. Fungoid may be guarded against by tar applied hot near ground level and held by coarse canvas. Washers of large area should be placed below all bolt heads and nuts. Bolts should not be less than $\frac{3}{4}$ in. diameter. Pole-caps in zinc make a satisfactory finish. It may be economical to adhere to wood poles for straight line work and carry out angle, terminal and special work in fabricated steel sections or tubular poles. Section masts should be inserted at intervals in long straight lengths of line to give stability. For 0·1 sq. in. conductor line 2 000 yd. between anchor masts should answer. For cross-country work in urban and rural districts the economical span for wooden poles is about 70 to 80 yd. for single member poles and 120 to 130 yd. for "A" poles.

Steel poles are widely used for long span work, and the higher initial cost is compensated by longer life and reduced number of erections. Tubular poles are more pleasing in appearance but less economical than lattice work; the latter should be provided with an "anti-climbing" guard to prevent interference. Lattice steel masts made up in standard steel sections are economical in weight of material, and easily transported. Minimum thickness of material should be specified, not less than $\frac{1}{4}$ in. thick for main members and $\frac{1}{16}$ in. for top bracings; rivets and bolts not less than $\frac{5}{8}$ in. Lattice masts are advantageous in wet ground, but their greatest merit is flexibility. A good design should withstand a torsional movement of 1/50 of the length of the pole without permanent set of material. Poles in concrete suitably reinforced have proved wonderfully flexible.

Cross Arms and Fixings.

Arrangements of brackets, cross-arms and insulator supports are very numerous. The most simple form is the swan neck for screwing direct into pole. This can be economically used for low tension work with light conductors. For pressures above 2 000 V necessary clearances can only be obtained by brackets or channel cross-arms. Bent flat iron brackets with suitable stay between insulator position and pole also make an excellent mounting. Cross arms are used for large clearances and are cheaper than large brackets in fabricated iron work. Bent cross-arms should be avoided, as their use prevents fixing of suitable bird-guards. Insulators should not be fixed on the top of poles; bolt holes near the top open out fibres and permit access of weather.

Except for very high voltages the distance apart of conductors is governed only by physical conditions, i.e., span length and consequent sag, arrangement and weight of wires, windage, etc. The minimum clearance for l.t. work for spans of 70 yd. should be 12 in. In long span work conductors should not be in a horizontal plane nor fixed vertically one over another. Practice in this country allows a needlessly high factor of safety in spacing; 2½ ft. spacing on 70 to 90 yd. spans proves quite satisfactory. In order to avoid vertical or horizontal alignment of conductors the so-called tipped triangle answers very well. Stays and struts should be fixed in undisturbed earth as far as possible. Stay ropes should be of high tensile steel (45/50 ton quality). Both struts and stays should preferably be fixed at not less than a 45 deg. angle with the pole top, with 30 deg. as minimum. Cattle guards, and an anti-climbing device composed of barbed wire should be provided.

Insulator Details.

The requirements of standard insulators are set out in B.E.S.A. specification No. 136 but shape and mounting are wisely left open. Porcelain insulators are now generally used; glass has proved too brittle. Good experience with composition insulators is reported. Moulded insulators in gum are also being widely used but require further tests. A first grade insulator must be mechanically strong for packing and handling, and of a shape avoiding deep corrugations on the under surface, which are apt to become dirty. Single piece types are preferable to multi-piece. The shape of an insulator should permit arcing without heating or injury, and its qualities should be independent of the glazed surface. Present practice favours disc-suspension insulators for 66 kV and upwards, and with longer spans, they may be advisable on 33 kV. The suspension insulator requires a higher tower but affords the better protection against lightning. The cap and pin type have the best electrical qualities. The fixing of the insulator to the pin should be so arranged as to prevent slack insulators on spindles. Screwed ferrules are unsatisfactory owing to the growth of iron due to oxidation, etc.; hemp serving as a cushion is fairly satisfactory but needs careful impregnation, and makes it necessary to remove pin and insulator together from the line for replacement. Trouble has been found in using cement to fix insulators on spindles, owing to the variation in quality of cement. Shackle insulators in porcelain should be avoided, as growth of metal is apt to burst the insulators. Some engineers favour a rigid binder, others a flexible one; an intermediate condition appears best. Hard drawn copper is best for heavy work, soft copper will answer for small conductors, and copper clad steel is useful where maximum strength is important. All scrap ends of wire should be collected; otherwise they are picked up by grazing animals or find their way into cattle food with fatal results and consequent claims for compensation.

Connections to earth include those (*a*) for operating purposes, e.g., middle wire and neutral of polyphase systems, and (*b*) for protection to prevent potential rises above earth on supporting structures. Earths should be well grounded, preferably in water, should be able to carry the maximum current likely to occur, and connections to the earth plate or cone should receive special attention. Flat plates are preferable to buried pipes. The earth adjacent must be kept in a moist state. All metal work other than that intended for conductors should be permanently earthed. An aerial earthing wire is usually fixed below conductors and used to support other circuits, and should have flexible supports to prevent breakage due to fatigue of metal.

The Guarding Problem.

In the next section the author refers to guardings for roads, railways and other circuits. On public roads duplicate conductors or the equivalent in bridle wires, which increase the factor of safety by 100 per cent., give adequate protection. An earth-bar arrangement to make dead a falling wire may also be provided. Where horizontal flat surfaces occur near conductors insulating media are needed to prevent large birds setting up an earth between conductor and cross-arm. Fibre tube is often used for the purpose.

An alternative to guarding open wires is to insert a length of underground cable at important crossings and keep the terminal poles away from the side of the road. For such cable-links there is no danger in placing cables underground if satisfactory terminal boxes, including an expansion chamber to take care of the larger volume of compound in hot weather, are used. The chief objection to cable links is their heavy cost.

Telephone circuits on the same line of poles as power conductors are not satisfactory. Inductive interference may be overcome, but the small gauge wire does not well withstand storm conditions, and its support in cable form to aerial earth wire is costly. Research is now proceeding on "carrier currents," i.e., wireless telephonic apparatus in which communications are transmitted over the power conductors.

Protection of aerial lines against surges due to external influence is a difficulty. Various devices, such as chokers, electrolytic arresters, etc., are unsatisfactory. It is best to rely on substantial reinforcement of insulation (400 per cent. above normal) on end coils of transformers connected to lines.

Conductors may be of copper, aluminium, phosphor-bronze, copper-clad steel and aluminium-clad steel. Ninety per cent. or more of conductors erected in this country are of copper. Aluminium is only one-third as heavy, half as strong as copper, and has two-thirds of the conductivity, but can be used, making allowance for these facts, if the cost per lb. is less than twice that of copper. The increased sag due to temperature in the two cases is about the same. Bronze is only used on special cases and experience with copper-clad steel is limited. Compound aluminium-clad steel conductors have been more used.

Transposition of wires several times along the route will

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prevent unequal phases at receiving end. Joints in heavy conductors should be made at poles or masts. Forms of solderless connecters, with a breaking strength three times that of the conductor, are available. In work with aluminium mechanical means of jointing are absolutely necessary. Cable terminations should be substituted for overhead lines where buildings are entered.

The Regulations Obstacle.

In the next section of the paper the author discusses existing regulations in some detail. Such regulations have been much criticised and are being studied by a committee of the Institution. Standardisation of methods is most desirable and the B.E.S.A. specifications are a distinct advance in this direction. The chief drawback of overhead line work is the greater cost of maintenance. Another matter that deserves attention is the design of outdoor stations. Dealing with low tension distributors, the author emphasises the importance of good appearance and the avoidance of unsightly arrangements. When street lighting is not under consideration the use of back roads is preferable. As far as possible street work should be limited to single poles. Roof and chimney stack work is best avoided. Various arrangements of distributing circuits and guarding arrangements are shown in the original paper.

Extensive use may be made of existing tramway standards for street work. The average span for distribution work is 50 yd., or 40 yd. where frequent branch line or service work is needed. The standard G.P.O. insulator is often used for 400 V with quite satisfactory results. Tension insulators make a better construction than pin insulators for terminal and angle positions. Self-contained fuses can be used to give protection to branch lines. As an instance of unobtrusive street work, the author mentions the method at Sheffield, where span wires are run across the street from wall fixings, the conductor being suspended over the kerb line.

The author in the original paper quotes the B.O.T. regulations for service connections, where covered cable, mostly T.B., is commonly used for overhead work. Several alternative methods of making service connections to overhead lines are illustrated. In conclusion the author gives the following comparison of cost :—

Voltage	Underground Cables. £	Overhead Lines. £
33 000	3 800 ..	1 080
11 000	2 440 ..	950
6 600	1 000 ..	450
Low Tension	846 ..	430

The comparison is for equal route lengths and does not show the saving due to overhead lines by shortened routes made possible by cross-country lines as compared with underground work laid along the highways.

DISCUSSION.

Overhead Transmission Necessary to High Voltages.

Mr. S. J. Watson (Salford) said the only way in which supply could be taken into the remote districts was by means of overhead lines. This system had many advantages, especially on long runs where rivers or hills were crossed or where a main road did not exist. The importance of wayleaves could not be overstated, and the need for some methods of negotiating these was obvious. Comparing overhead with undergound work, there were limits to the price to be paid for reliability. Generally speaking, the overhead line was not as reliable as the underground cable, but troubles were comparatively rare, and if the overhead lines were run in duplicate, then they had done all that could reasonably be expected to ensure an efficient supply. A point in connection with insulators was that they should not be of white material, otherwise they formed an admirable cockshy for the small boy. One of the principal weaknesses in overhead work was at the junction of the overhead line and underground cable. No reference had been made to insulated overhead wires. He had used these on a housing scheme, thus considerably reducing the cost.

A New Standard Voltage.

Mr. W. B. Woodhouse (Yorkshire Electric Power Co.) said a large amount of work was being done by both the B.E.S.A. and the Research Association on overhead work. This was of such a nature as to warrant a greater financial support than it had received hitherto. It had been decided to adopt a voltage of 45 000 V as intermediate between the 66 000 V and 33 000 V, the reason for this being that in some cases 33 000 V was not sufficiently high to be economical, whereas 66 000 V precluded the use of combined overhead and underground. This decision had been come to at the recent meeting of the International Electrotechnical Commission. The B.E.S.A. was preparing specifications for hard-drawn copper and aluminium and the relationship between the strength of individual wires and the stand made up of seven or more wires, and on a cable made up of a steel core surrounded by aluminium. Wind pressure was important, and he thought it would be found that we had been allowing more for wind pressure than circumstances warranted. As a result we should be able to lighten our structures. The foundations and pole line design based on Post Office experience were unsatisfactory. Both the "A" pole and the "H" pole must be condemned. Although the industry had compulsory powers with regard to wayleaves, great care must be taken as to how they were exercised. It would be a valuable thing if the Association and other associations representing supply authorities could get together and draw up a standard wayleave agreement, for it would be easier to get wayleaves if a reasonable and simple form of agreement was drawn up and put forward as the minimum which the industry could accept.

Cables Preferred.

Mr. J. W. Burr (Swansea) said he had come to the definite conclusion that overhead lines were not so reliable as cables. He had had interruptions due to birds and lightning lasting 13 and 14 hours, and if the ventilating fans at the collieries stopped for five minutes, the men had to run for their lives, and once they were out of the pit they would not go down again that shift. The men were, in fact, getting discontented, and complained that there were many more interruptions since they had taken the public supply than when they had their own plant at the colliery.

Light Poles a False Economy.

Mr. S. R. Siviour (Yorkshire Electric Power Co.) said there was sometimes a tendency to put in light poles to save expense, but that was false economy more often than not owing to the need for providing for future development. Although overhead lines could not be said to be absolutely as reliable as underground, still, if a duplicate line was installed and the lines were sectionalised, the trouble of momentary interruptions could be overcome.

Councillor J. W. Collins (Birkenhead) complained that overhead lines were not æsthetic, and as regards wayleaves we were rather suffering from Government's compulsory powers and were rapidly approaching a state of nationalisation, which was repugnant to the English character.

Wayleaves and Arable Land.

Mr. H. Bell (Hull) said in the case of arable land it was impossible to get permission to run a straight line. Some unity of effort in regard to wayleaves would be useful.

Comparative Costs.

Mr. R. A. Chattock (Birmingham) said he presumed the figures of comparative cost given by the author were per mile. In the case of 33 000 V cables there was a difference in favour of the overhead line of £190 a year, but against that had to be set the greater maintenance charges on the overhead line. Ferro-concrete structures were very flexible and did not require painting. Duplicate overhead lines were necessary for reliability. That had to be taken into account in comparing the cost of overhead and underground mains because underground cables had been brought to such a state of perfection that a single or ring main could be relied upon to do all that was required.

Mr. A. H. Dykes said we should never have the same amount of distribution by overhead lines in this country that there was abroad. His experience in India convinced him that where overhead wires were used we should have to accept, as part of the price to be laid for getting current to the outlying districts cheaply, something less in the way of reliability.

In the afternoon a break was made from recent tradition by holding a meeting in the afternoon. This was done to receive the report of the Electrical Apparatus Committee and to give an opportunity for an informal discussion on electric cooker design. It was hoped somewhat fearfully that some very frank criticisms would be made, and a number of manufacturers' representatives diffidently attended their own vivisection. In the event the proceedings were mainly

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concerned with a description of the worth of electric cooking and were not inaptly likened by a certain irreverent critic to a revival meeting. However, we give a short account of the proceedings below:—

The Electric Cooker Position.

Mr. R. B. MITCHELL (Glasgow) said that the Electrical Apparatus Committee of the Association had been formed to ascertain the views of municipal and company electrical engineers as to the desirability of the combined purchase of electric cookers with a view to better terms being obtained from the manufacturers. This Committee was also asked to report on the question of standardisation. The following informative figures were divulged in replies sent to a *questionnaire* issued on the subject. It appeared that there were approximately 5 000 electric cookers in service in this country, and probably 80 or more per cent. were installed under schemes of hire or hire purchase. Business was, however, only just beginning, and an encouraging proof of the development was the estimate that in the year 1923 the output of cookers from manufacturers' works for immediate installation would be over 5 000. Indeed, as one manufacturer was sending out at the rate of 50 standard hiring cookers per week, the estimate was modest. In Glasgow he had during the past 12 months installed over 500 cookers. He had proceeded with caution in order to satisfy himself as to reliability, cost of maintenance and satisfactory operation and running cost from the consumer's point of view. The cooker of to-day fulfilled all these requirements, and the oven and grill were superior to any competitive apparatus, whether oil, coal or gas. This superiority did not extend to the boiling plates, but he was not without hope that the efficiency of this part of the cooker would be increased in the near future. As it stood, the open type of plate with high loading appeared to be the nearest approach to the ideal. Used in alliance with a quick boiling kettle, the cooker of to-day performed satisfactorily all ordinary domestic cooking requirements. Nothing less would suffice. If, as we were sometimes told, gas boiling rings should be retained for rapid work, how were we to secure the " all-electric " housing schemes of the immediate future. Was it suggested seriously that a gas service should be laid on to each house to supply a small boiling ring ? The majority opinion was that a scheme of co-operative purchase of cooker requirements would result in lower prices being obtained from various manufacturers, though the latter considered that the volume of present business did not warrant further reduction in price. When business developed lower prices would undoubtedly be obtained. Another point upon which most of them were agreed was that the time had not yet arrived for standardised design. Another *questionnaire* was to be sent round asking for information as to faults in design and their elimination, and it would probably be found wise to await the views of those numerous supply authorities who were now, for the first time, in a position to obtain first-hand experience of cookers in service. There was now almost complete agreement in the industry that the electric cooking load was desirable, and it was gratifying to note that the majority of engineers were in a position to offer a cooking rate low enough to attract the business. Agreed on these two essentials, he could foresee no limit to expansion. A pleasant feature of the investigations which had been carried out was the cordial co-operation of the company undertakings.

To Standardise or Not to Standardise.

Mr. S. T. ALLEN (Wolverhampton) said the I.M.E.A. had been directly interested in the question of standardisation of cooking apparatus for many years. Although no effort should be made to tie the hands of designers and manufacturers of electric cookers, there were many essential features which could with advantage be made common to all cookers, and it was considered necessary that those features should, if possible, be decided upon and incorporated in a preliminary specification, which could form some basis upon which all cookers could be designed in the future.

Some Disadvantages of Hiring.

Mr. J. CHRISTIE (Brighton) said he had come to the conclusion that people who hired out apparatus did not take the care of it that those who obtained the apparatus on the hire purchase system or by direct purchase, and now he was not hiring out any apparatus at all. When electric cooking apparatus was carefully looked after there were practically no maintenance charges.

Ald. ROBINSON (Aylesbury) spoke of his own satisfactory experience of electric cooking ; in his house he had no gas supply at all. Committees should support their engineers in developing the cooking load.

A Woman's Experiences.

Mrs. HOWIE (Walsall) said it was 12 years ago since she had first considered cooking by electricity. She now had an up-to-date cooker, which gave no trouble at all.

Standardisation a Mistake.

Mr. F. S. GROGAN, while agreeing that standardisation of details might be advantageous, said he should vote against any proposition to standardise cooker designs as a whole at present. Where apparatus had to be hired, it was necessary to bring the cost down from £20 or £30 to £10 or £15. Further, he had arranged to secure a temperature in the oven of 260 deg. in ten minutes with a further rise of 100 deg. in the next five minutes, so that a temperature of 360 deg. to 400 deg. was obtainable in a quarter of an hour, and the heat was so maintained that it did not fall below 300 deg. for about 45 minutes. In turning out cookers manufacturers had troubles of their own. The elements were chiefly made of nickel chrome, and the makers of this material had not yet got down to a proper working basis, with the result that the quality varied so much that it was necessary to watch very carefully the material that came into the works. Research should be carried out in this direction.

Mr. A. F. BERRY (British Electric Transformer Co.) said it was essential that they should give a service comparable to that given by their competitors and hire out apparatus at a cheap rate. On the question of maintenance and reliability, it was possible to make to-day electric cooking apparatus which would outlast any human being's life.

Staffs and Electric Cooking.

After some further discussion, Mr. J. W. BEAUCHAMP (British Electrical Development Association) said he was very anxious to see the number of cookers installed increased. Mr. Berry had mentioned that ovens could be made which would outlast the life of human beings ; the attention of the Commissioners should be brought to this, because they were still working on the seven years' basis for loans for apparatus. A large proportion of chief engineers were now using electric cooking, and the next step was to see that the assistant engineers and the staffs also used it.

Mr. L. L. ROBINSON (Hackney) said there was great timidity on the part of central station engineers in regard to electric cooking because they were afraid of what it would do to their networks He had with him a large number of curves which showed that the cooking and domestic load did not touch the ordinary peak. After seeing those curves he did not think station engineers need have any fear as to the effect of the domestic load in the direction he had mentioned.

In the evening what a good many thought was the most enjoyable function of the Convention took place. This consisted of a gala performance at the Floral Hall, given by the Fol-de-lols Concert Party. Not only was the musical programme of an exceedingly high standard, but the topical allusions were apt and amusing and the funny men really funny. Altogether an evening to be remembered.

Thursday, June 21st.

This morning a meeting was held in the Town Hall, when a Paper on " Modern Generation Applied to Existing Distribution," by Mr. F. W. Purse, was read and discussed:—

Modern Generation Applied to Existing Distribution.

By FREDK. W. PURSE, Chief Engineer, West Ham.

The paper deals generally with problems that arise in adapting existing distributing systems to a modern system of generation. The increasing demands for electricity have rendered such changes essential, and many and varied problems arise. The first generally used system was h.t. single-phase alternating current. Then l.t. direct current became predominant, only to be supplanted eventually by h.t. alternating current, but this time three-phase. With few exceptions, generating plant of the future will produce a three-phase supply. The distribution question falls under two headings, according to whether the original system was h.t. alternating or l.t. direct current. The former case presents little difficulty if the frequency is the same, the latter is often more complicated.

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Existing Cables of New Systems.

One of the chief matters to consider is the extent to which existing cables can be used for a new system of supply. To illustrate this point the author gives in the original paper two tables, the horizontal columns showing the original type of supply and cable used, the vertical columns indicating whether these cables can be used on the new system. If consumers are tapped off low tension mains at intervals, and their connections must not be altered, the number of possible changes is further limited. In some cases a whole core is thrown surplus, and it may be cheaper to recover the cable and lay a new one; alternatively, a whole spare core may be connected in parallel with others to reduce copper losses. In cases where copper is spare or run at less than the rated current density, the new arrangement may permit an increase in current. The new conditions may also involve unsymmetrical arrangement for two or three-phase working, causing inequality of phase voltage. For l.t. work this is usually of small moment; its importance in h.t. work depends on the length of the feeder.

The simplest case is where all the existing d.c. network is retained and the a.c. supply all converted to d.c. low-tension by means of rotaries, motor generators, rectifiers, etc. But in large towns it may be necessary to supply large consumers from the a.c. supply through static sub-stations on the premises; a saving in cost of mains and conversion is thus effected. Sometimes new and additional a.c. mains must be laid. Where h.t. a.c. supply is available it is useful to apply this in outlying districts. The above cases do not call for any material change in the existing network. The initial cost would be lower by installing conversion plant, but there is a permanently higher cost of converting all the supply to d.c., and, in a scattered district, in laying mains of section sufficient to avoid serious voltage fluctuation. In some cases it is desirable to change over the l.t. network and feed direct from the a.c. supply—e.g., by connecting the phases individually to each three-core cable and supplying it as a single phase three-wire system. Care must be given to balance, and a disconnecting box may be provided enabling distributors to be changed over from one phase to another. In such a case meters, motors, etc., have to be changed, and also lamps if voltage is varied. The cost of this is a serious item, but the problem will have to be faced when supply is purchased in bulk in the near future.

The Walsall Change Over.

As an actual instance of a somewhat complicated change-over, the author gives a summary of the circumstances in Walsall. The original h.t. direct current was converted to l.t., and this in turn gave way to 3 300 V a.c. supply converted to d.c. This system was changed in turn to 6 600 V a.c. supplying direct to l.t. network through static transformers. This last step involved alteration in periodicity. Feeders, before being changed over, were pressure-tested *in situ* at 13 200 V between phases and half this voltage to earth, and gave no trouble. The transformers in sub-stations were re-wound for 6 600 V on the e.h.t. side, and provided with 3 300 tappings, so that when the change-over was made the transformers were changed to 6 600 tappings. H.t. switchgear was discarded in favour of 6 600 V switchgear. The only alterations on the consumers' premises were a few meters on h.t. bulk supplies, but no alteration in pressure was made on the l.t. side.

A great deal of work has been done on the l.t. direct network. When a section was changed over it was necessary to: (*a*) Inspect and test all installations on consumers' premises; (*b*) reverse connections of all meters connected to the new third wire, and (*c*) remove all faults from distributors and services. Also, much temporary work had to be done in various sub-stations in connection with rotary plant and d.c. boards. Consumers' loads had also to be transferred to effect balance. After this came the work of changing over outlying districts, where extensions are now carried out with four-core distributors; and the d.c. services are so arranged that when converted to a.c. no alterations are necessary.

The cases where the predominant system was single phase were less complicated; but change of frequency involved considerable alterations to existing motors, meters, transformers, etc. When it is proposed to shut down entirely the existing generating plant the new three-phase supply can be converted through Scott-connected transformers to two-phase at the required voltage and the existing single phase feeders balanced as nearly as possible across the two phases.

The Effect of Change Over on the Power of Load.

In the case of Hampstead, where a change over has been made, about 1 000 motors were re-wound or changed and approximately 14 000 meters recalibrated or replaced. Eighty-eight distribution transformers, aggregating 5 285 kVA were scrapped and replaced by new ones. The plant installed at the main sub-station included four sets 1 500 kVA Scott-connected transformers, three-phase/two-phase, with e.h.t. and h.t. switchgear controlling them, as well as e.h.t. trunk mains. The actual cost of the conversion was £76 000. The detailed estimate was £92 000, of which the most important items were; Changing meters (£28 350), motors (£18 928), distributing transformers (£12 500) and switchgear (£9 065).

Where single phase generating plant is temporarily retained it appears best to use the Scott transformer principle with two phases; where frequency is altered frequency-changers or other suitable apparatus can be adopted in main or sub-stations, thus eliminating the cost of changing transformers, motors, meters, etc. In many cases where the original system was single phase there have been steady developments in the introduction of multi-phase generating plant to meet increasing demands, usually involving re-winding. It is not possible to lay down a hard-and-fast rule to cover all cases that may arise; much depends on local circumstances. Another interesting case dealt with in the original paper is furnished by Stoke-on-Trent, where the incorporation of the systems of the six pottery towns now grouped together presented varied and interesting problems. In addition, the borough boundaries were enlarged in 1922, and this involved further additions to plant in the form of a three-phase 6 600 V 50 frequency system with turbo-generators, rotary converters or motor converters being installed at some existing generating stations.

Some Cable Problems.

In the final section of the paper the author discusses various points in connection with cables—namely, voltage drop, skin effect, sheath losses, interference with telephone circuits, endosmose, electrolysis, voltage rating and power transmitted. In changing over to a.c. reactance drop may become important, but the actual values can be obtained from known formula if the linear dimensions are known. Skin effects are only important when transmitting large currents over cables of large copper section. Thus, with 1 sq. in. copper section at a frequency of 50 the increase in resistance would amount to 10 per cent. In changing over to a.c. sheath losses may also be incurred; these are proportional to the square of the current. The heating due to such losses precludes the use of single-armoured cables for a.c. work, but they may be ignored for ordinary plain lead cables. When go-and-return cables are surrounded by the same sheath, the losses are less and the conditions rarely serious. If go-and-return cables are in close proximity and in good state of maintenance, interference with telephones should not occur. Trouble due to electrolysis—electrolytic corrosion of sheathing experienced with d.c. systems—should largely disappear with the introduction of a.c. When a system is changed from d.c. to a.c. the cost of changing meters must be faced; but where only a change of voltage or frequency is involved some use may be made of existing meters. For example, meters wound for 200 V can be used for 100 V (but not *vice versa*, owing to excessive heating of pressure coil). Meters may also be used without recalibration on a fairly wide range of frequency, but the larger and more important ones should be recalibrated. In the case of motors frequency is of some moment, and each case must be considered on its merits. For instance, an induction motor run on a smaller frequency than that for which it was designed will run at a lower speed, and with constant voltage the power factor will be increased and the motor will tend to overheat; if, however, voltage is dropped in proportion to the frequency, torque will be the same, but output reduced in proportion to speed. In the original paper diagrams illustrating the effect of change of frequency are given. It is possible to use transformers under certain changes of frequency. A slight decrease may, however, have a marked effect, increasing iron losses and magnetising current; even a 20 per cent. reduction may make a transformer unsuitable for use. There is no difficulty in converting super-h.t. voltages as are now frequently employed down to any voltage in a single transformation—thus 30 000 has been stepped down to 70 V for furnaces, and from 100 000 to 5 000 V for ordinary power working. However, the use of transformers of small output for these super-voltages is uneconomical. Protective devices need careful consideration. Circuit-breakers which suffice on a

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system supplied from generating plant of a few thousand kilowatts may be inadequate when the local supply is derived from a big power scheme.

DISCUSSION.

Mr. H. A. HOWIE (Walsall) said the change over at Walsall referred to by Mr. Price had involved a complete new generating station with e.h.t. transmission system as well as the distribution system. The total cost had been considerable, but he estimated that the cost of changing-over existing sub-station plant and mains was approximately £300 000, or about £4 per consumer. Whatever the cost, however, the results had proved the policy of changing over had been the right one, as the old system could not possibly have dealt with the present load, nor could it have been expanded to meet the future needs of a large industrial town. The scheme was such that the work could proceed gradually over a number of years, and, as a matter of fact, was still proceeding. In this way it had been possible to spread the cost over a long period. As direct current was required for the tramways, it was not proposed entirely to dispense with it at any time but eventually would be confined to the centre of the town and one principal sub-station. This would have the advantage of keeping up the power factor of the system.

Voltage Regulation Difficulties.

Mr. C. TURNBULL (Tynemouth) said it would be an advantage if the three wires of a three-wire system could be taken and used for a three-phase system, and the lead on the cable employed for the fourth wire as an earth return. If this could be done it would save a great deal of money. Modern transformers were made with large reactance, which meant that the voltage regulation tended to be bad. He proposed to use a.c. boosters at the station which would be adjusted at various times of the day to keep the pressure as nearly right as possible. He had made arrangements so that the booster would work automatically.

The Change of Frequency Problem.

Mr. A. NICHOLS-MOORE (Newport, Mon) said he was making a change of frequency from 87½ to 50. That was one of the most important parts of the whole subject, and, to his surprise, the author had not mentioned it. His problem was whether rubber-insulated cables laid in 1895 for h.t. single phase, and still in use, could be employed in connection with the change of frequency. It was decided to adopt Scott-connected transformers, one reason being that the l.t. a.c. network was very defective, and this was the only way it could be made use of and the difficulties which would arise from the neutral of the three-phase l.t. transformer being earthed to comply with the Board of Trade regulations avoided. The single phase supply had been grouped into areas of 500 kW, and these groups were connected in sections through Scott transformers, which supplied to the main switchboard; there had been no trouble on the one section which had so far been completed. He did not agree with the author that there would be no trouble with meters provided there was a non-inductive load. When he was changing over he made careful tests of all the leading types of meters, and he only found one meter which was at all accurate under the changed conditions of frequency.

Diesel Engines for Outlying Districts.

Mr. J. G. GRIFFIN (Delhi Tramways Co.) remarked that where it was a case of supplying an outside district on the d.c. system an excellent case could be made out for Diesel engines with an output of not less than 15 million kWh and a load factor of, say, 15 per cent. In such a case the total cost of generation would not exceed 0·8d. In small undertakings where it was foreseen that a.c. would be inevitable in the future alternators might be added in tandem to two or three of the machines in the station. These would then take care of the a.c. load for a few years until it was thought desirable to add a.c. plant to the power station, and the prime movers to which they were fitted could be run at full load irrespective of the power factor.

The Use of Frequency Changers.

Mr. C. G. MORLEY NEW (Cardiff) said he had an old single phase station at one end of the town and a modern station at the other, and the single phase load was increasing in the vicinity of the modern station. It was therefore decided to put in frequency-changers and run a trunk main from the main station. This avoided running new mains right through the city. As the load increased it was found that the loss in conversion was heavy, so three-phase feeders were run out to a sub-station which was built in the vicinity of each power station to supply the single phase network. Thus, although since 1908 there had been a great increase in the single phase load, there had been no necessity to put down new feeders or plant. The change-over in his case was comparatively simple, and was carried out in the summer months. It was entirely a matter of organisation of detail work and planning. There had been no difficulty with regard to meters. The whole of the work had been carried out out of revenue.

A Change Over in Two Parts.

Mr. C. W. SALT (Carlisle) said it was best to separate an area, when dealing with a change-over, into two parts—a a central area, and a zone which filled the space between the central area and the boundary of supply. In that outer zone it was desirable to make early preparations to purchase sites for static transformer sub-stations and to lay out the system gradually for three-phase four-core distribution. In the direct-current area it was best to keep within the limits of the converting plant and the carrying capacity of the feeders. He saw no objection to super-imposing an a.c. network on a d.c. network, and it might be that that was quite a reasonable proposition and worth consideration. The star-star transformer had been used for three-phase four-core distribution, but the regulation was not so good on an unbalanced loading. The star-star system could not be interconnected with delta-star, as although the voltages of the phases might be similar, there would be angular displacement.

Cables and Factors of Safety.

Mr. R. B. MITCHELL (Glasgow) pointed to the statement in the paper that where a change over from d.c. to a.c. is effected, it was assumed that the voltage in both cases was the same, whereas, as a matter of fact, under the new conditions, the insulation was subjected to a higher maximum value with consequent greater risk of breakdown, especially if the cable was not in a very good condition. He did not agree with this statement so far as the assumption was concerned. In many cases the factor of safety in l.t. feeders and distributors was so high that even higher pressures could be admitted, certainly in the case of feeders in a system supplying 500 V d.c. It had occurred to him that the d.c. feeders now running at 500 V could quite readily be worked up to 2 000 V three-phase from the sub-station, which would increase their capacity considerably. He had been assured by cable makers that the factor of safety was sufficient to allow of this.

Mr. C. H. YEAMAN (Stoke-on-Trent) said a point not touched upon was that of a network consisting of three single cables laid solid in either wood or stoneware troughing. He had ultimately decided to put down static transformer sub-stations and put one on each of the three diametrical legs, on what some people called a double star, and other people three-phase/six-phase diametrically connected transformer, but care was necessary because there was double balancing inasmuch as they were balancing between the two sides of the three wire system, and also on each phase.

Councillor MCLEOD (Hull) said there was no object in reducing the cost of generation by ¼d. per kWh, and so saving £10 000 a year if to do that involved an annual expenditure of £50 000. Therefore, it was for the engineers to show that their schemes would pay.

A Fearful Handicap to Electricity Supply.

Dr. S. Z. DE FERRANTI said the country had been facing changes in electricity supply for some little time, with a view to the improvement of the supply throughout the country. The greatest possible handicap from which commercial electrical work suffered was the variety which was possible in the ways of carrying out any particular job. Hence all these different frequencies and different systems of supply. It was truly terrible and a fearful handicap to electricity supply as a business. It might be desirable to face a considerable percentage loss rather than allow this great variety of systems to continue. Only by uniformity should we get electricity at a sufficiently low rate to enable it to be so generally used that it would really help the country. There was a distinct indication that before long transformation from a.c. to d.c., might become a very easy and cheap matter, and this would greatly affect the d.c. networks in use to-day.

An A.C. Enthusiast.

Mr. S. G. MARSTON (Stockton-on-Tees) said there were two points which had not been mentioned in the discussion. The first was the absence of trouble on a.c. networks compared

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with d.c. networks, and the second was that when d.c. networks had reached their limit and it had been found impossible to carry on without some radical alteration, it became a question of installing more d.c. copper, rotaries and generating plant or taking the bull by the horns and starting afresh on a.c. The cheapness and accuracy of a.c. meters compared with d.c. meters was another thing in its favour.

ANNUAL DINNER.

In the evening, the annual dinner was held at the Grand Hotel, Lieut.-Col. W. A. Vignoles, D.S.O., President, being in the chair. A large company including the Mayor and Mayoress of Grimsby and the Mayoress of Scarborough were present.

In proposing "The I.M.E.A.," Mr. B. LONGBOTTOM (Chairman of the B.E.A.M.A.) referred to the close working relationship which had existed between the two bodies in recent years as contrasted with the time when one was the buyer and the other the seller with no identity of interests, and expressed satisfaction that that co-operation was now firmly established. The Research Association was about to issue an invitation to the municipalities and companies in the supply industry to become associate members of that Association in order that the industry might give it greater assistance.

The PRESIDENT, responding, spoke of the wider scope of the work of the I.M.E.A. now as compared with before the war and the new system introduced by Mr. Roles of Bradford, when he was President, of appointing committees which took on a great deal of the detail work which otherwise had fallen upon the hon. secretary and the council. In this way the work of the Association had been made more efficient and the influence of the Association made the greater. The Association now represented over 80 per cent. of the undertakings in the country and was not merely an association of engineers and committee members, but of undertakings. The number of delegates at this Convention was larger than at any previous Convention and the attendance at the meetings had been greater than in past years.

Friday, June 22nd.

The business this morning consisted of the annual general meeting to receive the report for 1922, and to elect the officers for the ensuing year. The interest taken in these matters after the excitements of the past few days was not very great, and the business was hurried through at high speed.

The report is a voluminous document from which we take the following paragraphs of general interest. :—

ANNUAL REPORT.

Membership.

The total number of municipal electricity undertakings on the membership roll is 208, representing a total population of 19,807,460, and over 81 per cent. of all the undertakings eligible for election.

During the year applications for membership were received from Atherton, Malvern, Hebden Bridge and Preston. Sleaford resigned its membership for financial reasons, and Redditch owing to the control of its undertaking being transferred to a company. The Council has agreed to the request of the Association of Municipal Electrical Engineers of the Union of South Africa to become affiliated with the I.M.E.A., with the object of keeping the two Associations in touch with one another on matters of mutual interest and for the interchange of literature. The director of the Stockholm Electricity Supply Undertaking also requested to be allowed to receive the I.M.E.A. publications, and in this case a small annual subscription is paid. The director of the Central Bureau van de Vereeniging Electriciteitsbedrijven in Nederland has also asked to be supplied with the publications of the Association, and the Council has agreed to supply copies at cost price.

Committee Work.

A large amount of the Association's work is conducted by means of committees of which there are a great number dealing with a wide variety of subjects. The Association is also represented on the British Engineering Standards Association, the B.E.A.M.A., the British Electrical Development Association, the Electric Vehicle Committee, the I.E.E. Model General Conditions of Contract and National Proving House Committees and the work done by their representatives is reviewed in the report.

As a result of representations the Council has considered the desirability of earthing meters and cut-outs. But, in view of the expense involved, considered it undesirable to disturb existing arrangements.

Joint conferences have been held with the Associations representing the tramways, gas, and water undertakings, on the subject of the transfer of certain financial matters to the borough treasurer. The joint action thus made possible was successful in one important case.

As a result of a meeting with meter manufacturers the question of marketing meters which will register the current consumed by the small lamps now on sale is being taken up.

The New Council.

The following officers and council were elected for the forthcoming year: *President*, Mr. S. E. Britton (Chester); *Vice-President*, Mr. W. C. P. Tapper (Stepney); *Past President*, Lieut.-Col. W. A. Vignoles, D.S.O. (Grimsby); *Hon. Solicitor*, Mr. P. M. Heath (Manchester); *Hon. Treasurer*, Mr. H. Faraday Proctor (Bristol), and *Hon. Secretary*, Mr. A. C. Cramb (Croydon). The new members of council elected were as follows: *Representing large towns*—Mr. A. S. Blackman (Sunderland), Mr. A. J. Fuller (Fulham), and Mr. S. L. Pearce (Manchester); *Small towns*—Mr. A. W. Barham (Watford); *Representing committees*, Councillor G. Billington (Salford), and Councillor H. W. Thickett (Grimsby). A hearty invitation from Chester to hold the next Convention there was accepted.

Electricity Commissioners' Expenses

A resolution put forward by the Council, that in view of the fact that the expenses of the Electricity Commissioners have been settled by Act of Parliament the question cannot be reconsidered until further legislation is proposed, was accepted without discussion. At the last annual meeting a resolution was passed expressing the opinion that the expenses of the Commissioners should be a national charge, and the resolution now adopted was the result of the council's consideration of this resolution.

Electric Vehicles at Edmonton.

Mr. L. L. ROBINSON (Hackney) asked for some information in connection with the report of the Electric Vehicle Committee, as to the reason for the abandonment of electric dust carts at Edmonton. He wished to know whether the whole thing was perfectly straightforward, or whether it was a matter of politics.

Mr. E. E. HOADLEY (Hon. Secretary of the Committee) said the whole of the facts were being gone into by the Committee, which would doubtless issue a statement in the next issue of the "Electric Vehicle Journal." So far as his information went it was a matter of direct labour as against contract labour.

Mr. NICHOLS MOORE said he had been meeting the same difficulty at Newport, and the issue there was as between direct and contract labour. He had made the suggestion to his committee—and it was being favourably considered—that the Corporation should provide the vehicles and a contractor provide the labour.

National Proving House.

Mr. C. TURNBULL (Tynemouth) moved a resolution, which was adopted, that the I.M.E.A. representative should not be withdrawn from the I.E.E. National Proving House Committee. He said that a large amount of inferior materials were often used in wiring premises in small towns where the local authorities had not the opportunities for testing the materials which existed in the larger towns, and he hoped the I.M.E.A. would continue to co-operate with the I.E.E. Committee.

The HON. SECRETARY explained that the reason why the I.M.E.A. had not felt disposed to continue any further participation in this scheme for the moment was that it appeared to them that the scheme as put forward by the I.E.E. contemplated an expenditure of £2 000 per annum, all of which would be expended upon staff and offices and none of it upon actual work. The I.M.E.A. was fully sympathetic with the idea of a national proving house, but it did not like the scheme as at present proposed.

On the motion of Mr. S. T. ALLEN (Wolverhampton), who is also chairman of the E.D.A. this year, it was referred to the Council to consider means for taking part in the various electrical functions which are to be held at the British Empire Exhibition at Wembley next year. Mr. L. L. Robinson (Hackney) seconded.

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Units Output Basis of Representation.

Mr. A. J. C. De Renzi moved that the Council take into consideration the question of electing members of council on a units output basis instead of upon a population basis, his reason being that many small towns had a very large output and came within the category of large towns for this purpose. They had difficulties peculiar to themselves and should be represented more largely so that these could be brought forward.

The motion was seconded and carried.

Mr. T. Roles asked that there be added to the resolution a statement asking the Council to consider the election of three vice-presidents instead of one, there being no senior vice-president, but the Council making a selection of the president out of the three vice-presidents. It might be that the one vice-president might not be able to accept the office of President, yet the election to a vice-presidency was an honour which such men could not otherwise have, and generally he thought the fact that there were three vice-presidents would give the council a better choice of president. The proposal was seconded, but was defeated.

The usual votes of thanks to the various people who had contributed to the success of the Convention were cordially passed as were similar votes to the President, Council and honorary officers. Sympathy was expressed with Mr. C. H. Wordingham in his illness, and it was decided to send him a message wishing him a speedy recovery.

The rest of the day was left free for such members as remained to inspect further the beauties of Scarborough and the neighbourhood.

After visits to the Scarborough Electricity Works and Plaxton's Motor Coach Works on Saturday, a most successful Convention came to a close.

Reactances for Electricity Supply.

Details of G.E.C. Design.

One of the most interesting features of modern power station construction and distribution system layout is the use of reactances to limit the amount of current flowing on short circuit and to localise high frequency surges. Essentially such a reactance is a choking coil of small ohmic resistance and high inductance. During normal working the loss it causes is small, while in emergency its utility is indisputable.

Constructional Details.

A number of types of reactance have been suggested or made, but one of those which has proved most satisfactory

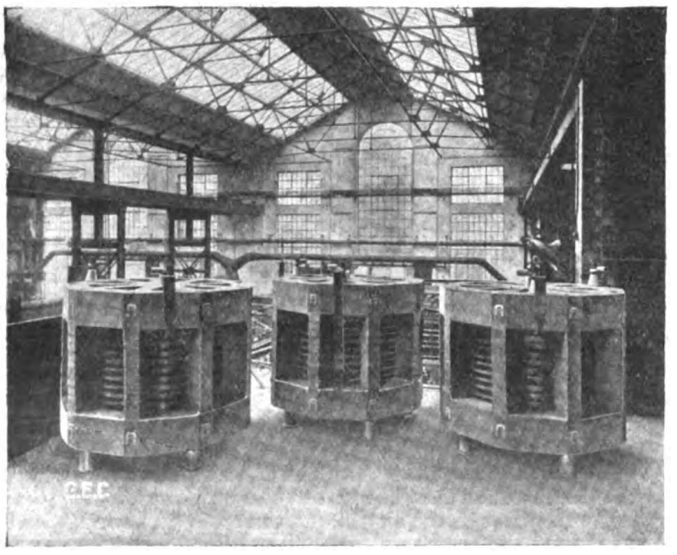

Fig. 1.—General View of G.E.C. Reactances.

in practice consists of a concrete or porcelain foundation on which the windings are carried. This is the type manufactured by the General Electric Co. The coils, as Fig. 1 shows, consist of a series of horizontally wound spirals having single or double conductor windings, which are supported in the recesses of concrete arms. These arms are fitted radially and are built up to form vertical walls. Layers of these arms are assembled on a heavy concrete base and a header of similar size is placed on top. The whole is then rigidly secured by brass rods which are equally spaced near the periphery of the base and header. The brass rods and clamping nuts are heavily insulated from the concrete and the nuts are in recesses of the base and header. Ventilating holes are provided in the base and header opposite to each other, thus forming with the radius arms vertical cellular compartments through which air can circulate for cooling purposes. The winding usually consists of bare stranded copper conductors which are securely fastened at the ends to cable clamps bolted to header and base. Owing to the method of construction adopted, great strength and rigidity are obtained, rendering the coils capable of withstanding the severe electrical and mechanical

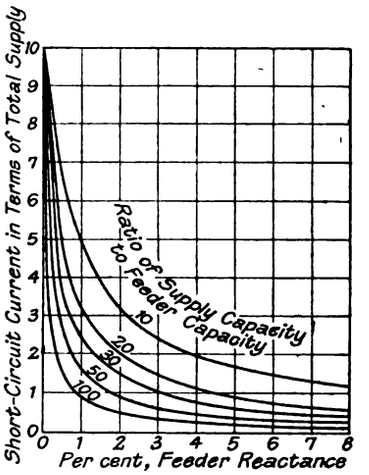

Fig 2.—Reduction in Feeder Current by Use of Reactances.

stresses to which they are subjected when heavy short circuits traverse them. They are likewise thoroughly fireproof. Each coil is supported on strong porcelain insulators, capable of withstanding the insulation test pressure called for in the B.E.S.A. requirements.

Reactance on Feeders.

The greatest use of reactances is to be found on feeders, where their employment eliminates heavy stresses on the circuit breakers, and therefore leads to a reduction in the cost of this apparatus. Fig. 2 contains curves showing the reduction in current flowing into a short circuit brought about by the installation of feeder reactance coils; the different curves are given with various ratios of total supply capacity to the capacity of the individual feeder under consideration and with 10 per cent. reactance in the generating circuit. From these curves it will be seen that a very small per cent. reactance on a feeder (the ratio of total supply to feeder capacity being large) reduces the short circuit to practically a negligible quantity; the small per centage value of the reactance also has but a negligible effect on the regulation of the feeder. The percentage reactance of the feeders given as horizontal ordinates of the curves in Fig. 2 is the reactance of the feeder based on the full load current to the feeder.

Pulverised Fuel at the New Detroit Station.

Latest Particulars of the Biggest Boilers in the World.

As recently noted in The Electrician, six new boilers of 325 000 lb. normal evaporation per hour each have been ordered by the Detroit Edison Co., and are to be fired with "Lopulco" pulverised fuel. It is now understood that these boilers are of the "W" Stirling type of 29 000 sq. ft. heating surface, and will be installed at the new Trenton Channel Power Station. The equipment for the first section is to consist of the six boilers and two 50 000 kW General Electric Co. turbines, and the working pressure is 425 lb. gauge with Babcock and Wilcox economisers. These boilers are intended to operate usually at about 300 per cent. American rating, that is, 300 150 lb. evaporation per hour, but are guaranteed to take 400 per cent. rating, that is, 400 200 lb. per hour for peak loads and emergencies.

We understand that the Detroit Edison Co. have made the most exhausting investigations into the performance of the "Lopulco" installation at Lakeside, Milwaukee. The net results show an efficiency of 5 to 6 per cent. in favour of pulverised fuel, but an even more important point is stated to be that 400 per cent. rating can be operated without difficulty.

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A Useful Electrical Exhibition.

Some Lessons and a Moral.

As mentioned by Col. Vignoles in his Presidential Address ast week, an internal publicity campaign in favour of the development of the domestic load has been waged by the Incorporated Municipal Electrical Association during the past twelve months. This campaign was fittingly concluded at Scarborough by the organisation of a small exhibition at which those attending the Convention were able to see the sort of equipment that is now available for the use of their consumers. It might be thought that such a campaign and such an exhibition were unnecessary. But having first divided supply engineers and committeemen into the converted and the unconverted on the subject of electric cooking, we find that the latter can also be divided into those who are in favour of electric cooking when suitable equipment is available and those who are still unbelievers in the widest sense. The second class were, as Mr. Berry would express it, sufficiently " hammered and beaten " during the course of the Convention to shake even their unbelief. The exhibition of cookers and water heaters which was arranged by the Council of the Association should have convinced the doubting Thomases of the first class as to the unsoundness of their attitude. If both these things have been achieved neither the Convention nor the exhibition will have failed of its purpose.

The Object Achieved.

The exhibition, which was open during the whole of the Convention, was held in the Constitutional Club, Scarborough, and was small and select. The following firms illustrated forcibly what they could do to produce efficient cooking and water heating apparatus, and nobly achieved their object: Bastian and Allen, British Electric Transformer Co., Brompton and Kensington Accessories Co., Carron Co., General Electric Co., George Nobbs, Hotpoint Electric Appliance Co., and Jackson Electric Stove Co.

We do not propose to describe in detail the apparatus exhibited by these firms. That has been done from time to time in THE ELECTRICIAN, and to repeat our efforts would be to lose sight of the real purpose of the display. What is wanted is a general view, and we therefore present a few points which may be helpful both to those engineers and committeemen who visited the exhibition and to those who did not.

Plenty of Efficient Apparatus Available.

Taking cookers and cooking apparatus first it would be a bold man who asserted that no efficient and reliable electrical cooking equipment was available. If he had visited the exhibition, he would be extraordinarily obstinate. If he had not visited it, he would have the assurance of ignorance. The only difficulty that any electrical engineer can possibly have on this subject is to choose the best cooker from so many that are good. Fortunately, in making such a choice prejudice comes to his assistance. He may believe that open hot plates are the best; in which case certain designs are eliminated. He may prefer closed hot plates; certain other designs are therefore ruled out. There remains the cooker which uses both open and closed hot plates. In the same way certain preconceived notions about grills and ovens may help him, but not much. As brought out by Mr. Mitchell in the discussion on " The Development of Cooking Apparatus," both the modern oven and the modern grill are high efficiency equipment, and, what is more, probably the most efficient equipment of any on the market. It therefore in the end boils down to matters of details: whether fuses should be placed where they are easily accessible, whether they should be fixed where the children cannot touch them, whether the grill should be arranged so that it can be used as a dish warmer, and so on *ad infinitum*. Our advice, therefore, to station engineers and committeemen is to make their choice and pay their money; they will obtain a great deal of satisfaction. Even if they are timorously inclined they can do a little. For there are oven and griller combinations, and grillers and ovens alone, to say nothing of quick-boiling kettles, all of which do their work well and will give both the user and the supplier a great chance of ascertaining how cleanly, how flexible, how comfortable and how cheerful electric cooking is.

Water Heating Progress.

When we pass on to the water heating apparatus we are upon more debatable ground. It is admitted that electric water heating equipment has not reached the same pitch of perfection as much of the other equipment. But there is no need to despair. We have to revise our ideas, that is all. And the water heating apparatus shown at the exhibition should do much to assist that conversion. The theory of the matter is simple; it has recently been propounded by Mr. Bastian in THE ELECTRICIAN. Design the heater to use a small quantity of energy for a long period and give up trying to imitate gas geysers and coal consuming apparatus. It is advisable to have a " boosting heater " for emergencies, but it must be recognised that the real need of the average household is a large quantity of moderately hot water. The small quantity of boiling water that is required in addition can best be obtained from a kettle, of which many efficient quick boiling designs were available.

The Moral.

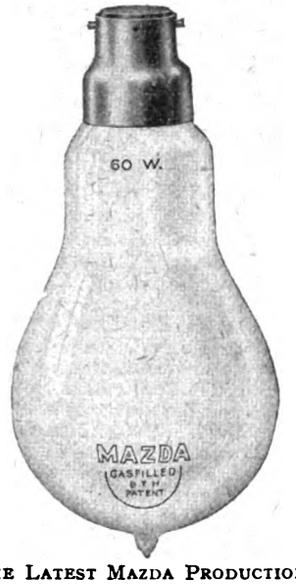
There is a little moral in all this for station engineers and committeemen. The manufacturer has done a great deal of hard work and shown much enterprise in designing and producing both cooking and hot water apparatus which no one need fear to use. The station engineer, on his part, must do his bit. He must cease to be fearful about his distribution system. As has been amply shown, that is largely a bogey. He must reduce his prices and revise his tariffs. He must get enthusiastic about electric cooking for its own sake lest " all the voyage of their life is bound in shallows and in miseries." Any lack of progress in the development of the domestic load can now only be the fault of the suppliers of electricity.

The Latest Development in Gasfilled Lamps.

The White Mazda Lamp.

" White Mazda Lamp " is the name given to the regular Mazda gasfilled lamp when obscured by an entirely new process.

This process which is claimed to have many advantages over previous methods tones down the glare and by means of a special enamel applied to the exterior of the bulb gives a permanent finish



THE LATEST MAZDA PRODUCTION.

equal to opal glass and at a much lower cost. The surface produced is smooth and does not therefore collect particles of dust. The density of the enamel can be varied as required.

The new lamps can be supplied by the BRITISH THOMSON-HOUSTON CO. in all sizes up to 300 W at prices 10 per cent. above those for ordinary lamps.

Correspondence.

Letters received up to 12 noon on Wednesday can be included in the current week's issue. Correspondents should, however, forward their letters at the earliest possible moment and are requested to keep their communications as short as is consonant with their argument.

"ALTERNATING CURRENT ELECTRICAL ENGINEERING."

To the Editor of THE ELECTRICIAN.

SIR,—In my review of the new edition of Mr. Kemp's excellent book, I find I made a slip in stating that it is not proved how easily the power can be measured in an unbalanced three-phase system. I find the proof is given in another section than the one I was considering. As will be seen from the review, the object of my criticism was to draw attention to the need of treating more adequately the important question of the unbalanced three-phase circuit.—I am, etc.,

S. PARKER SMITH.

London, S.W.7.
June 19th, 1923.

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Parliamentary Intelligence.

Electricity Schemes.

In reply to Sir J. Remnant on Monday Col. Wilfred Ashley said: The Electricity Commissioners have thus far made two Orders embodying approved schemes for the reorganisation of supply in electricity districts. These Orders are:—

(i) The South-East Lancashire Electricity District Order, 1923.

(ii) The South-West Midlands Electricity District Order, 1923.

A further Order embodying the scheme approved by the Commissioners for another electricity district will, I hope, very shortly be made. In addition, schemes for six other districts are in an advanced stage; three Draft Orders have already been published.

Naval Electric Tubes and Fuses.

On June 21st Mr. Snell asked the Financial Secretary to the War Office if he was aware that an order for 20 000 fuses, base, large No. 16, Mark IV, and tubes, electric, had been given to private firms by contract; and, in view of the fact that after the Armistice the whole of the tubes and fuses supplied by private firms were examined by the Inspector of Naval Ordnance and the Chief Inspector of Armaments without one perfect tube or fuse being found, and that the fuse factory had, for the last five years been employed in correcting tubes produced by private contractors, whether, under these circumstances, he would have those articles produced in the ordnance factory, where complete efficiency could be relied upon?

Commander Eyres-Monsell: I have been asked to reply. Orders for fuses and electric tubes are distributed between the trade and the ordnance factories with due regard to all the important considerations involved. The statements in the latter part of the question do not correctly represent the position as regards the whole of the tubes and fuses supplied to the Admiralty by private firms. Orders will only be given to such firms as are capable of fully meeting Naval requirements.

Electricity Commissioners.

Sir J. Remnant asked the President of the Board of Trade, on Monday, if he would give the cost of the Electricity Commissioners for the year 1922 and the estimated cost for 1923; and what were the salaries of the Commissioners and the staff?

Col. Ashley: I have been asked to answer this question. The expenses of the Electricity Commissioners are, as my hon. and gallant Friend is aware, defrayed by the industry and not from moneys voted by Parliament. The expenses, apart from the repayment of past advances, in respect of the year 1922-23 were £35 567, and the estimate for the year 1923-24 is £46 250. This includes £15 227 in respect of salaries of Commissioners and £20 273 for staff.

Chesterfield Corporation Bill.

The Chesterfield Corporation Bill, which is to consolidate local Acts in force within the Borough of Chesterfield and to confer further powers upon the Corporation in respect of their various undertakings, is under consideration by the Local Legislation Committee of the House of Commons, presided over by Sir Thomas Robinson. Sections dealing with tramways, trolley vehicles and omnibuses, and with the Corporation's electricity undertaking, have been dealt with and the clauses approved.

With regard to tramways, it is provided that the tramway undertaking, as it exists, is to continue vested in the Corporation. Powers are given to construct two short lengths of new tramways, to connect up existing tramways, and there are a number of usual provisions, dealing with gauge (4 ft. 8½ in., or such other gauge as may, from time to time, be approved by the Minister of Transport), rails, cross-overs, etc.; the tramways are to be completed within five years from the end of 1923. With regard to fares, the Corporation are empowered by the Bill to demand a fare not exceeding 1½d. per mile, and are required to run a proper and sufficient service of cars for workmen, at fares not exceeding 1d. per mile. If complaint is made to the Minister of Transport that such a proper service is not provided, he may, by Order, direct the Corporation to provide a reasonable service, and the Corporation shall be liable to a penalty of £5 for every day during which they fail to comply with such an Order. There is provision for the revision of fares at intervals of three years. The Corporation are empowered to supply electricity for the tramways, and also to enter into agreements with local authorities, companies or persons for the supply by the latter of electricity for the tramways.

As to trolley vehicles, the Corporation may, with the consent of the Minister of Transport, use trolley vehicles along any road along which they are authorised to run tramways, and provisions are made for the necessary electrical works. The Corporation are to have the exclusive right of using the apparatus provided by them for working trolley vehicles, and those using the apparatus, except by agreement with the Corporation, are liable to a penalty of £20 for each offence. Certain provisions of the Tramways Act, 1870, are applied to trolley vehicles, so far as they are applicable, and certain powers in the present Bill with regard to tramways are applicable to trolley vehicles, including those dealing with fares and the supply of electricity. The trolley vehicles must be approved by the Minister of Transport, who is also empowered to authorise new routes. Powers are contained in the Bill to run omnibuses, and both the trolley vehicles and omnibus undertakings are to be part of the tramway undertaking.

With regard to the electricity undertaking of the Corporation, the limits of supply are defined as the borough and an area outside. The maximum price is 13s. 4d. for any amount up to 20 kWh, and for each additional kWh 8d. Among the clauses relating to the undertaking is one providing that no consumer to whom electricity is supplied for power purposes shall, without the consent in writing of the Corporation, use it for lighting purposes. Other clauses of the usual character relate to the allowance of a discount up to 5 per cent. to consumers for prompt payment, the construction of sub-stations under streets, entry upon premises (with a penalty for obstruction), the supply of electricity by agreement, notice to discontinue supply, the erection of generating stations on specified lands, with the consent of the Electricity Commissioners, etc.

Legal Intelligence.

Postmaster-General v. Liverpool Corporation.

On June 22nd, the House of Lords dismissed the appeal of the Postmaster-General from an order of the Court of Appeal reversing an order of the Divisional Court and restoring the judgment of the County Court Judge of Liverpool in favour of the Liverpool Corporation.

The facts of the case were that on August 6th, 1918, there was a leakage of current from the Corporation electric light main, followed by an explosion which damaged a Post Office telephone cable and pipe, repairs to which cost £40 8s. 9d. The Postmaster-General claimed this sum from the Liverpool Corporation, but the latter disputed liability under terms of an agreement with the National Telephone Co., whom the Post Office succeeded in respect of the telephone service. The County Court judge at Liverpool held that the agreement of June, 1896, was binding on the Postmaster-General. A Divisional Court of the King's Bench Division reversed the County Court judge's decision and ordered judgment to be entered for the Postmaster-General for £40 8s. 9d., and costs, but the Court of Appeal restored the finding of the County Court judge, so the Postmaster-General appealed to the House of Lords, where his appeal was dismissed with costs.

Lord Birkenhead, in delivering judgment, regretted that the Postmaster-General did not leave the matter after the admirable judgment of the learned County Court judge. It was a perfectly hopeless appeal.

Lord Carson said it seemed to him that the Postmaster-General wanted to lay it down that he could do no wrong, and if he did a wrong, that he could ask someone else to pay for it.

Tramways and Light Railways Association.

Annual Congress at Swansea.

The fifteenth annual congress of the Tramways and Light Railways Association was held at Swansea last week, the attendance numbering over 150. Mr. C. G. Tegetmeier, chairman of the Council of the Association, presided.

Papers, which will be dealt with in our next issue, were read by Mr. A. W. A. Chivers on "Tramways, and some of To-day's Problems," and by Mr. W. E. Ireland on "Tramway Rolling Stock." The discussions which followed were well sustained.

During their stay, the delegates were entertained by the Swansea Harbour Trustees, the British Electrical Federation, the Swansea Improvements and Tramways Co., and the Mayor of Swansea.

Birmingham and District Electric Club.

Visit to B.T.-H. Works at Rugby.

Members of the Birmingham and District Electric Club paid a visit to the Rugby Works of the British Thomson-Houston Co. last week. The saloons of the party were taken direct to the special siding attached to the works; lunch was served in the staff canteen, after which the party was conducted over the various departments by special guides. The foundry, the controller shops, etc., were all examined with great interest, and automatic apparatus for the remote control of sub-stations was the subject of special attention. After tea the party went over the "Mazda" lamp works, and we understand that the whole experience is one which none of the members would willingly have missed.

Books Received.

"Science Abstracts." Sections A. and B. Vol. 26, part 4, No. 304. (London: E. and F. N. Spon.)

"Atomic Structure and Spectral Lines." By Arnold Sommerfeld. (London: Methuen and Co.) Pp. 626. 32s. net.

"Radiotélégraphie et Radiotéléphonie a la Portée de Tous." By G. Malgorn. (Paris: Gauthier-Villars et Cie.) Pp. 231. 10 fr.

"Converting a Business into a Private Company." By H. W. Jordan. Third edition. (London: Jordan and Sons.) Pp. 48. 1s. net.

"L'Eclairage. Solutions modernes des problemes d'éclairage industriel." By E. Darmois. (Paris: Gauthier-Villars and Cie.) Pp. 280. 15 fr.

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Empire Trade.

Difficulties and Prospects as Seen by the F.B.I.

The Federation of British Industries appointed early this year a committee to consider the question of inter-Imperial trade. They now present the first interim report of this committee to the Government. Others will be presented later.

The report deprecates the tendency in certain quarters to adopt the attitude that the economic difficulties of this country can be entirely solved by rapid and considerable development of trade with the Dominions, and that in Empire markets will be found the means of restoring trade lost in other parts of the world. On the evidence of trade statistics alone they hold such an assumption is untenable. For instance, British export figures show that the ratio of Imperial to foreign trade has remained practically constant over the period 1913-1922. Thus the total United Kingdom exports in 1922 were 68·9 per cent of the pre-war figure; the total exports to the Empire being 70 per cent. of pre-war, as against a total for foreign countries of 68·2 per cent. They point out that many of our existing manufactures being intended for a white population in a state of high civilisation, it is useless to expect that the relatively small white population of the Empire, however high its individual purchasing capacity per head, can take the place of our European markets as consumers of British goods in any near future.

The Federation welcomes the summoning of the Imperial Economic Conference, and suggests that every year subsidiary conferences, consisting of high commissioners and other resident representatives of the Dominions of this country, together with the representatives of the British Government departments concerned, should be held to deal with matters of detail. A small permanent secretariat should, they suggest, be instituted, charged with following up the results of one conference and preparing for the next.

Empire Wireless.

The Empire is already fairly well linked up, and with the completion of the projected high-power wireless schemes (which the F.B.I. hope will be put into operation at the earliest possible moment) the only parts of the British Empire outside the chain will be the British West Indies and the Crown Colonies in Africa. The Federation suggests, therefore, that the Government should seriously consider the erection of a local system of wireless throughout the British West Indies, with a station for communicating direct with Great Britain. Similarly, the Crown Colonies in Africa could be linked up into the chain by the station which is to be erected at Capetown.

Forty Years Ago.

"The Electrician," June 30th, 1883.

Electric Lighting at the Reform Club.—The electric light at this club, where the Elphinstone-Vincent machine is working Woodhouse and Rawson's lamps, has given so much satisfaction that the committee are now extending it to the billiard room.

* * *

The Dynamicables.—The idea, originating in Paris, of electricians meeting together for the purpose of dining and an evening's social intercourse has borne fruit in London, and a society under the name of the Dynamicables is gathering into its folds all those convivial spirits who like to meet and wyne. Each meeting has a new president, the principal function of the president being to nominate his successor. Each member has the pleasure of paying a half guinea subscription per annum, and also of paying for his dinner. The next meeting of this social club will be held at the Fisheries' Exhibition the first Friday in July.

* * *

The Future Electrical Engineer.—The electrical engineer of the future, says the "Mechanical World," must have a sound practical training in the schools and shops, and more especially in the latter. He must be well grounded in the physical sciences and in mechanics, for he will have under his control complicated engines and machinery, and in their installation will have to be prepared for unexpected contingencies. He must be able to select the best engines and boilers for his purpose, to put them down, and design the best means for driving his machines; be prepared for breakdowns, with the best means for preventing and remedying them without calling in the advice of his brother the mechanical engineer. In hydrostatics and pneumatics, because of the analogies existing between these and electricity and magnetism. In sound, light and heat for a similar reason. In electricity and magnetism, in order that he may be acquainted with the basic theory of his profession, whatever it may happen to be at the moment. Besides all this, he must be a fair mathematician, and have a little more than a smattering of chemical knowledge.

"Meg's" Success.

About nine months ago we visited the works of Evershed and Vignoles and inspected their new "Meg" insulation tester, an account of which duly appeared in these columns. The other day we received an ash tray which, as is the way with such things, artistically advertises the Meg. Being an unrepentant smoker, we shall find great use for this, but what is puzzling us is how to connect Megs and ash trays without being uncomplimentary. So far we have not succeeded, but the inspiration may come before long. What does not puzzle us or surprise us is to learn that the demands for this instrument both at home and abroad are very large. We congratulate its makers.

Electrical Contractors' Association.

Annual General Meeting and Report.

The annual general meeting of the Electrical Contractors' Association, Incorporated, the N.E.C.T.A., Ltd., and the National Federated Electrical Association, was held at the offices of the Association on June 20th, when the accounts and annual report were adopted and other business transacted. The chair was occipied by the president, Mr. Marryat, who remarked that the year under review had been one of considerable development for the three Associations. Fifty meetings of the Council and Chief Committees had been held, and he had attended a total of 200 meetings, conferences, arbitrations, etc. During the year, new offices had been taken, and the whole of the office routine revised.

So far as the E.C.A. was concerned, Mr. Marryat drew attention to the constitution of the registration authority formed under the scheme for the voluntary registration of electrical contractors. The E.C.A., he said, is adequately represented on the authority.

Dealing with the N.E.C.T.A., Mr. Marryat referred to the report on the Special Committee dealing with the trading policy of the Association. An abstract of this report appeared in The Electrician, May 4th, p. 485. During the year, a new agreement had been made with the C.M.A., and a new one was now being negotiated with the E.L.M.A., The opinion of the Council was that the trading position of the Association was never better. The Propagandist Committee had been renamed the Development Committee, and had been active in recruiting new members. A sign had been adopted for the use of members, and the Association's subscription to the E.D.A. had been largely increased, certain specific advantages being sought in return.

Relations with Labour.

Mr. Marryat then dealt with the National Federated Electrical Association, remarking that relations with labour remained on a most friendly footing. The Industrial Councils had worked well, as had the National Sliding Scale Agreement, which had been honoured in all cases. The subsidy fund had been maintained, and had accumulated to a substantial figure, which had stood between them and trouble in at least two districts during the year. The Apprenticeship Committee had made recommendations regarding wages, and had dealt actively with the question of training apprentices.

During the year the membership of the three Associations had been immensely strengthened. This was not reflected in the Official Return of membership, there having been during the year a large number of resignations which had been voluntarily accepted from the firms whom it was felt were no asset to the Association. The new firms which had been admitted to replace these were substantial concerns, adding greatly to the Association's strength in trading and labour negotiations.

Mr. Marryat proceeded to express his appreciation of the work of Mr. Tate and his staff. The work carried out in the office was far greater than was generally understood. Looking to the future, the problems which, in his considered opinion, required the most urgent attention of the Council were:—

(1) The extension of the trading agreements upon the lines of the declared trading policy. This would necessitate facilities being given to many firms to enter the N.E.C.T.A., Ltd., who were at present unable to do so, and would ultimately result in improved financial benefit to the members.

(2) The increasing competition of small and irresponsible firms.

(3) The formulation of an active policy of co-operation with electricity supply authorities in the development of the use of electricity.

The New President.

It was then intimated that the offices of president and vice-president for the ensuing year had been accepted by Mr. R. Robson (Newcastle-on-Tyne) and Mr. Walter Riggs (London), respectively.

Mr. W. A. Shaw moved a vote of thanks to the retiring president, and stated that Mr. Marryat had presented several thousands of pounds to the Association as the result of twenty years of work upon "The Electrical Contractor." Mr. W. R. Rawlings, seconding, paid a tribute to Mr. Marryat's ability in the chair and said they had never had a more able president and one who had put in more work for the Association.

The motion was carried by acclamation, after which the incoming president, Mr. R. Robson, and vice-president, Mr. W. Riggs, addressed the meeting. Both speeches were received with applause, the outline of future policy laid down by Mr. Robson receiving marked approval.

I.E.E. London Students.

Summer Tour to Belgium and Holland.

A summer tour to Belgium and Holland has been arranged by the London Students' Section of the Institution of Electrical Engineers. The party will leave London on July 24th and return on August 3rd. Visits will be paid to works at Antwerp, Liege, Eindhoven, and Hengelo, and pleasure trips will include a visit to the grottoes of Han and Rochefort, a tour round Brussels and a steamer excursion to Dinant.

Mr. A. C. Warren, chairman of the section, informs us that the tour is already an assured success, but that further applications will be welcomed. These should be addressed to him at 47a, McLeod Road, Plumstead, London, S.E.18.

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Imperial Notes.

AUSTRALASIA.

Progress of the Morwell Electricity Scheme.

Some of the electrical generators at the Morwell works of the Victorian Electricity Commission are expected by the chairman of the Commission, Sir John Monash, to be ready for commercial operation early in 1924. Two of the turbo-generator sets have been partially erected, over 350 steel towers for the transmission line from Yallourn to Yarraville have been put in position, and a deposit of coal 175 ft. in thickness has been revealed by the operations that have been carried out.

Victorian Electricity Commission's Distribution Powers.

If the Victorian Electricity Commission's policy in regard to the distribution of electricity is repugnant to some of the municipal councils, their disapproval is not shared in all cases by the ratepayers. Warrnambool Council decided to retain the distribution powers in their own hands. The ratepayers, to show their disapproval of this policy, refused on a poll to sanction the necessary loan. In other towns of South-West Victoria the councils have agreed that the distribution shall be done by the Commission.

The New Pacific Cables.

Mr. J. A. Milward, manager in Australia of the Pacific Cable, states that it has been definitely decided to duplicate the cables south of Suva. A cable is to be laid from Southport to Sydney and another from Auckland to Suva direct. The "Colonia" is to leave England during the present month with the cable in her tanks, and the laying of the cables should be completed in August. The duplication between Suva and Vancouver is postponed for the present, with a view to watching the results on the cable recently laid across the Atlantic, and which is expected to reach a very high speed of working.

Melbourne Tramway Developments.

The Melbourne and Metropolitan Tramways Board has submitted to the Railways Standing Committee a scheme of tramways for the development of the Metropolis. The scheme is intended to meet the requirements of Melbourne and suburbs for the next twenty years, by which time it is expected that the metropolis will have a population of nearly 1 500 000.

The board has at present under its control about 46 route miles of cable tramways and 70 route miles of electric tramways, and it has obtained authority from the Governor-in-Council to construct about 22 route miles additional.

The scheme provides for the construction of 83 miles of double track and 51 single, estimated to cost £4 000 000, and it is expected that, during the next decade or so, the board will have to spend another £4 000 000 in converting the cable tramways to electric traction. The scheme provides for the extension of the electric tramways into new industrial centres to the west of Newport and Yarraville, and in the direction of Sunshine; and also for extensions in the northern and eastern suburbs and to the beaches at Brighton and Sandringham in the south. More routes into Melbourne are to be provided.

The committee notify that they will give formal endorsement of the scheme. When the board propose to proceed with a particular line those interested may appear before the committee and support the route chosen or seek an alteration.

EAST AFRICA.

A New Power and Lighting Company.

Particulars of the East African Power and Lighting Co., Ltd., were filed in London on June 13th, pursuant to Section 274 of the Companies (Consolidation) Act. The capital is "7 000 000 shillings" in 350 000 shares of 20 shillings each. The company was incorporated in Kenya Colony, under the Indian Companies Acts 1882 to 1900, on January 6th, 1922, to acquire the undertakings and all or any of the assets and liabilities of: (*a*) The Nairobi Electric Power and Lighting Co., Ltd., and (*b*) the Mombasa Electric Light and Power Co., Ltd.; and to carry on electrical business and construct works in the colony and Protectorate of Kenya, the Uganda Protectorate and Tanganyika Territory. Each share confers one vote. The directors were authorised by the original articles to borrow, without the sanction of a general meeting, up to 3 000 000 shillings. By special resolution dated January, 1923, this limit was increased to 6 000 000 shillings (£300 000). The British address is at Basildon House, Moorgate, London, E.C.2, where A. W. R. Lovering, chartered secretary, is authorised to accept service of process and notices on behalf of the company. The directors in Nairobi are: C. Udall, V. M. Newland, M. Maxwell and G. A. H. Hamilton. The Local Board in London consists of J. T. B. Stone, Sir Thomas O. Callender and O. K. A. Moncrieff.

INDIA.

Calcutta Tramway's Improved Dividend.

In submitting their report for the year ended December 31st last, the directors of the Calcutta Tramways Co. state that the accounts having been made up on the basis of the par value of the rupee being taken at 1s. 4d., it is not possible to give comparative figures, as the accounts in 1921 were made up on the basis of 2s. per rupee. The revenue account shows a credit balance of £105 236, to which is added £12 096 brought forward, giving a total of £117 331. After allowing for debenture interest and the preference share dividend, there remains a balance of £82 574. It is proposed to reserve £45 000 for depreciation; to make a contribution to the staff provident fund of £1 845, and to pay a dividend on the ordinary shares of 5 per cent., free of tax, for the year, leaving £1 327 to be carried forward. The dividend for 1921 was 3 per cent., free of tax.

Foreign Notes.

EUROPE.

Proposed Tube Railway at Genoa.

The Italian correspondent of the "Financial Times" states that a concession has been granted to an Italian company, financed by Spanish-French groups, for the construction of a tube railway at Genoa. The works are estimated to cost ultimately 150 000 000 lire, and it is expected they will start early next year.

Proposed Italian Cable Extensions.

A message from Rome states that developments are to be undertaken by the Italian company of Under-Sea Telegraph Cables. As the result of negotiations of the Bank of Italy and other leading banking houses, the capital of the company is to be increased, and within three years cables are to be laid between Italy, Spain, Brazil and Argentina; from the Azores direct to North America; and between Italy and Greece.

Norwegian Hydro-Electric Power Stations.

The Norwegian Government, says "Engineering," has promised to bring forward a measure for State support to a number of hydro-electric power stations in different parts of the country. A number of power stations have applied for State aid and the department concerned has now sifted the applications. It appears that 40 municipal hydro-electric power stations are in difficulties, the cost of the installations amounts to 192 000 000 kr., and they leave a yearly deficit of 5 600 000 kr. What shape the contemplated State aid will take has not yet been decided. The Secretary of State has reported that by January 1, 1923, there were altogether about 1 000 000 000 kr. invested in Norwegian hydro-electric power stations and installations for the ordinary supply of electric energy alone. The Government is also preparing measures dealing with the completion of the large Nore power stations and the transmission of power to Hedmark and Opland. It is estimated that power from Raanaasfos and Mörkfos should be available by the end of 1924.

Swiss State Telegraphs and Telephones.

The report on the working of the Swiss Government Telegraph and Telephone Administration for 1922 states that the profit on the two sections combined was 932 370 fr., compared with a deficit of 1 948 695 fr. for the preceding year. This profit was, however, entirely earned by the telephone section, on which the surplus was 5 315 800 fr., the telegraph business showing a deficit of 4 383 430 fr.

The Swiss radiotelegraph station at Berne operated by the Marconi Radio-Station Aktiengesselschaft Bern was opened on April 12, 1922, and has been in regular communication with Great Britain and Spain, and a limited amount of traffic has been exchanged with Poznan and Cracow (Poland), Brunn (Czecho-Slovakia) and Moscow. Messages dealt with by the Swiss station up to the end of the year were 99 606 originating and delivered in Switzerland and 141 through communications originating and delivered outside the country.

Automatic telephone switching is being adopted. Full automatic working is expected to be in operation by the end of 1923 at the Montblanc exchange, Genf, and at the Lausanne exchange, by 1924 at the Hottingen exchange and by 1925 at the Limmat exchange, both in Zurich. The Selnan exchange, Zurich, is to be converted to full automatic by 1926 and a new full automatic station, to be named the Uto, is also to be opened at Zurich by 1926. Other projected full automatic stations are the Bollwerk, Bern (to be opened in 1925) and one to be opened in the same year in the building occupied by the existing exchange at Basle.

LATIN AMERICA.

New Power Station in Argentina.

The "Review of the River Plate" states that Señor Mayorino Rossi has been authorised to establish and operate an electric power station at Altos de Chipión, in the Department of San Justo, Argentina.

An Association of Electrical Interests.

As mentioned at the annual meeting of the Argentine Tramways and Power Co., a scheme has been arranged for associating the interests of the company with those of the Cordoba Light, Power and Traction Co. It is proposed that an exchange or purchase of the debenture stock and shares of the Argentine Co. for debenture stock and shares of the Cordoba Co. shall be made on the following terms: The 5 per cent. debenture stock of the Argentine Co. to be exchanged for 6 per cent. debenture stock of the Cordoba Co. on the basis of £85 of the latter stock for each £100 of the former, each 7 per cent. preference share of £1, fully paid, of the Argentine Co. to be exchanged for one 7 per cent. cumulative preference share of £1, fully paid, of the Cordoba Co., ranking for dividend as from April 1st, 1923, and each ordinary share of £1, fully paid, of the Argentine Co. to be exchanged for one ordinary share of £1, fully paid, of the Cordoba Co., ranking *pari passu* with the existing shares.

Mr. W. S. Poole, the chairman, and Mr. C. R. Hoare, a director of the Argentine Co., are to be elected to the Board of the Cordoba Co. The third director of the Argentine Co., Mr. H. F. Gunning, will retire.

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Electricity Supply.

Extensions and Developments.

CHEADLE and GATLEY Urban Council has received from the Commissioners sanction to a loan of £10 000 for mains and services.

KING'S LYNN Town Council has deferred until September the question of holding an electricity exhibition. Information is to be obtained as to the cost.

FULHAM (London) Electricity Committee recommends that an expenditure on mains capital account amounting to £8 784 be authorised for mains extensions.

GLASGOW Corporation Electricity Committee has recommended to the Corporation that application be made to the Commissioners for authority to borrow an additional sum of £2 000 000 to meet the capital expenditure on additional plant and the extension of mains, etc., during the next three years.

PRESTON Electricity Committee has decided to provide a separate sub-station near the Dock, the engineer to report further as to a site for a sub-station at Ribbleton. Following negotiations with the English Electric Co. as to terms for the supply of current, the committee recommends the Council to enter into an arrangement to establish a joint sub-station on the firm's premises in Strand Road.

The "Scotsman" states that H.M. the King will perform the opening ceremony of the new power station at PORTOBELLO during the visit of the King and Queen to Edinburgh next month. The anticipated date is July 11th or 12th. In connection with the new EDINBURGH and LOTHIANS electricity area, the new company, who have arranged with the Edinburgh Corporation to distribute current in the Lothians, have now acquired the Lothians Power Co. The scheme whereby electricity is to be conveyed over East and Mid Lothian areas is now completed, and the building of the first sub-station at Monkton Hall, near Musselburgh, has commenced. This sub-station is to be completed early in August. The construction of the other buildings for Lasswade, Tranent and Haddington is being pushed forward.

Alterations in Charges, Proposed and Actual.

WILLESDEN Electricity Committee recommends a reduced lighting charge of 4½d. per kWh, and a reduced charge for heating and cooking of 1½d. per kWh. Other reductions are also recommended.

HOYLAKE and WEST KIRBY Electric Supply Committee has decided that the price for power shall be reduced at the end of June from 3½d. to 3d. per kWh for first 500 kWh, and from 3d. to 2½d. per kWh beyond.

EXETER City Council has reduced the charges for electricity to 6d. per kWh for lighting, to 3d., 2½d., and 1½d. per kWh for power and heating, and for tramways from 2d. to 1½d. per kWh for above 500 000 kWh per annum.

BATH Electricity Committee has recommended the Town Council to reduce the charge for electricity for lighting by 1d. per kWh and for power by ½d. per kWh, bringing the latter price down to the pre-war charge of 1¾d.

WINCHESTER City Council has applied to the Ministry of Transport for an order fixing the maximum prices at those authorised by the Temporary Increase of Charges Order, namely, 9d. per kWh with minimum payments of 11s. 3d. for each winter quarter and 7s. 6d. for each summer quarter.

The LANCASHIRE Electric Power Co. announces the following new scale of charges from the end of June:—Lighting, 6d. per kWh, or 1s. 6d. per quarter per 33 W installed, plus 1½d. per kWh; heating, cooking, and domestic power, first 250 kWh per quarter, 2d. per kWh; beyond, 1½d.; small industrial power, first 1 000 kWh per quarter, 2½d.; beyond, 1½d. per kWh. The minimum charge per quarter has been reduced to 7s. 6d.

A scheme for providing cheaper electricity for window lighting purposes is before the ST. PANCRAS (London) Borough Council. On a consumer notifying that he wishes to avail himself of the reduced charge for shop window lighting after 7.30 p.m. until 10.30 p.m., or later, a reading of his meter will be taken at 7.30 p.m., and the window lights left on to whatever hour he may require the lighting to extend. The number of kilowatt-hours consumed will be ascertained, and from this the total number of kilowatt-hours utilised for each winter quarter will be arrived at and credit given on the account so that these units may be charged at 2d. per kWh.

Tapping New Areas.

BUILTH WELLS Chamber of Trade is to discuss at its next meeting an electric light scheme for the town.

ROMSEY Town Council is considering the question of obtaining a supply of electricity for the borough.

DARFIELD URBAN COUNCIL has accepted the terms of the Yorkshire Electric Power Co. for a supply of electricity for street lighting.

EXETER Town Council has decided to apply for a special order authorising the Council to supply electricity in the parish of Topsham.

HOLYWOOD (Co. Down) Urban Council has decided to acquire a site at Seapark, extending to 2½ acres, for the erection of a power station in connection with the electricity scheme.

AXMINSTER Rural Council has consented to the application of the North Somerset Electric Supply Co. for an order to supply electricity to parishes in the Council's area. The proposed maximum charge is 11d. per kWh.

Inquiries and Orders.

The Cleveland Trust has applied to the Electricity Commissioners for a Special Order to supply electricity in SALTBURN-BY-THE-SEA urban district. Objections to the Secretary, Electricity Commission, Whitehall, London, by July 16th.

The THAMES VALLEY ELECTRIC SUPPLY Co. has applied to the Electricity Commissioners for a Special Order authorising the company to produce and supply electricity in the borough of Henley-on-Thames and parts of Henley and Wokingham rural districts.

CALNE Corporation is applying to the Electricity Commissioners for a Special Order authorising the generation and supply of electricity in the borough of Calne and parts of the parishes of Calne Without, Bremhill, Cherhill, Compton-Bassett, Heddington and Hilmarton. Any objections must be sent to the Secretary, Electricity Commission, Whitehall, London, by July 14th.

The STRATHCLYDE ELECTRICITY SUPPLY Co. has applied to the Electricity Commissioners for a Special Order authorising the company to purchase and supply electricity in the parishes of Eastwood and Mearns (Renfrewshire), Carmunnock and East Kilbride (Lanarkshire). Objections are to be sent to the Secretary, Electricity Commission, Whitehall, London, by July 14th.

KETTERING Urban District Council is applying to the Electricity Commissioners for a Special Order extending the Council's electricity supply area so as to include Market Harborough, Desborough and Rothwell urban districts and certain parishes in Market Harborough, Oxendon, Kettering and Wellingborough rural districts. Objections to the Secretary, Electricity Commission, Whitehall, London, by July 16th.

Miscellaneous Supply Items.

The new Advisory Committee appointed to investigate the development of electricity supply in SOUTH WALES and MONMOUTH met for the first time on June 7th, Mr. Roger T. Smith (Great Western Railway) being nominated chairman. The Committee has been formed on the advice of Sir John Snell to succeed an earlier Committee which has been in existence since February, 1921. It will have no executive functions, its principal work being to propose a scheme for submission to the Commissioners in due course. Mr. Lewis W. Dixon is hon. secretary and treasurer. He has acted in this capacity to various Committees since 1916 and has done a large share of the work.

At SKIPTON District Council, last week, reference was made to the differences which have arisen between Yorkshire Electric Power Co. and Keighley Corporation. Mr. Farey stated that Skipton was suffering because of these differences. It was thought that the position had been overcome, but it had reasserted itself. He thought the Commissioners might end the difficulty so far as Skipton was concerned by authorising a supply to be provided. It was ridiculous that Skipton should be made to suffer because a public company and a Corporation could not agree. The Council had offered to put down their own plant, subject to the consent of the Commissioners, and so generate their own current.

Personal Items.

Lytham St. Annes Council has fixed the salary of Mr. J. FAIRCHILD, assistant electrical engineer, at £450, inclusive of bonus.

Mr. KENNETH R. STUART has been appointed manager of the Sheffield branch of Crompton and Co., with offices at 8, Norfolk Row.

Mr. HAROLD J. BROCKLEHURST, of Metropolitan-Vickers Electrical Co., was married at Liverpool, last week, to Miss Dorothy Harrison.

We are glad to learn that Mr. C. H. WORDINGHAM, who has had acute bronchial trouble, is making good progress, although under medical advice he is still remaining indoors.

Mr. ROWLAND DUNKERLEY, chief works accountant of the Metropolitan-Vickers Electrical Co., has been elected Chairman of Council of the Institute of Cost and Works Accountants, for the ensuing year.

The Glasgow City Council has, after discussion, approved of the tramways manager, Mr. J. DALRYMPLE, attending the annual convention of the American Electric Railway Association in Atlantic City next October.

Dover Electricity Committee has appointed Mr. C. S. GRIEFF, power station superintendent at Paisley, and previously assistant engineer of the Reading Corporation Tramways, as superintendent of the Electricity Works, at a salary of £387 3s. 10d. per annum. There were 169 applicants.

Mr. F. PEDLEY, of Bingley, has been appointed electrical engineer by the Worksop Urban Council, at a salary of £450 per annum. There were about 150 applicants for the position. The Council's retiring electrical engineer, Mr. J. P. CROWTHER, has accepted an appointment with the Yorkshire Electric Power Co.

Mr. T. PIERSON FRANK, Plymouth borough engineer, who is taking up an appointment with Cardiff City authority, was the recipient of a handsome silver salver, suitably inscribed, as a parting gift from the indoor staff of the Plymouth department, as a mark of their esteem, and an expression of their good wishes.

OBITUARY.—Mr. J. ANNAN BRYCE, who died on Monday, was chairman of the British Westinghouse Co., becoming later chairman of the Metropolitan-Vickers Electrical Co. when the latter concern absorbed the former. He retired in 1922.

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Tenders Invited and Accepted.

GREAT BRITAIN.

BIRMINGHAM CORPORATION, July 2nd.—(1) Wiring and fitting; and (2) five-wire balancer set, for new salvage works at Witton; and (3) five-wire balancer set for Montague Street destructor works Specification, etc., from Mr. J. Jackson, Salvage Department, 161, Corporation Street, Birmingham.

CHORLEY PARISH CHURCH INSTITUTE, July 2nd.—Electric light wiring and fitting. Plans can be seen at the Institute, Park Road, Chorley, Lancs.

RHYL URBAN DISTRICT COUNCIL, July 3rd.—Two 300 kW motor converters or rotary sets, one 150 kW ditto, h.t. and l.t. switchgear, and alterations to l.t. board. Specification from the Engineer, Electricity Works, Rhyl.

SHOREDITCH (LONDON) BOROUGH COUNCIL, July 4th.—One water-tube boiler (not less than 40 000 lbs. evaporative capacity), two superheaters, coal bunkers and conveying plant, and one 1 500 kW converter. Specifications from the Borough Electrical Engineer, Coronet Street, Shoreditch, N.1.

MILE END (LONDON) GUARDIANS, July 5th.—Electrical fittings, engineers' materials, etc. Forms of tender from the Clerk, Bancroft Road, Mile End, E.1.

SOUTHEND CORPORATION, July 5th.—100 tons Sandberg steel tramway rails. Specification from the Borough Engineer.

BOROUGH OF HACKNEY CLUB, July 6th.—Electric light wiring and fitting. Specifications from the Secretary, Borough of Hackney Club, 27 and 29, Haggerston Road, London, E.8.

HULL CORPORATION, July 6th.—Ponds, foundations for cooling towers, inlet and outlet to drain, etc., in connection with electricity works extension.

BOLTON GUARDIANS, July 9th.—Electric light wiring and fitting at Townley's Hospital. Specifications from Mr. John Ward, 24, Mawdsley Street, Bolton.

EDINBURGH CORPORATION, July 9th.—Pavement box frames and covers and fireclay pipes, for the Electricity Department. Specifications from the Engineer and Manager.

HALIFAX EDUCATION COMMITTEE, July 9th.—Wiring and fitting Pellon Lane and Booth Town council schools and St. Augustine's voluntary school. Specifications from the Borough Engineer.

BLACKPOOL EDUCATION COMMITTEE, July 16th.—Electric light wiring and fitting of Devonshire Road school. Particulars from Education Offices, Municipal Buildings, Blackpool.

CARDIFF CORPORATION, July 16th.—Wet-air filter for 5 000 kW turbo-alternator, and setting for two boilers and economisers. Specifications from the Electrical Engineer, The Hayes, Cardiff.

LONDON COUNTY COUNCIL, July 16th.—Supply and maintenance of 200 sets of tramcar motors, with accessories. Specification from the General Manager, L.C.C. Tramways, Victoria Embankment, W.C.2., on and after July 2nd.

AUSTRALASIA.

NEW SOUTH WALES GOVERNMENT RAILWAYS AND TRAMWAYS, August 8th.*—Six water-tube boilers with electrically-driven mechanical stokers, forced-draught fans, etc., for White Bay power house.

IRELAND.

MINISTRY OF FINANCE OF NORTHERN IRELAND, July 3rd.—Electric lighting of bungalow hostels at Stranmillis. Specification from the Secretary, 15, Donegall Square West, Belfast.

BELFAST CORPORATION, July 6th.—Wiring 50 parlour houses on Woodvale Road site. Specification from the City Surveyor.

URUGUAY.

STATE ELECTRIC LIGHT WORKS, MONTEVIDEO.*—Eight overhead transporters, each capable of lifting 3 000 kilogs.

WICKLOW URBAN DISTRICT COUNCIL has accepted the tender of the Irish Electrical Construction Co. for cables, £1 899.

DURBAN (NATAL) CORPORATION have placed a contract with D. Adamson and Co. for electro-pneumatic sewage lifting plant.

WEST HAM CORPORATION is recommended to accept the tender of the English Electric Co. for a 1 000 kW rotary converter, £3 765.

DEWSBURY CORPORATION has accepted the tender of Whitehead and Poole for sewage screens, £2 684, and electrically driven pumps, £3 009 6s.

The tender of the Hewittic Electric Co., Ltd., for an electric vehicle charging apparatus at £690, has been accepted by DOVER CORPORATION.

SALFORD CORPORATION is recommended to accept the tender of Maitland and Co. for electric wiring and fitting at Ladywell Sanatorium, £312 10s.

HACKNEY (LONDON) BOROUGH COUNCIL has accepted the tender of the Cape Asbestos Co. for lagging pipework in the power house extension at £408 12s.

For electric wiring and fitting on Cathcart Road housing site, the tender of White, Thomson and Co., £557 6s. 5d., has been accepted by GLASGOW CORPORATION.

HAMMERSMITH (LONDON) BOROUGH COUNCIL is recommended to accept the tender of Fenn and Co., £100, for wiring and fitting St. Mary's Church, Stamford Brook.

*Particulars from the Department of Overseas Trade.

HUDDERSFIELD CORPORATION has placed a contract with the English Electric Co. for 10 top-covered tramcars, including trucks and electrical equipments, comprising D.K. 30 motors and D.B.1 K.3 controllers.

MACCLESFIELD CORPORATION has accepted the tender of Whitehead and Poole for two sets of sewage screens, with electrically driven raking and screening apparatus with electric motor and worm reducing gear.

The tender of Bolckow, Vaughan and Co. (lowest tender) for 10 tons of tramway fishplates, £14 per ton, has been accepted by DUNDEE CORPORATION. Seven tenders were received, the highest being £18 15s. per ton.

The tenders of the Metropolitan-Vickers Electrical Co. for transformers, £470 11s, and Bertram Thomas for switchgear, £784 and £55, for Reyrolle ironclad cubicles, have been accepted by STRETFORD URBAN DISTRICT COUNCIL.

FULHAM ELECTRICITY AND LIGHTING COMMITTEE recommends the acceptance of the tender of the British Electric Transformer Co. for six 200 kW transformers, at a cost of £1 228 10s. Nine tenders were received, ranging from £678 to £1 398.

The tenders of Bolckow, Vaughan and Co. for 50 tons of steel rails, £12 8s. 4d. per ton, and Hadfields, Ltd., for crossings, switches, fishplates, etc., for Lower Broughton Road, £1 553 15s., are recommended for acceptance by SALFORD CORPORATION.

RUGBY URBAN DISTRICT COUNCIL has accepted the tender of the British Thomson-Houston Co. for equipment of transformer substation in Union Street, and for six 30 kVA s.p. transformers, and that of British Insulated and Helsby Cables, Ltd., for cables, etc.

The tenders of the Underfeed Boiler Co. for ash-handling plant at the east and west boiler houses of the electricity works, £2 925 and £7 369 respectively, and Ferguson, Pailin Ltd., for switchgear, £13 383, have been accepted by MARYLEBONE (LONDON) BOROUGH COUNCIL.

STEPNEY (LONDON) BOROUGH COUNCIL has accepted the tender of L. G. Tate and Co. (lowest tender) for electric light wiring and fitting (in place of the present gas lighting) at the Coroner's Court, mortuary and disinfecting station, at £145. Six tenders were received, the highest being £297.

Tenders accepted by SOUTHEND CORPORATION include the following: Electricars, Ltd., tower wagon (60 cell battery), £995; Hicks-Diesel Engine Co., four-stage compressor, £245; Spencer Bonecourt, Ltd., 3 boilers, with superheaters, £1 336; Edison Accumulators, Ltd., battery for Edison tipping wagon, £600.

HAMMERSMITH (LONDON) BOROUGH COUNCIL is recommended to accept the tender of the Park Royal Engineering Co. for distribution boards and circuit breakers, standard type, £258 10s. The same firm tendered for artic type, £442 10s. There were nine other tenders, varying from £426 to £527 14s. for artic type, and from £236 to £474 for standard type.

ST. PANCRAS (LONDON) BOROUGH COUNCIL is recommended to accept the following tenders: E. Green and Sons (lowest tender) for supply of new economiser at the Prince of Wales' Road Baths, £1 298 10s. (three tenders received, highest £1 395); British Thomson-Houston Co., supply of additional cubicle to h.t. switchgear at the Regent's Park Station, £413.

LONDON COUNTY COUNCIL has accepted the following tenders: Globe Pneumatic Engineering Co. (lowest tender in accordance with specification) for two air-compressing equipments for use by permanent-way branch of Highways Department, £1 086 17s. (nine tenders received, highest £1 425 4s.); Pirelli General Cable Works (lowest tender) for additional l.t. cables and alterations to existing l.c. cables, £2 001 15s. 3d. (ten tenders received, highest £3 020 5s. 5d.)

STEPNEY (LONDON) BOROUGH COUNCIL is recommended to accept the following tenders: D. P. Battery Co., new battery for electric vehicle, £174 8s. (one other tender received, £182 12s.); Crow, Catchpole and Co. (lowest tender), 50 tons of pitchwork, £386 19s. 1d. (four tenders received, highest £462 10s.); J. MacLennan and Co., 1 000 rolls of 1 in. white tape, £89 7s. 6d. (three other tenders from £89 7s. 6d. to £113 15s.); E. and F. Wright, 72 c.i. pavement boxes, £193 1s. (one other tender, £197 2s.); Reason Manufacturing Co. (lowest tender), 2½ to 25 A meters for one year, £2 878 6s. 8d. (three tenders received, highest £4 093 15s.); Ferranti, Ltd., 50 and 100 A meters for one year, £85 19s. 6d. (four tenders received, from £72 1s. 6d. to £237 19s. 6d.); Aron Electricity Meter, Ltd., combined meters and demand indicators, 200 to 1 000 A, £111 17s. 3d.; Venner Time Switches, Ltd., time switches, 10 to 25 A, £600 (one other tender, £612 10s.).

GLASGOW CORPORATION is recommended to accept the following tenders for annual supplies of stores and materials: Jas. Allan, sen., and Son, Carron Iron Co., McDowall, Stevens and Co. and R. Taylor and Co., c.i. boxes and pillars; Dempster, Moore and Co., iron tubes and fittings; Enfield Ediswan Cable Works, Ltd., single lead-sheathed and insulated cable, 660 V 4-core and 2-core cable and flexible cables; Callender's Cable and Construction Co., concentric and triple concentric insulated cables, telephone cables, 660 V, 2-core, 3-core and 4-core insulated cables and e.h.p. cables; W. T. Glover and Co., e.h.p. cables; Craigpark Electric Cable Co., rubber-covered cables; Edison-Swan Electric Co., d.c. ampère-hour meters d.c. watt-hour meters and a.c. meters; Chamberlain and Hookham, d.c. ampère-hour meters; Metropolitan-Vickers Electrical Co., a.c. meters; Ferranti, Ltd., d.c. ampère-hour meters; Beacon Carbons, Ltd., and General Electric Co., arc lamp carbons.

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Electric Traction.

Tramway Extensions and Developments.

Through cars are now running on the route between Musselburgh and EDINBURGH. The new electric section between Murrayfield and Corstorphine has been passed by the Board of Trade Inspector, and is now working.

Mr. E. S. Rayner, manager of the HULL tramways, has designed a new type of light tramcar, the weight of which is 8 tons, with seating capacity for 64. The special feature is a new method of transmission by a worm-drive, effecting considerable saving in the maintenance, cost and current consumption.

The 21st anniversary of the opening of the tramways in the CHATHAM district was celebrated on June 16th, when a smoking concert was held. The general manager of the Tramways Co., Mr. W. Jenson, presided, and during the proceedings he was presented by the staff and employees with a fumed oak chiming bracket clock. Two of the oldest employees, Mr. Bexley and Mr. Taylor, each received a silver cigarette case and a pipe.

Fares, Receipts and Passengers.

For the week ending June 16th, receipts on LONDON tramways under "Underground" control, amounted to £41 395 as against £46 826 in the corresponding week last year.

Reference was made in this column last week to the experiment of issuing weekly passes at 2s. each on the Lidget Green route, BRADFORD Corporation tramways. It is not known yet whether the experiment has proved successful, but the number of passes so far sold is 889, which means that more than a quarter of the people who use the route daily have availed themselves of the facility. It is expected that more passes will be sold. Interviewed by the "Birmingham Post," the general manager of the Birmingham Corporation tramways said he thought that such a system would be quite impracticable in Birmingham.

Electric Railway Items.

The contract has been placed by the LONDON "Underground" for the construction of a terminal station at Edgware on the extension now being constructed from Golders Green. The price is £16 690 and the contractors are J. Parkinson and Son.

It is reported that the heat wave in the United States temporarily put out of operation the NEW YORK Central Railroad terminal and suburban service by melting the insulation of the electric power cables and buckling part of the electrically-charged third rail.

Addressing members of the MANCHESTER Rotary Club last week, Mr. F. R. Lankshear said that experiments had not yet gone far enough for the adoption of a general system of railway electrification, and there was also against it the financial consideration. The progress made in regard to the building of steam locomotives had given them a new lease of life. When the time came electrification might be for the general benefit, but the time had not yet arrived.

Business Items.

Mr. A. W. FERGUSON, electrical engineer, has opened premises at 65, Ticthfield Street, Kilmarnock.

T. C. GILBERT AND CO., electrical engineers, Folkestone, have removed their business from 36, Cheriton Road, to 26, Guildhall Street.

BARNES BROS., wireless specialists, 115, Park Street, Southend-on-Sea, have opened new showrooms and offices at Radiex House, Heygate Avenue, High Street, Southend-on-Sea.

The electric installation business of the Dumfries Electricity Supply Co., whose undertaking has been taken over by the Corporation, has been acquired by Mr. W. R. MACAULAY, 34, Lockerbie Road. Mr. Macaulay has for 10 years been in the installation department of the company.

Owing to the need for increased accommodation WM. SANDERS AND CO., switchgear manufacturers, Wednesbury, have transferred their London showrooms from 90, Charing Cross Road to Palace House, 128, Shaftesbury Avenue. The telephone number remains the same, viz., Gerrard 8984.

New sales arrangements have been made by the SUN ELECTRICAL Co. in the Yorkshire area. Mr. J. D. Chisholm has ceased to act as agent of the company, and the branch at 29, Park Place, Leeds, is now under the direct control of the company. Mr. David Fraser has been appointed branch manager, and will take up his duties on August 1st.

The business of A. C. ALEXANDRA AND CO., which has been carried on for some time at 10, Iddesleigh House, Caxton Street, Westminster, London, S.W.1, has now been converted into a private limited company, with a nominal capital of £20 000, for purposes of expansion and development. The business will be carried on as previously under the direct personal supervision of Mr. A. C. Alexandra, who occupies the position of managing director, and he is assisted on the board of directorship by Mr. J. A. Spencer, who has occupied the position of general manager for some time.

Why?

Willesden Electricity Committee recommends that no action be taken in connection with an application by the ELECTRICAL DEVELOPMENT ASSOCIATION for a subscription to "a proposed Electrical Exhibition at Wembley in 1924."

Wireless News.

A New Retailers' Association.

Particulars have been sent us of a new trade organisation to be known as the WIRELESS RETAILERS' ASSOCIATION, and whose aim is stated to be the promotion, development and safeguarding of the interests of retailers of wireless apparatus. The first committee consists of Messrs. E. A. Bagley (chairman), F. S. Horsey, H. C. Willard, G. H. Parker, W. E. Greville, H. H. Pugh, L. Willcocks, H. Spencer Ellen, A. E. Betambeau, and R. Alexander. The secretaries are Clifford and Clifford, 70, Finsbury Pavement, London, E.C.2.

The following statement has been issued by the Association:—

"On the question of status, the belief is entertained that the public will welcome any endeavour by the trade to maintain a high level of efficiency amongst its members, since purchasers largely depend on retailers for reliable information and advice on technical matters. It is also felt that the retailer, with his constant and close contact with the consumer of wireless goods, is in a position collectively to give useful information for the guidance of the 'powers that be' on such important matters as the licence question, broadcast programmes, etc."

Wireless in Ireland.

Speaking in the Dail last week, the Irish Free State Postmaster-General, Mr. J. J. Walsh, said that the three wireless stations in Kerry, Donegal and Clifden had been destroyed by the Irregulars, and the Marconi Co. wanted too high a price for restoring the installation at Clifden. He expected they would have to establish some central wireless station, perhaps in the neighbourhood of Dublin. On the assumption that they were not going to give a worse service to the commercial community they were determined to persevere in retrenchment. If they could make the service pay its way, and at the same time give as good or better service than the English did, then they would succeed in doing what the English failed to do.

Imperial and Foreign Items.

The new SWEDISH WIRELESS STATION at Kongsbacka is now in direct communication with America.

The Government have purchased about 800 acres of land at Hillmorton, near Rugby, for the purpose of erecting a wireless station in connection with the IMPERIAL SCHEME.

An experiment is being made by the Hungarian Post Office in the introduction of WIRELESS LETTERS TO THE UNITED STATES. The letters are transmitted to America by wireless and are then forwarded to the addresses by the ordinary post. The service is to cost about 3d. a word.

Some experiments carried out in America have shown that by using a special form of antenna, the AUDIBILITY OF WIRELESS SIGNALS COULD BE INCREASED by nearly 40 per cent. The conductor is composed of ten strands of No. 18 bare copper wire braided closely together on a special machine to give it a ribbon-like appearance, ½ in. wide by ⅛ in. thick. With an antenna 30 ft. long of this type, strung in a basement at a level about 1 ft. below the surface of the earth, better results were obtained than with an antenna of the usual type, of 100 ft. length, strung between two poles out of doors at an elevation of about 40 ft.

"Gecophones" on the River.

Wireless Service, Ltd., in association with Electrical Installations, Ltd., have equipped a punt for wireless demonstrations on the Thames. At the extreme end of the punt rises a slender bamboo pole carrying the aerial, to which is coupled a two-valve "Gecophone" wireless receiving set, together with a large loud-speaker equipment. Some highly successful trips have been made in this punt, which has been able to prove in no uncertain fashion the practicability of river wireless.

Derry Electrical Employees' Wages.

After prolonged conferences between the Derry electrical engineer and the municipal employees' representative a schedule of wages of the men employed in the Derry power station has been agreed to. The men are to receive a penny per hour less than the wages paid in the Belfast station. In one instance, however, where three grades of workers are employed in Belfast and only one in Derry the latter has been placed in the middle grade, involving an increase of 12s. a week.

Wages in the West Midland Area.

A circular issued by the District Industrial Council for Electricity Supply Industry, No. 5 (West Midlands Area), states that the next wages revision, based on the cost of living, is due from July 1. There will then be a reduction of one halfpenny per hour in the wage rates paid to all adult workers, whose rates and conditions are regulated by the Industrial Council. The reductions in the pay of youths and apprentices will be 9d. per week in the case of boys of 16 and 17 years of age, and 1s. 4d. per week in the case of youths of 18 to 20 years of age, inclusive.

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Companies' Reports, Dividends, etc.

ROYCE, LTD.—No dividend is to be paid on either the preference or ordinary shares.

EDGAR ALLEN AND CO.—The accounts for the year ended March 31st show a loss of £15 123, but a surplus of £20 068 was brought forward, and the board propose to transfer £40 000 from the reserve. A final dividend of 6d. per share is proposed on the ordinary shares, making 1s. per share (5 per cent.), free of income-tax for the twelve months, carrying forward £9 523.

The STOCK EXCHANGE COMMITTEE have granted official quotations to 38 507 £1, fully paid, ordinary shares of the Cawnpore Electric Supply Corporation; 75 000 £1, fully paid, 6 per cent. cumulative convertible first preference shares of the Lancashire Electric Light and Power Co.; 400 000 £1, fully paid, shares of the Shanghai Electric Construction Co.; and 204 885 £1, fully paid, ordinary and 231 305 £1, fully paid, 6 per cent cumulative preference shares of the Yorkshire (West Riding) Electric Tramways Co.

Edison Swan Capital Reduction Scheme.

The accounts of the EDISON SWAN ELECTRIC CO. for the year ended June 30th, 1922 show a loss of £283 204, which is carried to the deficiency account and added to the debit of £289 720 brought forward, and capital losses, £239 940. Allowing for appropriated reserve, less dividend paid and debenture sinking fund appropriation, a deficiency of £765 742 remains to be carried to the balance-sheet. A circular issued with the report outlines a capital reduction scheme. It is proposed to write down the value of the ordinary shares from £1 to 4s. per share, which will absorb the whole of the above deficiency. The preference share capital is to remain intact, but the participating rights are to be cancelled and the rate of dividend increased from 7 to 7½ per cent. The accrued dividend from August 1st, 1921, to June 30th, 1922, is to be cancelled, and a full year's dividend at the increased rate as from July 1st next is to be paid, after the scheme has been adopted by the shareholders and confirmed by the Court. The directors have submitted the scheme to a combined meeting of the larger preference and ordinary shareholders, representing a substantial proportion of the company's share capital, who have approved it.

James Keith and Blackman Co.

The report states that, after providing for debenture interest, preference dividend, and for depreciation and doubtful debts, a credit balance remains of £21 120 (against £21 006 for the preceding year). A dividend on the ordinary shares at the rate of 7½ per cent., free of income tax (unchanged), is recommended, absorbing £15 000, and leaving £6 120 to be carried forward (against £15 944).

Cable and Telegraph Companies.

EASTERN EXTENSION, AUSTRALASIA AND CHINA TELEGRAPH CO.—Interim dividend declared for the three months ended March 31st of 5s. per share, free of tax.

EASTERN TELEGRAPH CO.—Dividends declared of 3½ per cent., less tax on the preference stock for the quarter ending June 30th, and of 2½ per cent. (first quarterly interim) on the ordinary stock, free of tax, in respect of profits for 1923.

ORIENTAL TELEPHONE AND ELECTRIC CO.—Final dividend for the year ended December 31st last of 6 per cent. on the ordinary shares, free of tax, making a total of 10 per cent. for the year, free of tax (the same as for 1921) and a bonus of 2 per cent. on the ordinary shares, free of tax (the same).

Traction Companies Results.

IMPERIAL TRAMWAYS CO.—The available balance for 1922, after payment of interest on debenture stock and interim dividend on the preference shares is £16 716. Dividend proposed of 4 per cent., less tax, on the ordinary capital, placing £6 129 to reserve, and carrying forward £187.

New Issues.

TOTTENHAM DISTRICT LIGHT, HEAT AND POWER CO.—It is announced that the issue of £100 000 "B" Consolidated stock of the company was considerably over-subscribed. The average price of the tenders accepted was £104 1s.

TOKYO ELECTRIC LIGHT CO.—On Wednesday an offer was made of £3 000 000 6 per cent. sterling bonds at 94 per cent., being part of an authorised issue of £6 000 000. The offer was made in this country by the Whitehall Trust, Ltd.

New Companies.

PHILLIPS VALVES, LTD.—Private. Cap., £300 in £1 shares. Manufacturers of and dealers in valves and other parts connected with wireless installations, etc. Reg. office: 15, Aldersgate, London, E.C.1.

CHALUME, LTD.—Private. Cap., £100 in 1s. shares. Dealers in articles appertaining to lighting and heating by electricity, gas or other methods, chemical or otherwise, etc. Reg. office: 8, Queen Street, Cheapside, London, E.C.4.

HUNTER'S VALE ACCESSORIES CO., LTD.—Private. Cap., £500 in £1 shares. Mechanical and electrical engineers, stampers, piercers, tube and metal rollers, machinists, iron and brass founders, etc. Reg. office: 30, Waterloo Street, Birmingham.

AUCKLANDS WIRELESS, LTD.—Private. Cap., £7 000 in £1 shares. To acquire the business of manufacturers of component parts for wireless telegraphy and telephony now carried on by G. Z. Auckland and Son at 395, St. John Street, Clerkenwell, London, E.C., and elsewhere.

NATIONAL ELECTRIC LAMP CO., LTD.—Private. Cap., £100 in £1 shares. General supply agents, electrical manufacturers, engineers and contractors, etc. C. Seymour, 98, Dora Road, Wimbledon Park, London, S.W.19, electric lamp factor, is manager and a permanent director.

VISSO LIGHTING CORPORATION, LTD.—Private. Cap., £500 in £1 shares. Manufacturers of and dealers in gas and electric lamps, mantles, lighting and heating apparatus and accessories, etc. Power is also taken to carry on business as telephone, wireless and installation engineers, etc Reg. office: 24, Lower Marsh, London, S.E.1.

H. E. C. ELECTRIC CO., LTD.—Private. Cap., £1 000 in £1 shares (400 7 per cent. cumulative preference). To take over the "Wireless Section" of the business formerly carried on at 112, New Oxford Street, London, W.C.1, and recently at 99, St. Paul's Road, London, N.1, by the Higham Engineering Co., Ltd. Reg. office: 99, St. Paul's Road, London, N.1.

EWING INVENTIONS, LTD.—Private. Cap., £500 in 1s. shares. To adopt an agreement with G. N. Ewing and V. Lloyd, and to carry on the business of electricians, mechanical engineers and manufacturers of and dealers in telephone, telegraph, wireless and electrical apparatus, acoustical apparatus, motive power and light, etc. Reg. office: 21, Bucklersbury, London, E.C.4.

A. S. SCOTT AND CO., LTD.—Private. Cap., £2 500 in £1 shares. To buy, manufacture, and fabricate into rods, wires (bare or covered with silk, cotton, enamel, varnish, asbestos, or any special covering), strips, sheets, tubes and castings, metals (including copper, nickel, and alloys containing nickel, chromium, iron, steel, manganese, aluminium, zinc and all other metals in pure and alloyed forms) required by the electrical, mechanical and chemical industries, the arts and other manufactures; also to carry on business as electricians, engineers, export agents, shippers, etc. Reg. office: 89, St. James Street, Manchester.

Benn Brothers' Other Journals.

Some Features of the Current Issues.

THE CABINET MAKER (Merchant Shippers' Issue).—"Furnishing the 'Franconia'"; "Tapping the Overseas Markets"; "The Decoration of Furniture—Metalwork."

THE CHEMICAL AGE.—"Annual Meeting of the Society of Chemical Industry"; "Recent Developments in the Manufacture of Superphosphate," by A. Ogilvie.

THE EUROPEAN COMMERCIAL.—"Compulsory Labour Service in Bulgaria"; "Czecho-Slovakia's Export Surpluses"; "Stabilising the Danish Kroner."

THE FRUIT GROWER.—"Distribution and Prices Inquiry: Full Report of Committee's Recommendations, with Trade Views"; "Shows and the Entertainment Tax."

THE GAS WORLD.—Special Number containing full report of the Annual Meeting of the Institution of Gas Engineers—a three days Conference in Belfast.

THE HARDWARE TRADE JOURNAL (Merchant Shippers' Issue).—"Hardware Exporters' Trade and Prospects"; "Economical Handling of Goods in Factory, Works and Warehouse"; "Packing Goods for Export."

Miscellaneous.

The "Western Morning News" states that the representatives of the E.T.U. in Devon and Cornwall have decided to WITHDRAW FROM THE LOCAL WHITLEY COUNCIL, following a misunderstanding with the Plymouth Corporation.

Among the members of the staff of the GENERAL ELECTRIC CO., Witton, presented to the Prince of Wales on his recent visit was Mr. E. G. Oaten. We regret that in our account of the function his name was wrongly given as "Oten."

In pursuance of the policy of carrying out the work of the national survey with the help of local committees, the FUEL RESEARCH BOARD has appointed a committee to deal with the physical and chemical survey of the coal seams in the South Yorkshire area.

An Order was made on June 20th for the RESTORATION OF LETTERS PATENT No. 149 213, dated July 4th, 1917, and granted to Dr. Erich F. Huth G.m.b.H., and Dr. Siegmund Loewe for "Improvements in and relating to thermionic valve amplifiers and generators."

Speaking on Saturday at the opening of an institute and recreation grounds for employees of the Butterley Colliery Co., Mr. G. SPENCER said that since the company had introduced electric lamps into the pit nystagmus cases had been reduced 60 per cent., and another company in the district said their claims for nystagmus compensation were less by 45 per cent. since the introduction of electric lamps into the pit.

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Commercial Intelligence.

County Court Judgments.

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.]

ALBANY ELECTRICAL SUPPLIES CO., Mawdsley Street, Bolton, electrical appliance dealers. £22 16s. 9d. May 9th.

DUFFIN, A. H., AND CO., Provincial Buildings, Conway Road, Colwyn Bay, electrical engineers. £17 18s. 8d. May 14th.

ROCKALL AND CO., Stanley House, 8, Sherwood Street, W., electrical engineers. £15 4s. May 10th.

WRIGHT, ROBERT, AND CO., 34/6, Oxford Street, W., electrical engineers. £16 7s. 3d. May 9th.

Receiverships.

ILLUMINATED PUBLICITY, LTD.—R. Atherton, of 26, Church Street, W., was appointed receiver on April 23rd, 1923, under powers contained in debenture dated April 21st, 1923 (notice filed June 18th, 1923).

Private Meetings, etc.

[*Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.*]

PORTER, TURK AND SON, LTD., general agricultural and electrical engineers, Newbury, Berks. A statement of affairs submitted to a meeting of creditors held in London on Friday last showed total liabilities £6 931 (trade creditors £2 024), and assets £5 223, a deficiency of £1 708. It was reported that the company was registered in 1919 to take over two businesses, and had since been carried on at a loss. During 1920 the loss was £303, in 1921, £756, and last year approximately £1 300. Negotiations were proceeding for the introduction of further capital and the company offered the creditors a composition of 6s. 8d. in the £, which was to be payable in cash within a month. A committee of investigation was appointed consisting of Mr. E. H. Hawkins, of Poppleton, Appleby and Hawkins, and representatives of the D.P. Battery Co. and Burndept, Ltd.

London Gazette.

The following information is taken from printed reports, but we cannot be responsible for any errors that may occur.

Company Winding-up.

ELECTRICAL CO. (THE), LTD., 6, Old Jewry, E.C. Return (first and final) to contributories of £4 17s. 1d. on shares £5 paid, and £2 9s. 7d. on shares £2 12s. 6d. paid; payable at the office of the Official Receiver and Liquidator, 33, Carey Street, Lincoln's Inn, London, W.C.2.

Company Winding-Up Voluntarily.

NUNEATON ELECTRICAL CONTRACTING CO., LTD.—Percy Russell, Newdegate Street, Nuneaton, appointed liquidator.

Bankruptcy Information.

FRANCIS, Leonard, 2, Morrison Street, Castleford, Yorkshire, electrical engineer. First meeting, June 26th, 11 a.m., Official Receiver's office, 21, King Street, Wakefield. Public examination, July 12th, 11 a.m., Court House, Wood Street, Wakefield.

RIPPINGELLE, Frank Sidebotham, Winchester House, Victoria Square, Birmingham, agent for electric fittings. Receiving order, June 14th. Creditor's petition.

Notices of Dividends.

OATON, Thomas Green, carrying on business as an electrical engineer, under the style of T. G. COATON AND CO., 16, Humberstone Road, Leicester. First and final dividend of 3s. 5d. per £. Payable June 29th, Poppleton, Appleby and Hawkins, 4, Charterhouse Square, London, E.C.1.

DENNIS, Frederick Hungate, 20, High Street, Chelmsford, electrical engineer. First and final dividend of 5s. 11¾d. per £. Payable June 29th, Official Receiver's Offices, 29, Russell Square, London, W.C.1.

GILL, Frederick John, 26, Hardwick Street, Buxton, electrical engineer. First and final dividend of 1s. 6¼d. per £. Payable July 2nd, Official Receiver's Offices, Byrom Street, Manchester.

ROWE, Edward George, carrying on business at 119, Dunraven Street, Tonypandy, Glamorgan, under the style of DAVIES AND ROWE, electrical engineer. Second and final dividend of 7¾d. per £. Payable June 29th, Official Receiver's Office, 34, Park Place, Cardiff.

Bankruptcy Proceedings.

ALLEYN, Henry Mathew, 22, Queen Anne's Gate, S.W. On the hearing at the London Bankruptcy Court last week of an application for an order of discharge by this debtor, it was said by the Official Receiver that in August, 1916, he registered Fellows Magneto Co., Ltd., to acquire the business of a magneto manufacturer in which he was a partner. He was appointed a director and West End manager of the company from which latterly he had received a salary of £850 per annum and an allowance of £350 for office expenses. During the three years immediately preceding his bankruptcy which occurred in July, 1921, he had also received from the company £14,250 as commission in respect of underwriting shares. His appointment ceased on June 31st, 1921, three days after the date of the receiving order. After that date he was without occupation. In the opinion of the Official Receiver the total of the unsecured indebtedness amounted to £72 404, while the only asset was a bank balance of 19s. 11d. The debtor attributed his failure partly to losses incurred in speculating in 1913, from which he never recovered; partly to his inability owing to the financial depression to place further shares in the Fellows Magneto Co., Ltd., from which, had he been able to place them, he would have received a commission of £5 000; and partly to his liability in respect of calls on shares in a company and to heavy business expenses. The Official Receiver opposed the application on certain statutory grounds, two of which were disputed by the debtor. On the application of Mr. E. W. Hansell, who appeared on his behalf, the Registrar granted the debtor an immediate discharge subject to his consenting to judgment in a sum of £1 000 to be paid by instalments.

SLATER, Thomas Gascoigne, trading as SLATER BROS., 25, Dickinson Street, Mount Street, Manchester, electrical engineer. Statement of affairs shows liabilities £1 390, and a deficiency of £1 294, debtor attributing his failure to lack of capital and bad trade. He was previously in business in partnership with another, but the partnership terminated in November, 1921, when a composition of 10s. in the £ was paid on liabilities of £912.

STANDARD ELECTRIC SIGN CO., LTD., Evelyn House, Oxford Street, W. The Official Receiver observes in his report on this compulsory liquidation (see "Electrician," 27/4/23, p. 471), that the company was registered in July, 1921, with the main object of obtaining concessions to erect illuminated signs on tramway and lighting standards. It was promoted by Henry Thomas Hart-Spratt. After the preliminary expenses had been paid, the working capital of the company consisted of £400, which had been subscribed for preference shares for that amount, and for the first year of the company's existence it appears to have subsisted on loans provided by the petitioning shareholder, Mr. H. J. Davis, and on the deposits received from advertisers. The company's method of carrying on business was to obtain contracts from persons and firms for the advertisement of their business by signs to be affixed to tramway and lighting standards in consideration of a rental, a deposit being paid by the customer. The company entered into agreements with various corporations to affix the signs to the standards under their control, the company to pay a certain rental which included maintenance and upkeep. Numerous judgments have been obtained against the company and executions levied to a total amount of £1 108 three months of the date of the winding-up order, and it will be for the preferential creditors to consider whether they may not be entitled to claim from the execution creditors the proceeds arising from such executions. The books of the company have not been properly kept, and do not contain a complete or even an approximately accurate record of its transactions. The liquidation remains in the Official Receiver's hands.

Prices of Metals, Chemicals, etc.

TUESDAY, June 26.

		Price.	Inc.	Dec.
Copper—				
Best Selected	per ton	£69 0 0	—	£1 15 0
Electro Wirebars	„	£73 0 0	—	£1 10 0
H.C. Wire, basis	per lb.	10 5/16d.	—	3/16d.
Sheet	„	10¾d.	—	—
Phosphor Bronze Wire (*Telephone*)—				
Phosphor Bronze Wire, basis	per lb.	1s. 2 5/16d.	—	d.
Brass 60/40—				
Rod, basis	„	7¼d.	—	—
Sheet, basis	„	10¼d.	—	—
Wire, basis	„	10¼d.	—	—
Pig Iron—				
Cleveland Warrants	per ton	£6 0 0	—	—
Galvanised Steel Wire, basis 8 S.W.G.	„	£19 10 0	—	—
Lead Pig—				
English	„	£26 5 0	—	10s.
Foreign or Colonial	„	£25 2 6	—	7s. 6d.
Tin—				
Ingot	„	£188 17 6	—	£1 7 6
Wire, basis	per lb.	2s. 6d.	—	¼d.
Aluminium Ingots	per ton	£120 0 0	—	—
Spelter	„	£28 10 0	—	£1 0 0
Mercury	per bottle	£10 15 0	2s. 6d.	—

Sulphur (Flowers)—Ton £8 5s. *Sodium Chlorate*—Per lb. 2¾d.
„ (Roll-Brimstone)—„ £8 5s. *Sulphuric Acid* (Pyrites, 168°)
Copper Sulphate.. „ £26 per ton, £7 10s.
Boric Acid (Crystals). „ £50 *Sodium Bichromate*.—Per lb. 4½d.
Rubber.—Para fine, 1s. 2¼d.; plantation 1st latex, 1s. 1⅞d.

The metal prices are supplied by British Insulated & Helsby Cables, Ltd., and the rubber prices by W. T. Henley's Telegraph Works Co.,

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Patent Record.

SPECIFICATIONS PUBLISHED.

The following abstract from some of the specifications recently published has been specially compiled by MEWBURN, ELLIS AND CO., *Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C.*

194 983 R. M. RADIO, LTD., and H. R. RIVERS-MOORE. Detectors for wireless telegraphy and telephony. (26/5/22.)
181 343 HYDROTHERM FABRIK ELEKTRISCHER APPARATE GES. Electric water-heating apparatus. (8/6/21.)
181 360 A. THESEN. Electric roasting oven. (6/6/21.)
186 034 AKT.-GES. BROWN, BOVERI ET CIE. Apparatus for effecting automatic connecting and disconnecting of electrical machine units. (10/9/21.)
189 743 PATHE CINEMA, ANC. ETAB. PATHE FRERES. Electric lamps for cinematographic apparatus. (5/12/21.)
195 004 K. NOBUHARA. Commutating electrical machines. (3/8/22.)
192 695 GENERAL ELECTRIC CO., LTD. Apparatus for evacuation of incandescent lamps. (1/2/22.)
195 029 A. J. WHEELER. Electric relays, particularly for use in metering telephone calls. (14/12/21.) (Divided application on 194 766.) (Cognate application, 7 314/23.) (Divided application on 9 401/22.)
195 106 A. H. MIDGLEY. Junction boxes for electrical connections. (23/9/21.)
170 584 WESTERN ELECTRIC CO. Carrier telegraph circuits. (21/10/20.)
170 600 WESTERN ELECTRIC CO. Telephone exchange system. (25/10/20.)
195 121 WESTERN ELECTRIC CO. Printing telegraphy. (18/11/21.)
172 015 M. SEIDNER. Liquid-cooled electric machines. (29/12/17.)
172 942 GES. FUR DRAHTLOSE TELEGRAPHIE. Wireless direction finding apparatus. (14/12/20.)
195 134 G. H. MOODY and H. D. BUTLER. Insulating stands and holders or plugs for holding coils for use in electrical apparatus. (17/12/21.)
172 983 W. BARTEL and O. HAPPEL. Apparatus for cooling and ventilating electrical machines. (20/12/20.)
195 144 H. T. TUDSBERY and P. GROOM-JOHNSON. Electric rail bonds. (21/12/21.)
195 152 WESTERN ELECTRIC CO. Electromagnetic relays. (22/12/21.)
195 160 STANDARD MOTOR CO., R. W. MAUDSLAY and F. A. JOHNSON. Lighting circuits for motor vehicles. (23/12/21.)
173 518 Dr. O. T. BLATHY. Process for setting rotating electric meters. (14/4/20.)
195 168 J. R. BELL. Electric timing device. (29/12/21.)
195 185 HAGUE AND MCKENZIE and A. HAGUE. Electrically heated kettles, etc. (10/1/22.)
195 194 J. T. ROBIN. Incandescent lamps. (13/1/22.)
195 196 CHAMBERLAIN AND HOOKHAM and S. JAMES. Electricity meters. (14/1/22.)
195 198 METROPOLITAN-VICKERS ELECTRICAL CO. and W. A. COATES. Switch-gear. (17/1/22.)
195 209 WESTERN ELECTRIC CO. and G. DEAKIN. Telephone systems. (27/1/22.)
195 237 R. S. ALLEN. Time-lag switch. (20/2/22.)
182 434 METROPOLITAN-VICKERS ELECTRICAL CO. Switch-gear. (30/6/21.)
175 995 H. FREI. A.C. machines. (23/2/21.)
177 154 AUTOMATIC TELEPHONE MANUFACTURING CO. Telephone systems. (16/3/21.)
195 249 D. TINLOT. Switches. (7/3/22.)
195 251 R. ARAYA. Electro-therapeutic apparatus. (8/3/22.)
195 254 A. A. BULL. Current collecting apparatus for use on electric railways or tramways. (10/3/22.)
176 801 E. VARE. Element for storage cells. (10/3/21.)
195 258 E. W. REED. Electric lighting systems used on motor vehicles. (9/12/22.)
195 264 L. O. MEYER and C. S. BEST. Electric soldering irons. (21/3/22.)
195 266 DUBILIER CONDENSER CO. (1921) and W. H. GOODMAN. Electrical condensers. (22/3/22.)
195 273 WESTERN ELECTRIC CO. Telephone repeater systems. (3/4/22.)
195 310 P. HERMARDINQUER. Tables for supporting wireless telegraphic or telephonic installations. (21/3/22.)
186 582 AKT.-GES. BROWN, BOVERI ET CIE. Electrically insulating pipe section for high-vacuum pipe lines. (30/9/21.)
183 451 E. VON LEPEL. Device for improvement of the electric ignition in explosion motors. (21/7/21.)
195 318 WARD LEONARD ELECTRIC CO. Resistance devices. (27/3/22.)
195 319 WARD LEONARD ELECTRIC CO. Resistance devices. (28/3/22.)
185 410 PHILIPS GLOEILAMPENFABRIEKEN. Incandescent lamps. (30/8/21.)
193 056 W. BARTEL and O. HAPPEL. Method of cooling turbine-driven electrical machines. (20/12/20.) (Divided Application on 172/983.)
170 850 AKT.-GES. BROWN, BOVERI ET CIE. Single-layer winding for a.c. generators. (28/10/20.)
195 416 X-RAYS, LTD., and M. A. CODD. X-ray apparatus. (28/10/21.)
195 423 CONTELL, F. A.c. machines. (24/11/21.)
195 424 WESTERN ELECTRIC CO. Electro-magnetic relay. (24/11/21.)
195 429 A. M. TAYLOR. Means for reducing capacity current losses in electric cables. (30/11/21.)
195 431 A. H. JACKSON. Electric motor control systems. (3/12/21.)
195 439 H. BARON (F. ALENDORFF). Automatic telephone exchange system. (22/12/21.) (Cognate Application, 5924/22.)
195 440 GENERAL ELECTRIC CO., LTD., and B. S. GOSSLING. Electron discharge apparatus. (23/12/21.)
180 294 G. W. FERGUSON. Trolley poles. (18/5/21.)
195 447 G. H. WALLACE. Electrically controlled counting apparatus for use in totalisators. (29/12/21.)
195 453 H. SEFTON-JONES (C. LORENZ AKT.-GES.). Holder for arc generators for production of high-frequency electric waves. (29/12/21.)
195 455 SIEMENS BROS. AND CO., and H. E. HUMPHRIES. Automatic and semi-automatic telephone exchange systems. (30/12/21.)
177 488 SOC. FRANCAISE RADIO-ELECTRIQUE. Selective calling devices. (22/3/21.)
195 461 C. W. C. BECKMAN and P. ALEXANDER. Electrical apparatus particularly applicable to wireless sets. (3/1/22.)
195 468 METROPOLITAN-VICKERS ELECTRICAL CO. and W. T. GRAY. Couplers for train lines or conductors of electric railway vehicles. (11/1/22.)
195 470 L. G. DE KERMOR. Electric steam generators. (13/1/22.)
195 472 O. T. BANKS. Electric candle lamps. (17/1/22.)
195 477 H. LEITNER. Electric accumulators. (21/1/22.) (Cognate Applications, 2952/22 and 4304/22.)
195 484 G. H. and H. F. COLLINS. Electric connectors. (26/1/22.)
195 487 JOHNSON AND PHILLIPS and H. M. LACEY. Voltage regulator for alternating circuits. (30/1/22.)
195 490 F. C. CURTIS. Regulating switches. (1/2/22.)
195 494 CALLENDER'S CABLE AND CONSTRUCTION CO. and P. V. HUNTER. Electric cables. (6/2/22.)
179 141 METROPOLITAN-VICKERS ELECTRICAL CO. Interrupters for electric circuits. (25/4/21.)
195 496 WESTERN ELECTRIC CO. Electrical networks. (14/2/22.)
195 498 F. R. TUBBS and F. V. BREEDEN. Submerged electro-plating, shaking and scouring barrels. (16/2/22.)
195 506 G. COMBONI. Electrical hot-air stove. (4/3/22.
195 521 M. L. WILLIAMS. Terminal electrical connections. (24/3/22.) (Addition to 151 349.)
195 524 H. E. HOLMAN. Electric mincer. (6/4/22.)
195 533 W. FRISBY. Apparatus for automatically operating electric switches. (19/4/22.)
179 547 SCINTILLA. Rivetted joints for connecting a plurality of electrical conductors to a common insulator. (4/5/21.)
195 546 N. F. S. HECHT. Thermionic valve circuits. (9/5/22.)
195 555 VERITYS, LTD., and F. W. THORPE. Anti-vibration fittings for electric lamps. (16/6/22.)
195 557 NORWEST ELECTRICAL MANUFACTURING CO. and A. N. PENMAN. Safety devices for use with electrical apparatus. (16/6/22.)

APPLICATIONS FOR PATENTS.

June 11th.

15 157 A. W. BROWN. Resistances for heating.
15 175 TELE-RADIO CO. and T. R. ARMSTRONG. Variable condensers for wireless telegraphy.
15 178 COVENTRY AUTOMATIC TELEPHONES, LTD. (ARTER). Automatic telephone exchange systems.
15 181 A. E. WATKINS. High resistances for grid leaks, etc.
15 211 CREED AND CO. and F. G. CREED. Apparatus for quadruplex telegraphy.
15 215 A. LUZY. Electro-mechanical lamp. (13/7/22, France.)
15 220 H. BARON (ALDENDORFF). Automatic telephone switching systems.
15 221 AUTOMATIC TELEPHONE MANUFACTURING CO. Telephone systems. (14/5/21, U.S.)
15 226 J. H. HAMMOND. Radio communication. (11/8/22, U.S.)
15 234 MEASUREMENT, LTD. (CIE. POUR LA FABR. DES COMPTEURS ET MATERIEL D'USINES A GAZ). Electricity meters.
15 235 T. L. JONES. Electrical means for controlling temperature in pasteurising, drying, etc.
15 237 E. C. R. MARKS (COBB ELECTRO-REDUCTION CORPORATION OF CANADA). Volatilising and oxidising minerals.
15 248 W. S. HUBBARD. Vibratory rectifiers for alternating currents.
15 249 H. BRUCKNER. Telephone receiver.

June 12th.

15 252 A. M. TAYLOR. Electric power transmission systems.
15 257 J. D. DUNTHORNE and W. J. RICKETS. Inductance coils.
15 265 E. B. MOULLIN AND L. B. TURNER. Wireless telegraph receivers.
15 266 F. F. D. DAVIDSON. Fuse boxes.
15 269 F. A. ROSS. Electric fuse elements.
15 278 W. H. GARDNER. Contact pins for electrical apparatus.
15 297 A. H. SHAW, A. S. ABRAM and W. J. BARTHOLOMEW. Cut-outs.
15 305, 15 307, 15 308 and 15,309 E. Y. ROBINSON. Vacuum electric tubes.
15 327 A. E. CHAPMAN. Wireless receiving apparatus.
15 335 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electrodes.
15 339 F. P. HABICHT. Secondary sound wave producer. (13/4/23, Switzerland.)
15 346 J. L. SEMAT. Transmission of electric signals. (9/10/22, France.)

June 13th.

15 364 F. P. SEXTON. Lightning arrester.
15 378 G. L. WARD, T. N. COLE, and R. P. RICHARDSON. Inductances for wireless signalling.
15 393 GRIERSON, LTD., and R. GRIERSON. Electric heating systems.
15 411 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Insulators.
15 413 H. T. CULLIFORD and H. G. CLARK. Insulators.
15 414 G. H. LE GRYS. Devices for use with telephone receivers.
15 418 C. VALGUARNERA. Radio-signalling apparatus for ships, etc.
15 426 A. WILLIAMS. Electric terminals.
15 434 GENERAL ELECTRIC CO., LTD. Electric luminous discharge tubes. (6/12/22, Germany.)

June 14th.

15 442 H. G. FAULDS. Trolley electricity collectors.
15 456 C. W. WOODS. Shade holders for electric lamps.
15 464 H. INGHAM. Inductance coils.
15 465 W. T. FARQUHARSON. Trolley controllers.
15 468 A. T. CRASTON. Line contactors for electrically operated point turners, signals, etc.
15 495 ABBEY INDUSTRIES, LTD., H. MELVILLE-SMITH, and S. J. TYRRELL. Variable condensers.
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15 497 A. ROSWELL. Crystal detectors.
15 499 T. RONDELLI. Electric water heaters.
15 504 R. I. WELLS, H. L. CROWTHER and N. F. S. HECHT. Wireless signalling.
15 505 H. P. T. LEFROY. Wireless signalling systems, etc.
15 509 E. Y. ROBINSON. Vacuum electric tubes.
15 510 E. Y. ROBINSON. Vacuum tubes.
15 521 E. A GRAHAM. Telephone receivers.
15 528 J. K. MCWHIRR. Lightning arresters, etc.
15 531 J. H. RUNBAKEN and W. TORRANCE. Telephone installations.
15 538 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electric boilers.
15 549 W. E. H. HUMPHRYS. Thermionic valve-holder adapter.

June 15th.

15 507 E. COUSINS. Diaphragms for telephone receivers.
15 556 E. P. APPLEYARD. Fire alarms.
15 566 G. W. JACKSON and W. H. L. JARVIS. Plug and socket devices.
15 578 C. GOSTLING. Prevention of fires caused by fusing of electric wires.
15 590 ELECTRO-DYNAMIC CONSTRUCTION CO. and N. PENSABENE. Electrical machines.
15 593 F. D. RADNIC. Pocket wireless receiver.
15 603 FORGES ET ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE JEUMONT. Terminal or junction boxes for underground cables. (19/7/22, France.)
15 605 T. T. BAKER. Telegraphic transmission of photographs, etc.
15 608 H. G. MATTHEWS and B. J. LYNES. Electric gas discharge tubes.
15 623 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electric boilers.
15 646 AKT. GES. BROWN, BOVERIE ET CIE. Apparatus for electrically heating vacuum pump in metal vapour rectifiers. (12/7/22, Germany.)

June 16th.

15 658 A. A. FORROW. Induction coils.
15 663 O. S. PUCKLE. Crystal receivers.
15 699 A. R. ANGUS. Devices for amplifying electrical energy.
15 703 A. KELLY. Electric lamps.
15 707 RADIO COMMUNICATION, LTD., and J. SCOTT-TAGGART. Electric signalling receiving systems.
15 709 H. BARON (SIGNAL GES.). Determination of distances by means of reflected sound waves.
15 710 BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., N.Y.). Electric boilers.
15 719 A. J. and S. WILLIAMSON. Wireless receiving apparatus.

Arrangements for the Week.

MONDAY, JULY 2nd.

ROYAL INSTITUTION OF GREAT BRITAIN.
5 *p.m.* At the Institution, Albemarle St., London, W.1. General Meeting.

The Editorial, Advertisement and Publishing Offices of "THE ELECTRICIAN" are at 8, Bouverie Street, London, E.C.4. Telegrams: Benbrotric, Fleet, London. Telephone: City 9852 (6 lines).

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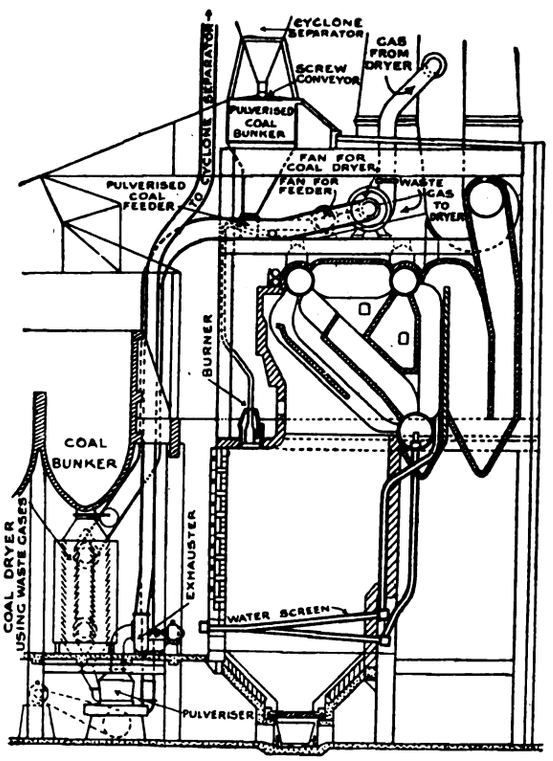
OF
PULVERISED FUEL

Illustration shows Cross Section through Boiler House of the Sce. Anme. Union d'Electricité Paris, at Vitry, where the system is being installed for four boilers each with a heating surface of 16 678 square feet. Normal evaporation per boiler per hour from and at 212° F., 140 580 lbs. Maximum evaporation from and at 210 870 lbs.

Combined efficiency of 84% based on gross value of the coal is guaranteed.



COVENTRY HOUSE, SOUTH PLACE, LONDON, E.C.2. WORKS: DERBY

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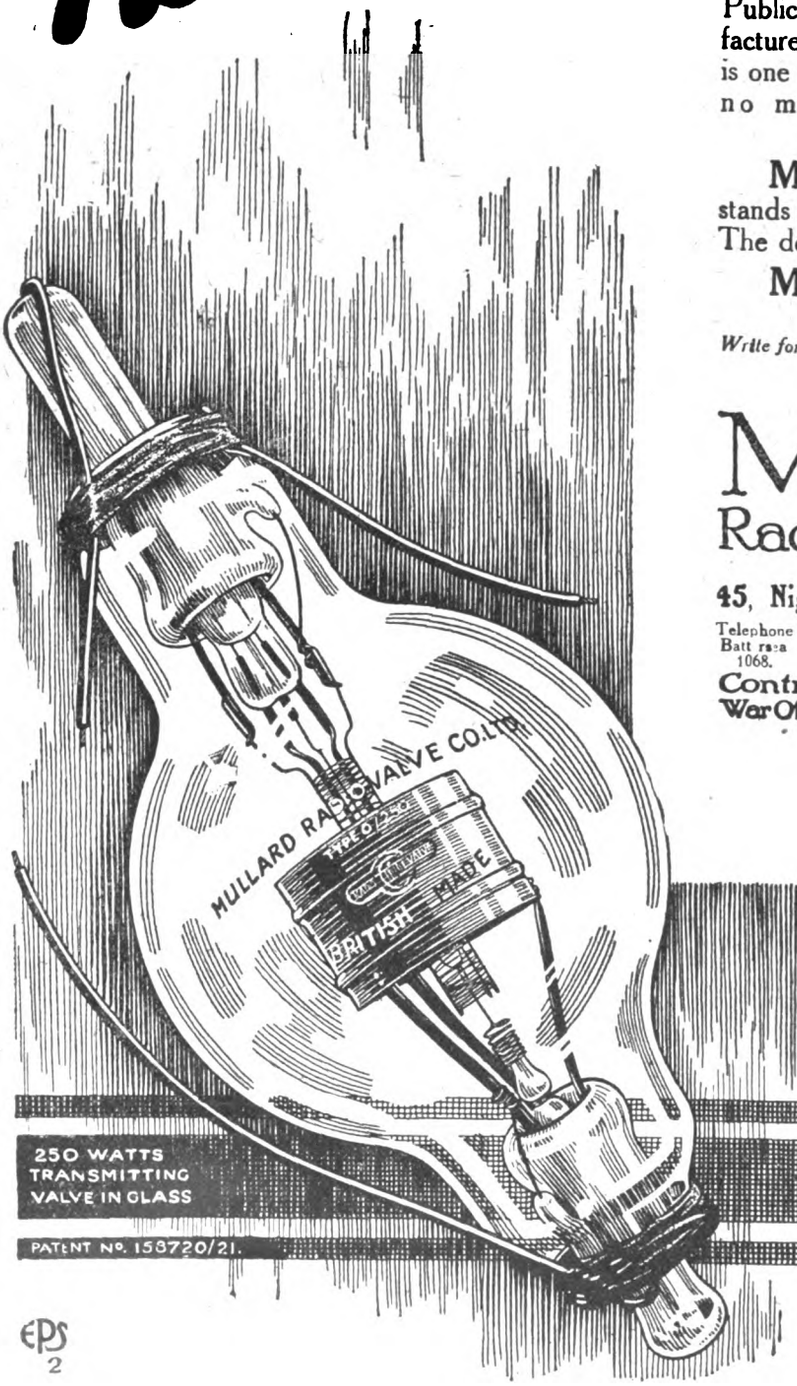

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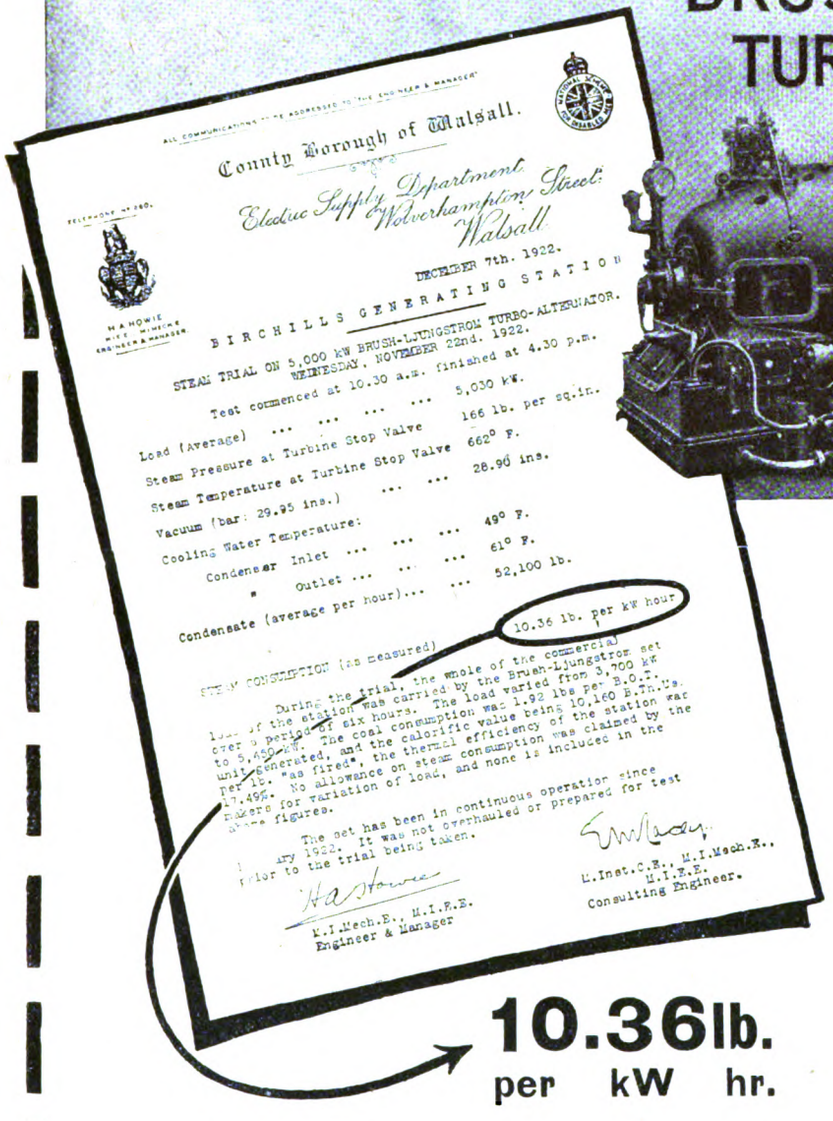
Independent Test of 5,000 kW BRUSH-LJUNGSTRÖM TURBO-ALTERNATOR



County Borough of Walsall.

Electric Supply Department, Wolverhampton Street, Walsall

DECEMBER 7th. 1922.

BIRCHILLS GENERATING STATION

STEAM TRIAL ON 5,000 kW BRUSH-LJUNGSTROM TURBO-ALTERNATOR.
WEDNESDAY, NOVEMBER 22nd. 1922.

Test commenced at 10.30 a.m. finished at 4.30 p.m.

Load (Average)	5,030 kW.
Steam Pressure at Turbine Stop Valve	166 lb. per sq.in.
Steam Temperature at Turbine Stop Valve	662° F.
Vacuum (bar: 29.95 ins.)	28.90 ins.
Cooling Water Temperature:	
Condenser Inlet	49° F.
" Outlet	61° F.
Condensate (average per hour)... ...	52,100 lb.

STEAM CONSUMPTION (as measured) 10.36 lb. per kW hour

During the trial, the whole of the commercial load of the station was carried by the Brush-Ljungstrom set over a period of six hours. The load varied from 3,700 kW to 5,450 kW. The coal consumption was 1.92 lbs per B.O.T. unit generated, and the calorific value being 10,160 B.Th.Us. per lb. "as fired", the thermal efficiency of the station was 17.49%. No allowance on steam consumption was claimed by the makers for variation of load, and none is included in the above figures.

The set has been in continuous operation since January 1922. It was not overhauled or prepared for test prior to the trial being taken.

H. A. Howie
M.I.Mech.E., M.I.E.E.
Engineer & Manager

E. W. Marsden
M.Inst.C.E., M.I.Mech.E., M.I.E.E.
Consulting Engineer.

10.36lb.
per kW hr.

(3439)

5,000 kW 3,000 r.p.m. Brush-Ljungström turbo-alternator installed at Birchills Generating Station, Walsall Corporation

The OVERALL THERMAL-DYNAMIC EFFICIENCY of the set during the test was

76.4%

This is the highest efficiency recorded for any turbine of less than 20,000 kW output.

THE BRUSH ELECTRICAL ENGINEERING CO LTD

FALCON WORKS, LOUGHBOROUGH.

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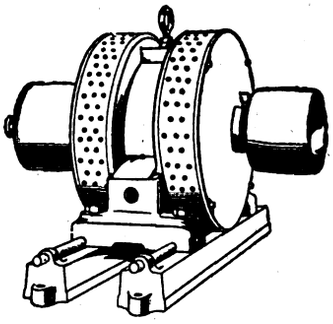

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THE "ELECTRICIAN" INDEX TO ADVERTISERS.

A.E.A.G. lvi
Ackroyd & Best, Ltd. xxvi
Allen West & Co., Ltd. viii
Anglo-American Oil Co., Ltd. lx
Arora Co. lxvi
Ashby Warner & Co., Ltd. lxv
Ashford Dunn & Co., Ltd. ..... —
Atlas Diesel Co., Ltd. ..... —
Avery, W. & T., Ltd. xxxvi
Babcock & Wilcox, Ltd. xv
Batteries, Ltd. xlvi
Bastian & Allen ..... —
Belling & Co. ..... —
Benn Brothers, Ltd. lii
Benn, Ernest, Ltd. xl
Berk, F. W., & Co., Ltd. xlii
Brackett F. W., & Co., Ltd. xxxi
Bremner, Ashton, M.I.E.E. xlviii
British Electrical Development Assn. Inc. .... —
British Electric Transformer Co. ..... —
British Engine Boiler Insurance Co., Ltd. iii
British Insulated & Helsby Cables, Ltd. lxix
British L. M. Ericsson Mfg. Co., Ltd. xxxiv
British Mannesmann Tube Co., Ltd. ..... —
British Steam Specialities, Ltd. xxxviii
British Thomson-Houston Co., Ltd. xxxiii
British Thomson-Houston Co. (Mazda), Ltd. .. —
British Wireless Supply Co., Ltd. ..... —
Brompton & Kensington Accessories Co., Ltd. xxxvii
Brookhirst Switchgear, Ltd. xxvii
Bruce Peebles & Co., Ltd. li
Brush Electrical Co., Ltd. lxxi
Bull Motors Ltd. ..... —
Burns, J., Ltd. xlviii
Cable Makers Association ..... —
Calderara, M. ..... —
Callender's Cable & Construction Co., Ltd. .. xlv
Cambridge & Paul Instrument Co., Ltd. ..... —
Cassell & Co., Ltd. lii
Chapman & Hall x
Concordia Electric Wire Co. Ltd. ..... —
Condor Lamp Co., Ltd. xxviii
Constable & Co., Ltd. ..... —
Crane, Fredk., Chemical Co. ..... —
Crosby Valve & Engineering Co., Ltd. xxxii
Cutters, S. A., Ltd. lxii
Damard Lacquer Co., Ltd. ..... —
Davenport Engineering Co., Ltd. ..... xii, xlii
Dennis, W. F. & Co. ..... —
Donovan & Co. xliv
Dorman, W. H., & Co. ..... —
D.P. Battery Co., Ltd. ..... —
Dubilier Condenser Co., (1921), Ltd. ..... —
Eastick, J. J. xlii
Eclipse Foundry Co. lix
Edison Accumulators, Ltd. ..... —
Edison Swan Electric Co., Ltd. ..... xix, xxxv
Electric Construction Co., Ltd. ..... —
Electric Control, Ltd. ..... —
Electric & Ordnance Accessories, Ltd. ..... —
Electrical Standardizing, Testing and Training Institution, Ltd. liv
English Electric Co., Ltd. lxxiii
Erith's Engineering Co., Ltd. lxviii
Evershed & Vignolles, Ltd. lxvii
Ferranti, Ltd. xi
Firth, Thos. & Sons, Ltd. xxix
Flactem Wireless Co. iii
Fuller's United Electric Works, Ltd. ..... —
General Electric Co., Ltd. ..... vi, xliii
Gent & Co., Ltd. ..... —
Glenfield & Kennedy lxi
Glover, W. T., & Co., Ltd. liv
Gott, L. H. xxx
Green, E., & Son ..... —
Grice (W.) & Sons, Ltd. xxvi
Griffiths Bros. & Co., Ltd. lviii
Guiterman, S. & Co., Ltd. lvi
Hackbridge Electric Construction Co., Ltd. v
Hampton & Beebee, Ltd. ..... —
Heenan & Froude, Ltd. xxxviii
Henley's (W. T.) Tel. Works Co. ..... xxv, xxvii, xlvi
Herbert, Alfred, Ltd. liii
Hick, Hargreaves & Co., Ltd. xiv
Higgs Bros. lxxii
Hill, W. W., Son & Wallace, Ltd. ..... —
Hollings & Guest, Ltd. ..... —
Hotpoint Electric Appliance Co., Ltd. lxi
Igranic Electric Co., Ltd. lv
Ioco Rubber and Waterproofing Co., Ltd. xxiv
Jeary Electrical Co., Ltd. ..... —
Jenkins, W. J. & Co., Ltd. xxxiv
Jenson & Nicholson, Ltd. ..... —
Johnson & Phillips, Ltd. xlvii
Kenyon (Wm.) & Sons ..... —
Landis & Gyr xlviii
Laurence, Scott & Co., Ltd. xx
Leeds Flint Glass Co., Ltd. lx
Lewis, H. K., & Co., Ltd. lxvi
Lindsay & Williams xlviii
London Electric Wire Co. & Smiths, Ltd. xliv
Lorival Manufacturing Co., Ltd xxx
M.K. Electric Co., Ltd. lxvi
MacMillan & Co., Ltd. lxvi
Marconi Wireless Telegraph Co., Ltd xxi
Marelli, Ercole & Co., Ltd. xxxvi
Mather & Platt, Ltd. iv
Matthews & Yates ..... —
Measurement, Ltd. ..... —
Metallic Seamless Tube Co., Ltd. lix
Metropolitan-Vickers Electrical Co., Ltd. xlix
Mewburn, Ellis & Prior, Ltd. ..... —
Midland Electric Mfg. Co., Ltd. lx
Midland Preswork, Ltd. xlii
Mullard Radio Valve Co., Ltd. lxx
Neville's (Liverpool), Ltd. xxxii
Northern Steel & Hardware Co. ..... —
Oerlikon, Ltd. xvi
Parkinson, F. & A., Ltd. xlii
Parsons, C. A., & Co., Ltd. lxii
Power Equipment Co., Ltd. ..... —
Power Rectifiers, Ltd. ..... —
Power Speciality Co., Ltd. ..... Outside Back Cover
Pratt, Fredk. xxviii
Premier Accumulator, Ltd. iii
Pritchett & Gold & E.P.S. Co., Ltd. xviii
Rawlplug Co., Ltd. xxxii
Record Electrical Co., Ltd. xxiv
Rees Roturbo Mfg. Co ..... xvii, xxvi
Reesolls, Ltd. ..... —
Relay Automatic Telephone Co., Ltd. ..... —
Reyrolle, A., & Co., Ltd. xxiii
Richardson, Westgarth & Co., Ltd. ..... —
Sandycroft Ltd. ..... —
Sankey (Joseph) & Co., Ltd. ..... —
Siemens Bros. & Co., Ltd. ..... Outside Front Cover
Siemens and English Electric Lamp Co. lx
Sloan Electrical Co., Ltd. ..... —
Smith, S., & Sons xxx
Smith, Thos., & Sons (Rodley), Ltd. xxxviii
Springfield Electric Co. ..... —
Statter (J. G.) & Co. xlviii
Stepney Borough Council xli
Sugg, Wm. & Co., Ltd. xxviii
Sullivan, H. W., Ltd. l
Taylor, Tunnicliffe & Co., Ltd. ..... —
Telegraph Condenser Co., Ltd. l
Terry, Herbert, & Sons, Ltd. lxii
Thompson, W. P., & Co. xlii
Tudor Accumulator Co., Ltd. ..... —
Underfeed Stoker Co., Ltd. lxix
Underwoods (Manchester), Ltd. xxx
Utting, S. xxii
Visco Engineering Co., Ltd. xxii
Vislok ..... —
Vidal Engineering Co. ..... —
W.R. Patents, Ltd. li
Wailes Dove Bitumastic, Ltd. ..... —
Walsall Electrical Co., Ltd. xxix
Wavwood-Otis, Ltd. ..... —
Wayne Engineering & Equipment Co., Ltd. xlii
Weir, G & J., Ltd. xxxix
Westinghouse Electric International Co. xliii
Weston Electrical Ins. Co., Ltd. ..... —
White Electrical Instrument Co., Ltd. ..... —
White, J. C. lvi
White, R., & Sons xxviii
Wholesale Electrical Co. (1922), Ltd. x
Wilesmith, J., & Co. xlviii
Wilkins, John, & Co., Ltd. ..... —
Wilcox, W. H., & Co., Ltd. ..... —
Wright Motors, Ltd. lxiv
Yorkshire Copper Works, Ltd. vi

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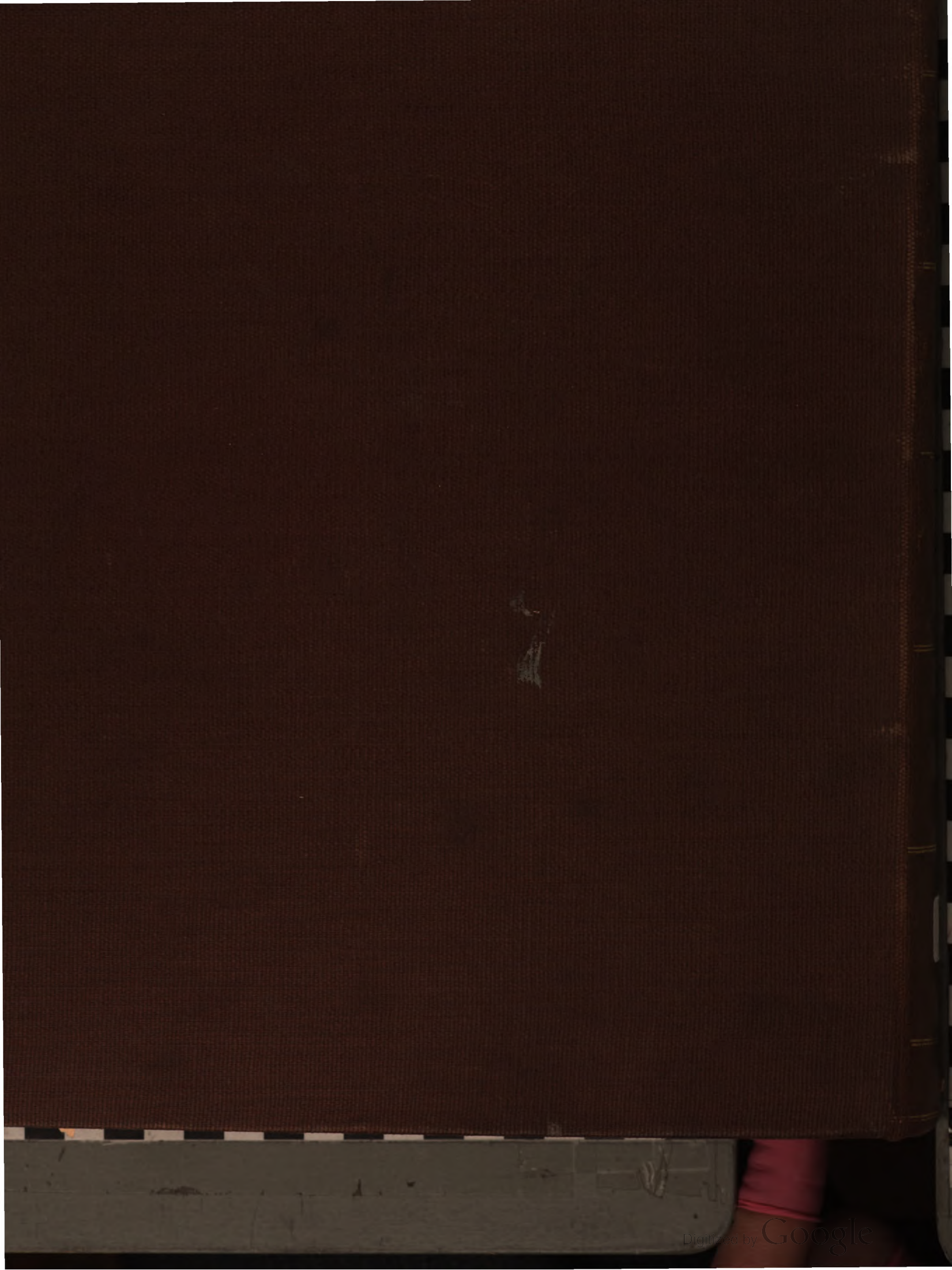
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